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PI/PD Name: Shenfu Dong

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☒ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☐ None

Citizenship: (Choose one) ☐ U.S. Citizen ☒ Permanent Resident ☐ Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name): ☒

REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project ☒

Ethnicity Definition:
Hispanic or Latino. A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.
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Asian. A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
Black or African American. A person having origins in any of the black racial groups of Africa.
Native Hawaiian or Other Pacific Islander. A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
White. A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

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PI/PD Name: Rana A Fine

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name): ☐

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PI/PD Name: Renellys C Perez

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☒ Hispanic or Latino ☐ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name): ☐

REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project ☒

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PI/PD Name: Janet Sprintall

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
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- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

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PI/PD Name: Glenn R Flierl

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
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- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

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List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 11-1

PD 98-1610 **02/15/11**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

OCE - PHYSICAL OCEANOGRAPHY

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

1130201

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
02/15/2011	2	06040000 OCE	1610	152764007	02/16/2011 8:30am S

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

590624458

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

University of Miami Rosenstiel School of Marine&Atmospheric Sci

AWARDEE ORGANIZATION CODE (IF KNOWN)

0015362010

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

4600 RICKENBACKER CSWY
KEY BISCAYNE, FL 33149-1031

NAME OF PRIMARY PLACE OF PERF

University of Miami, RSMAS

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

University of Miami, RSMAS

FL ,331491031 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **4,654,389**	**48** months	**10/01/11**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ EAGER* (GPG II.D.2) ☐ RAPID** (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)

PI/PD DEPARTMENT
CIMAS

PI/PD POSTAL ADDRESS
4600 RICKENBACKER CSWY

Miami, FL 331491098
United States

PI/PD FAX NUMBER
305-361-4457

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **Shenfu Dong**	**PhD**	**2004**	**305-421-4372**	**sdong@rsmas.miami.edu**
CO-PI/PD **Rana A Fine**	**PhD**	**1975**	**305-421-4722**	**rfine@rsmas.miami.edu**
CO-PI/PD **Renellys C Perez**	**PhD**	**2006**	**305-361-4518**	**rcperez@miami.edu**
CO-PI/PD				
CO-PI/PD				

Electronic Signature

CERTIFICATION PAGE

Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the Authorized Organizational Representative or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, lobbying activities (see below), responsible conduct of research, nondiscrimination, and flood hazard insurance (when applicable) as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG) (NSF 11-1). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

Conflict of Interest Certification

In addition, if the applicant institution employs more than fifty persons, by electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution's expenditure of any funds under the award, in accordance with the institution's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

The following certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:
(1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.
(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:
(1) community in which that area is located participates in the national flood insurance program; and
(2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:
(1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
(2) for other NSF Grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)
(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research. The undersigned shall require that the language of this certification be included in any award documents for all subawards at all tiers.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Kimberly Miller**	**Electronic Signature**	**Feb 15 2011 5:59PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
305-421-4079	**kmiller@miami.edu**	**305-421-4131**

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1130201

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 11-1

PD 98-1610 **02/15/11**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

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956006144

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

University of California-San Diego Scripps Inst of Oceanography

AWARDEE ORGANIZATION CODE (IF KNOWN)

0013177010

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

8602 La Jolla Shores Dr
Univ of California-San Diego
LA JOLLA, CA 92093-0210

NAME OF PRIMARY PLACE OF PERF

University of California-San Diego Scripps Inst of Oceanography

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

University of California-San Diego Scripps Inst of Oceanography
8810 Shellback Way
La Jolla ,CA ,920930230 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS
☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **3,016,474**	**48** months	**10/01/11**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ EAGER* (GPG II.D.2) ☐ RAPID** (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)

PI/PD DEPARTMENT
CASPO

PI/PD FAX NUMBER
858-534-9820

PI/PD POSTAL ADDRESS
9500 Gilman Drive

La Jolla, CA 920930230
United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **Janet Sprintall**	**PhD**	**1992**	**858-822-0589**	**jsprintall@ucsd.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

Electronic Signature

CERTIFICATION PAGE

Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the Authorized Organizational Representative or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, lobbying activities (see below), responsible conduct of research, nondiscrimination, and flood hazard insurance (when applicable) as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG) (NSF 11-1). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

Conflict of Interest Certification

In addition, if the applicant institution employs more than fifty persons, by electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution's expenditure of any funds under the award, in accordance with the institution's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

The following certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:
(1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.
(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

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Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:
(1) community in which that area is located participates in the national flood insurance program; and
(2) building (and any related equipment) is covered by adequate flood insurance.

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(1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
(2) for other NSF Grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)
(This certification is not applicable to proposals for conferences, symposia, and workshops.)

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AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Nancy A Wilson**	**Electronic Signature**	**Feb 14 2011 2:41PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
858-534-4571	**nwilson@ucsd.edu**	**858-534-9642**

* EAGER - EArly-concept Grants for Exploratory Research
** RAPID - Grants for Rapid Response Research

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 11-1

PD 98-1610 **02/15/11**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

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042103594

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☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Massachusetts Institute of Technology

AWARDEE ORGANIZATION CODE (IF KNOWN)

0021782000

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

Massachusetts Institute of Technology
77 MASSACHUSETTS AVE
Cambridge, MA. 021394301

NAME OF PRIMARY PLACE OF PERF

Massachusetts Institute of Technology

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

Massachusetts Institute of Technology
77 Massachusetts Avenue; 54-1626
Cambridge ,MA ,021394307 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

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TITLE OF PROPOSED PROJECT **Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **226,895**	**48** months	**10/01/11**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

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PI/PD DEPARTMENT

Earth Atmospheric & Planetary Sciences

PI/PD FAX NUMBER

617-253-4464

PI/PD POSTAL ADDRESS

77 Massachusetts Avenue
Building 54 Room 1427
Cambridge, MA 02139
United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME **Glenn R Flierl**	**PhD**	**1975**	**617-253-4692**	**glenn@ocean.mit.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

Electronic Signature

CERTIFICATION PAGE

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(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.
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AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Nancy Sahagian**	**Electronic Signature**	**Feb 14 2011 2:56PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
617-324-5382	**nsahag@mit.edu**	**617-253-4734**

* EAGER - EArly-concept Grants for Exploratory Research
** RAPID - Grants for Rapid Response Research

PROJECT SUMMARY

Intellectual Merit: Observations and models consistently indicate that variations in the Meridional Overturning Circulation (MOC) are strongly correlated to important climate changes such as variations in precipitation and surface air temperatures. To date, most MOC observations have been focused in the North Atlantic. However, model studies show that the South Atlantic is not just a passive conduit for water masses formed in other regions of the world ocean, but instead actively participates in their transformation. The South Atlantic also plays a significant role in the establishment of oceanic teleconnections: the Agulhas leakage reaches the northern hemisphere, and models suggest that changes occurring in the South Atlantic alter the global MOC. These results highlight the need for sustained observations in the South Atlantic that in conjunction with modeling efforts would improve our understanding of the processes necessary to formulate long-term climate predictions.

The U.S. CLIVAR Atlantic MOC (AMOC) implementation strategy calls for a MOC and meridional heat transport monitoring array across the South Atlantic. Three South Atlantic MOC (SAMOC) workshops were held between 2007 and 2010 to bring together the international community to design a suitable integrated observational program. Our hypothesis is that changes in the upper ocean return flow of the MOC in the South Atlantic could significantly impact the properties of the North Atlantic MOC waters over time. The goals of the program are (1) to characterize the time-mean and time-varying components of the MOC, as well as the heat and salt carried by the MOC, in the South Atlantic and (2) to provide a means to observe the changes in the ventilation characteristics and relative contributions of different water masses to the MOC.

This proposal seeks NSF support for a key U.S. component of the integrated program: a trans-basin hydrographic cruise and deployment, turn-around, and recovery cruises and four mid-depth and four deep dynamic height moorings to be deployed on the western and eastern boundaries along 34.5° S. The work proposed here will be an integral part of the overall program, which is a collaborative effort involving investigators from the U.S., France, South Africa, Brazil, and Argentina. The U.S., France, Brazil, and Argentina will provide the major instrumentation for the moored array along 34.5°S that will serve as the backbone for the SAMOC field program, while South Africa, Brazil and Argentina will contribute ship-time and local-expertise for the turn-around and recovery cruises. Together with the existing field programs at 26.5°N in the North Atlantic and across the two Southern Ocean choke points south of South Africa and Drake Passage, the South Atlantic program will provide the measurements necessary to evaluate inter-gyre, inter-hemispheric, and inter-ocean connectivity of the MOC.

Broader Impacts: The influence of the MOC variability on global weather patterns, marine ecosystems, terrestrial vegetation, oceanic CO_2 uptake, and other components of the climate system, is of important societal relevance. The proposed program aims to improve our understanding of the MOC variability in the South Atlantic and its impact on the global climate. Data will be made available to the research community, particularly to the modeling community, to expand our skill in reproducing the observed MOC variability, diagnose the mechanisms that produce MOC variability, and predict the future evolution of the MOC. Many of the PIs participate in the Mentoring Physical Oceanography Women to Increase Retention (MPOWIR) program, and postdoc participation in the program will advance the NSF's education goals.

TABLE OF CONTENTS

For font size and page formatting specifications, see GPG section II.B.2.

*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

TABLE OF CONTENTS

For font size and page formatting specifications, see GPG section II.B.2.

	Total No. of Pages	Page No.* (Optional)*
Cover Sheet for Proposal to the National Science Foundation		
Project Summary (not to exceed 1 page)		
Table of Contents	1	
Project Description (Including Results from Prior NSF Support) (not to exceed 15 pages) **(Exceed only if allowed by a specific program announcement/solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)**	0	
References Cited		
Biographical Sketches (Not to exceed 2 pages each)	2	
Budget (Plus up to 3 pages of budget justification)	8	
Current and Pending Support	2	
Facilities, Equipment and Other Resources	1	
Special Information/Supplementary Documents (Data Management Plan, Mentoring Plan and Other Supplementary Documents)	3	
Appendix (List below.) **(Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)**		
Appendix Items:		

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Appendix Items:		

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PROJECT DESCRIPTION

Prior NSF Support

S. Dong *Collaborative Research: Dynamics of Eighteen Degree Water (EDW) from CLIMODE Observations and its Climate Implications*. NSF-OCE-0958548, 04/01/10-03/31/13, $254,671. The proposed research is to examine the interannual variability in EDW volume and its dependence on ocean processes and atmospheric forcing, to parameterize the relationship between EDW and variables that have or can be observed over longer time periods, and to use that parameterization to examine the ability of IPCC-class models to simulate the role of EDW in climate variability. The goal of the research is to extend the results of the CLIMODE field program to longer time scales to better understand the climate implications of EDW and to provide metrics with which to evaluate the ability of climate models to simulate these processes.

R. C. Perez *Collaborative Research: Global Impact of Eddies on Inertial Oscillations of the Mixed Layer.* NSF- OCE-1031278, 10/01/10-09/30/14, $66,313. The goal of this project is to obtain substantially improved estimates of the wind-driven near-inertial energy flux into the interior ocean. The hypothesis is that the global near-inertial energy flux from the mixed layer to the interior is substantially shaped and accelerated by interactions with the mesoscale eddy field. The work involves analysis of the high-resolution surface drifter dataset, supplemented with process-oriented modeling. A planning meeting will be held in Seattle, WA in February 2011.

J. Sprintall *Collaborative Research: INSTANT: the International Nusantara STratification ANd Transport Program, 9/1/2002-8/31/2007;OCE02-20382, $1,164,991; Collaborative Research: Analysis of the INSTANT Observations of the Indonesian Throughflow, 9/1/2007-8/31/2010,OCE07-25476, $271,449.* The Indonesian Throughflow (ITF) leakage of western tropical Pacific water into the Indian Ocean through the Indonesian seas is an important pathway for the transfer of climate signals and their anomalies around the world. The first award covered the INSTANT field program: a 3-year deployment (2004-06) of moorings and coastal pressure gauges in the major inflow and outflow passages of the ITF. The second award supports the analysis of the mooring observations. Collaborative efforts with various modeling groups to help understand the ITF dynamics resulted in 15 publications in a special edition of *Dynam. Atmosph. Oceans*. The INSTANT data forms the basis of SIO student Kyla Drushka's PhD thesis. INSTANT data and publications are found www.marine.csiro.au/~cow074/index.htm.

R. A. Fine *Collaborative Research: Global Ocean Repeat Hydrography, Carbon and Tracer Measurements*. NSF-OCE-0223951, 01/01/03 – 12/31/08; $884,177. Chlorofluorocarbons (CFC-11, CFC-12, CFC-113) and CH_4 were measured on sections A20/A22 in the Atlantic, P2 and P16S in the Pacific Ocean. Our group consistently analyzed samples at 85-90% of the stations, and met WOCE relaxed standards for precision of <3%. Our data were submitted as required within six months to the CLIVAR/Carbon Hydrographic Data Office at Scripps. We were not funded for analysis, still, three manuscripts have resulted (Smethie et al., 2007; LeBel et al., 2008; Fine et al., 2008).

G. Flierl *Dynamics of Eddies and Dipoles in the South Atlantic, 2/15/2008-1/31/2012, OCE-0752346, $474,607*. Two manuscripts have resulted from this project (Baker-Yeboah et al., 2010; Baker-Yeboah et al., 2011). These studies used observational data and model studies to provide better understanding of the contribution of Agulhas eddies and associated dipolar

structures to heat and salt transport in the ocean. They have improved our knowledge of climate related inter-ocean exchange by quantifying the dynamical structure of the cyclonic and anticyclonic eddies that populate the upper and deep ocean. These manuscripts suggest eddy-dipole dynamics is an important pathway for exchange between the shelf and the deep ocean and for exchange around South Africa, a source region for warm salty waters that play a role in the MOC of the South Atlantic.

Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic

1. Introduction

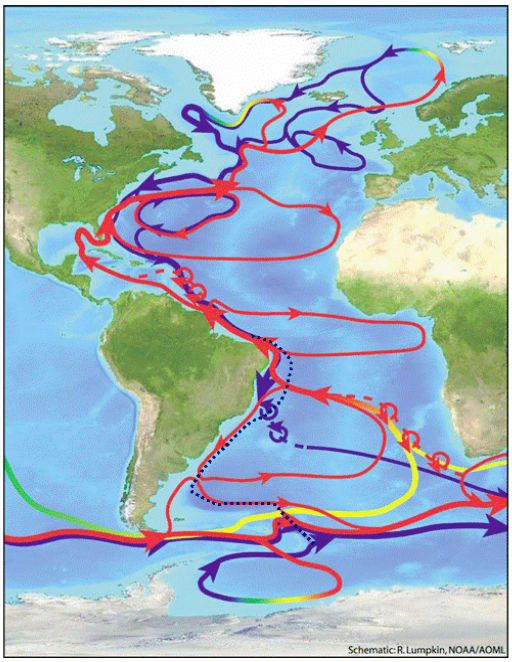

Figure 1. Schematic diagram of the overturning circulation in the Atlantic Ocean that represents the large-scale conversion of surface waters (red arrows) to deep waters (blue arrows in the Southern Ocean; dashed blue line arrows for the North Atlantic Deep Water), adapted from "charting and course of the Ocean Science in the United States for the next decade", 2007, R. Lumpkin, NOAA/AOML. The South Atlantic circulation includes water mass transformations including intermediate water (yellow and green arrows) and considerable uncertainty in the mean pathways (dashed lines) and eddy processes (red and blue circular rings).

The Atlantic component of the Meridional Overturning Circulation (MOC) is characterized by a northward flow of warm water in the upper layers from the tropics and the South Atlantic into the North Atlantic, sinking and formation of North Atlantic Deep Water (NADW) at high latitudes, and a southward return flow of cold water at depth (Fig.1). The Atlantic MOC (AMOC) carries 25% of the total global ocean-atmosphere northward heat flux (e.g. Trenberth and Caron, 2001). The majority of this heat is lost to the atmosphere in the midlatitudes where warm water meets cold, dry continental air masses. The AMOC regulates and maintains the meridional temperature distribution in the Atlantic. Variations in the AMOC and its associated ocean heat transport are coupled to atmospheric heat transport variations through the mechanism of Bjerknes compensation (Shaffrey and Sutton, 2006; van der Swaluw et al., 2007). As a result, changes in AMOC can have a direct and pronounced impact on a variety of climate phenomena (e.g., Vellinga and Wood, 2002), such as African and Indian monsoon rainfall, hurricane activity, and climate variability over the North America and Western Europe. Thus, understanding and monitoring the AMOC variability are crucial for improving our knowledge of important climate processes and for assessing future climate change.

Observational study of MOC variability has historically been focused in the North Atlantic in part because NADW is believed to be a driver for the long-term MOC fluctuations (e.g., Stommel, 1961; Weaver and Hughes, 1992; Stouffer et al., 2006). The limited collection of trans-basin hydrographic sections in the South Atlantic has

hampered efforts to understand the impacts of the South Atlantic on the global MOC. However, the South Atlantic is known to be particularly important as a region where oceanic properties are exchanged, mixed, and redistributed between different ocean basins (e.g., Saunders and King, 1995; Schouten and Matano, 2006; Biastoch, et al., 2008; Garzoli and Matano, 2011). These water mass modification and redistribution processes will impact the AMOC and global climate (Weijer, et al., 1999; Sloyan and Rintoul, 2001; Sarmiento, 2004). The circulation pattern in the South Atlantic also makes it unique in that it is the only major ocean basin that transports heat from the poles towards the equator (e.g., Talley, 2003). The strength of this net northward heat transport depends on the ratio of the water mass contributions from the South Indian Ocean (warm, salty) and from the South Pacific Ocean (cold, fresh) (Garzoli and Gordon, 1996). Thus, to describe the characteristics of the water transported to the north, and to understand how these characteristics change on interannual and decadal time scales, it is important to observe changes of the water masses transported from the South Atlantic to the North Atlantic. Although efforts have been made to estimate the inter-ocean exchanges in the past (e.g., de Ruijter et al. 1999), the limited number of observations available in the Southern Ocean has prevented a comprehensive examination. There is still some debate about how much of the water transported to the north in the upper layer of the AMOC comes from the Pacific through the Drake Passage (Rintoul, 1991) or from the Indian Ocean through the Agulhas Retroflection Region (Gordon, 1986), although the latter possibility has garnered more support in recent years. Model studies suggest that inter-ocean exchanges of heat and salt in the South Atlantic can significantly alter the long-term MOC response (e.g., Weijer et al. 2002; Peeters et al. 2004; Schouten and Matano 2006; Dong et al., 2010; Garzoli and Matano, 2011). Hence, understanding both the North and South Atlantic MOC variability is important for interpreting long-term climate variations (Weijer et al., 2002; Marsh et al., 2007).

2. Background

Our current understanding of the MOC and its governing mechanisms depends heavily on the use of numerical models (e.g., Manabe and Stouffer, 1994; Thorpe et al., 2001; Stouffer et al., 2006; Smith and Gregory, 2009), which have provided important insights into MOC behavior. However, as noted in the IPCC AR4 report: the sensitivity of the MOC to anthropogenic forcing is regarded as a key vulnerability due to the potential for sizeable and abrupt impacts. Although most coupled models predict weakening of the MOC for the 21st century when forced by increasing atmospheric CO_2, the mean strength and variability of the MOC in those models differ tremendously (Fig. 2). In order to assess the climate impact of the MOC and predict future climate change, it is important to accurately simulate changes in the MOC in response to forcing and the sensitivity of the net northward heat transport to the MOC variability.

Before we can rely on models to accurately simulate and predict the MOC and its impact on climate, continuous-in-time measurements of trans-basin full-water column fluxes of mass, heat, and freshwater are needed to improve these models. The only existing full-depth, trans-basin monitoring array is the RAPID/MOCHA/WBTS array at 26.5°N in the North Atlantic (USA-NSF/NOAA and United Kingdom-NERC). This array, which started in March 2004, has already provided valuable new insight on the variability of the AMOC at various time scales (Cunningham et al., 2007; Kanzow et al., 2007; Kanzow et al., 2010) and its meridional heat transport (MHT) (Johns et al., 2011). For example, the first year of observations from this array shows that the AMOC experiences large intra-annual variability, with transports ranging from 4 Sv to 35 Sv (Cunningham et al., 2007). This large intra-annual variability in the AMOC has lead

to questions about the recent controversial study by Bryden et al. (2005) which predicts a 30% slowdown of the AMOC and is based on instantaneous hydrographic surveys. Furthermore, the annual cycle of the MOC and MHT suggests the geostrophic and wind-driven components at 26.5°N differ from those predicted by numerical models (Kanzow et al., 2010; Johns et al., 2011). Despite the advances in our understanding of the AMOC behavior at 26.5°N, very little is known about the meridional connectivity of the AMOC on different time scales. Thus, as recommended by the U.S. CLIVAR AMOC implementation strategy, additional trans-basin measurements at other latitudes are critical to improve our understanding of the AMOC. Trans-basin lines in the subpolar North Atlantic and in the South Atlantic were suggested as high priorities and, together with the existing RAPID/MOCHA array at 26.5°N, they will provide measurements to evaluate inter-gyre and inter-hemispheric connectivity of the AMOC.

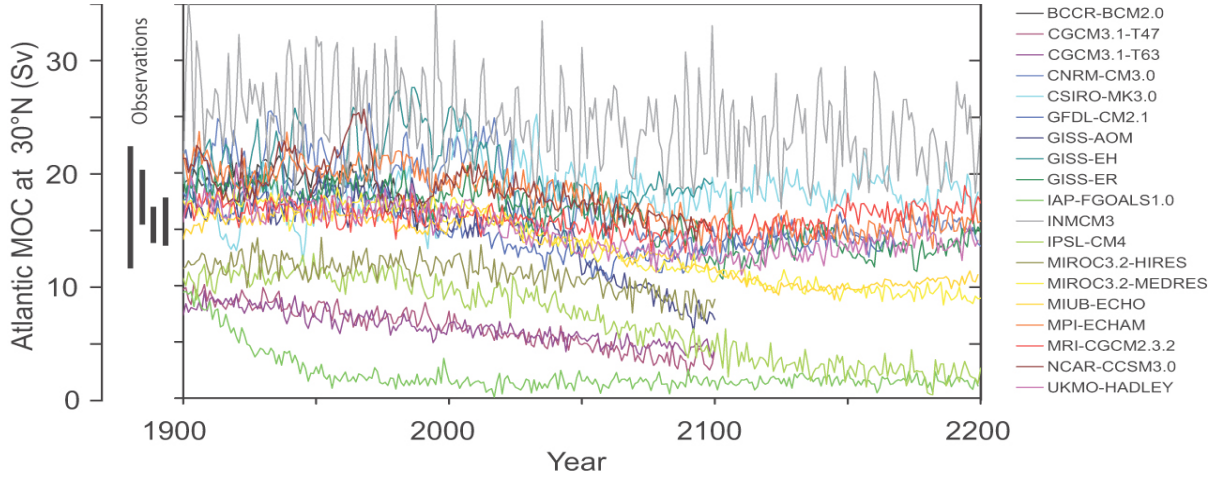

Figure 2. Evolution of the AMOC at 30°N from 19 coupled models integrated from 1850 to 2100 using 20th Century Climate in Coupled Models (20C3M) simulations for 1850 to 1999 and the SRES A1B emission scenario for 1999 to 2100, and constant concentration thereafter. Observationally based estimates of late 20th century MOC are shown as vertical bars on the left. Adapted from IPCC AR4.

Prior to the U.S. CLIVAR recommendation, the importance of obtaining measurements in the South Atlantic was established in February 2003 at the CLIVAR South Atlantic meeting in Angra dos Reis, Brazil. Subsequently, three South Atlantic MOC (SAMOC) workshops were held between 2007 and 2010. Their goals were to foster international collaborations and to establish an observational system designed to measure meridional heat, mass, and freshwater transports in the South Atlantic and the inter-ocean exchanges as components of the MOC. Fig. 3 summarizes all the current efforts to constrain the flow in and out of a South Atlantic box bounded by three high-density XBT transects (AX18 nominally at 34.5°S; AX22 across Drake Passage, and AX25 south of South Africa). XBT and CTD data collected along AX18 have been used to determine MHT (Baringer and Garzoli 2007; Garzoli and Baringer 2007) and its relation with the MOC (Dong et al. 2009). Consistent with findings from the RAPID/MOCHA/WBTS array (Kanzow et al., 2010; Johns et al. 2011), annual variations of the geostrophic and wind-driven components of the MOC and MHT inferred from AX18 transects also differ from those of present generation models (Garzoli and Baringer, 2007; Dong et al., 2009). However, one of the main sources of error in these XBT estimates was the lack of information about the magnitude and variability of the Deep Western Boundary Current near the South American coast and unresolved high-frequency fluctuations that could alias into longer period signals. To address

these deficiencies, the SAMOC community recommendation was to instrument and sustain a zonal trans-basin South Atlantic moored array (Garzoli et al., 2010).

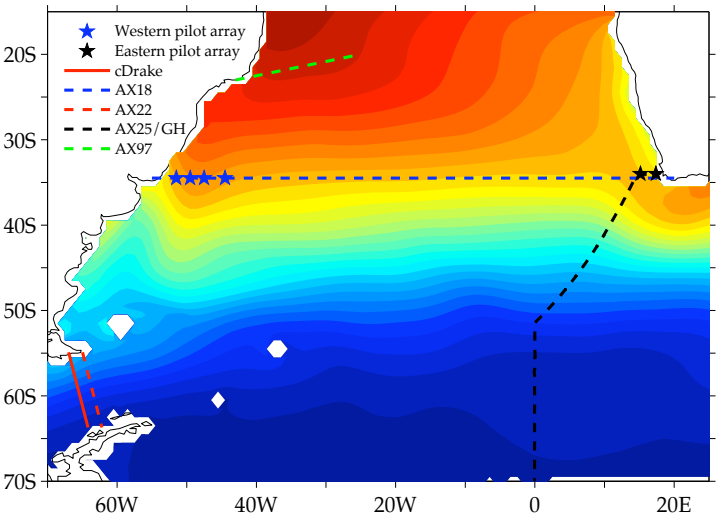

Figure 3. Existing observational systems in the South Atlantic in 2010 and 2011 (adapted from Garzoli et al. 2010) including: western (blue stars) and eastern (black stars) boundary pilot measurements along 34.5°S, the cDrake program (red solid), AX18 (blue dashed), AX22 (red dashed), AX25 (black dashed), and AX97 (green dashed). AX25 coincides with the Goodhope CTD line. Details of other planned observations in the South Atlantic can be found at http://www.aoml.noaa.gov/phod/SAMOC. Color contours are time-mean SST from World Ocean Atlas.

3. SAMOC Field Program

The main objective of the SAMOC field program is to resolve the mean and varying components of the MOC, as well as the heat and salt carried by the MOC in the South Atlantic. SAMOC provides a means to observe the changes in the relative contributions of different water masses to the upper ocean return flow of the MOC in the South Atlantic that could significantly impact the properties of the North Atlantic MOC waters over time. A summary of the main components and resources of the SAMOC field program and the respective PIs (see attached letters of intent) is found in Table 1. Specifically, the SAMOC field program (Figure 4) will comprise:

1. A trans-basin deployment and hydrographic cruise (**USA-NSF, this proposal**, France-ANR**)**, and subsequent eastern and western boundary turn-around and recovery cruises (**USA-NSF, this proposal**; with ship-time by Argentina, Brazil-FAPESP, South Africa).
2. A trans-basin array of approximately 20 deep ocean moorings: a combination of dynamic height moorings, pressure-equipped inverted echo sounders (PIES), and current-and-pressure-equipped inverted echo sounders (CPIES), coupled with several shorter direct velocity moorings on the shelf on either side of the basin (**USA-NSF, this proposal**, USA-NOAA, France-ANR, France-IFREMER, Brazil-MST/FAPESP, Argentina).
3. A line of 7 PIES along the meridional "oblique" transect between South Africa and the Greenwich meridian (hereafter referred to as the Goodhope transect) (France-ANR).

3.1 Rationale for the Design of the SAMOC Field Program

Experience gained in the implementation of the RAPID/MOCHA/WBTS array suggests that to successfully sample the MOC, it is critical and necessary to 1) obtain MOC estimates at a very high sampling rate (i.e. daily) to avoid aliasing high-frequency fluctuations into the semi-annual, annual, and longer periods that are of significant interest to climate studies (Kanzow et al., 2007), and 2) obtain reliable density measurements near the coasts where zonal variations in sea surface height are a poor proxy for upper ocean transport variations (Kanzow et al., 2009). Tests of prospective array types in a variety of ocean models and the RAPID/MOCHA/WBTS observations suggest that a 'geostrophic-style' moored array, i.e. those which provide estimates of full-water-column density profiles either directly (via dynamic height moorings with

numerous temperature-salinity-pressure sensors at several depths) or indirectly (via acoustic measurements by PIES/CPIES), is likely to yield very accurate and cost-effective transport estimates for calculating the MOC (e.g., Hirschi et al., 2003; Baehr et al., 2004; Meinen et al., 2004; Baehr et al., 2009; Perez et al., 2010). Nonetheless, care must be taken not to design an array so zonally sparse as to provide insufficient heat and salt information for calculating meridional transports of these properties.

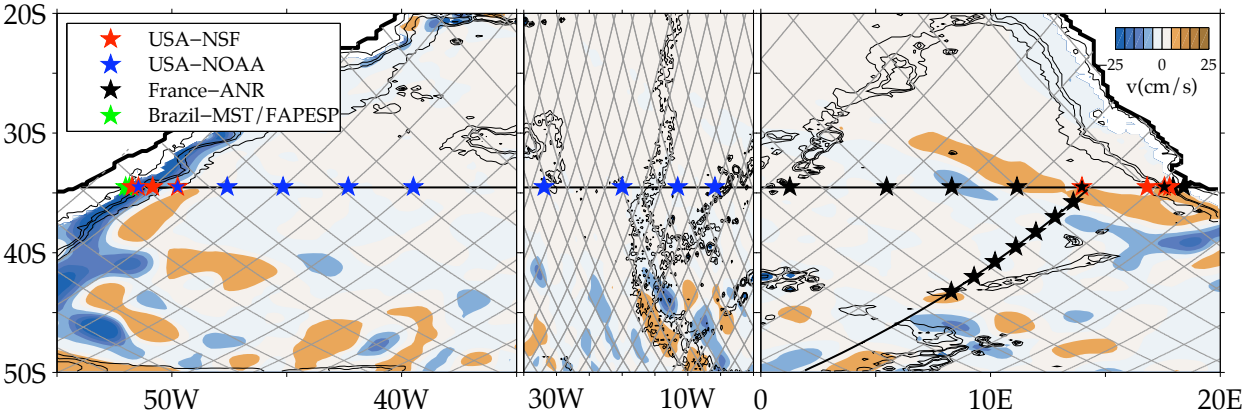

Figure 4. Schematic of the proposed trans-basin array along 34.5°S and the oblique Goodhope transect (see also Table 2). Note the x-axis scale is stretched over western and eastern boundaries. Stars indicate the different components of the array that have been (or will be) submitted to respective funding agencies: dynamic height moorings to **USA-NSF** (**this proposal,** red stars), western boundary PIES/CPIES and interior PIES-DP to USA-NOAA (blue stars), eastern boundary PIES/CPIES; bottom pressure gauges and ADCP to France-ANR (black stars), and western boundary bottom pressure gauges and ADCP by Brazil-MST/FAPESP (green stars). Color contours are of 27-year mean OGCM for the Earth Simulator (OFES) meridional velocity at 200 m depth. JASON ground-tracks are overlaid as light gray lines.

Recent numerical model studies indicate that the higher latitudes (30°S to 34.5°S) are likely to produce more robust estimates of the MOC for several reasons (Drijfhout et al., 2010; Garzoli et al., 2010; Perez et al., 2010). First, higher latitudes provide stronger density gradients, leading to improved signal-to-noise characteristics for geostrophic velocity calculations. Secondly, the strongest signals are more tightly confined to the boundaries at higher latitudes, particularly the eastern boundary, meaning that a more intensely sampled array of the stronger meridional currents can be accomplished over a smaller region. Thirdly, ocean model studies indicate that at higher latitudes it is possible to utilize less expensive mooring technologies (i.e., PIES/CPIES) more effectively in some locations, reducing the cost of the overall system. Finally, the measurement of the stability of the MOC[1], a crucial factor in attribution of observed signals, can best be measured at the southern boundary of the Atlantic, nominally along 34.5°S.

Another advantage of 34.5°S is that observation systems are already in place along that latitude (Fig. 3, Table 1) which can be used as building blocks for a basin-wide 'geostrophic-style' mooring array. Along with XBT transect AX18, these include pilot boundary current measurement systems deployed on the western boundary since March 2009 (USA-NOAA, Argentina-SHN, Brazil-USP & Navy) and on the eastern boundary since February 2008 (France-IFREMER, South Africa-UCT). Based on the location of existing resources and the SAMOC

[1] The stability of the MOC, a function of the baroclinic salt flux, can be computed from a trans-basin hydrographic section (Drijfhout et al., 2010).

community recommendation, a moored array across 34.5°S (Fig. 4) was selected for the **SAM**OC **B**asin-wide **A**rray (SAMBA). In addition to SAMBA, data collected during the trans-basin hydrographic section and the western and eastern boundary turn-around and recovery cruises will be crucial to aid in the analysis and interpretation of the moored observations.

Table 1. Summary of components and resources for the SAMOC field program. Existing measurements are highlighted in gray. **Those components requested as part of this proposal are highlighted in yellow.**

Component	Funding Agency	Principal Investigators	Country	Status
Western boundary pilot measurements (3 PIES/1 CPIES)	NOAA	C. Meinen, S. Garzoli, M. Baringer, G. Goni	USA	Funded
Eastern boundary pilot measurements (2 CPIES)	IFREMER	S. Speich	France	Funded
Eastern boundary pilot measurement augmentation (2 CPIES)	ANR	S. Speich	France	Funded
Quarterly AX18 XBT transect	NOAA	G. Goni, M. Baringer, S. Garzoli	USA	Funded
(1) Dynamic height moorings (8) (2) Deployment cruise and trans-basin hydrographic cruise	**NSF**	**S. Dong, R. Perez, J. Sprintall, R. Fine, G. Flierl, S. Baker-Yeboah**	**USA**	**This proposal**
Western boundary PIES (5)/CPIES (1), interior PIES-DP (4)	NOAA	R. Perez, S. Dong, C. Meinen, S. Garzoli, G. Goni, M. Baringer	USA	Proposed
(1) Eastern boundary CPIES(6), ADCP (1) and bottom pressure recorder (1) (2) Goodhope PIES (7) (3) Biogeochemical sampling during trans-basin hydrographic cruise	ANR	S. Speich	France	Proposed
Western boundary ADCP (1) and bottom pressure recorder (1)	Ministry of Science and Technology	E. Campos	Brazil	Proposed
Ship time for western boundary turn-around and recovery cruise	FAPESP	E. Campos	Brazil	Proposed
Instrumentation to augment western boundary moorings and hydrography	Argentina	A. Piola	Argentina	To be proposed
Ship time for eastern boundary turn-around and recovery cruise	SANAP	I. Ansorge, C. Reason	South Africa	To be proposed

Inter-ocean exchanges of the South Atlantic with the Pacific and Indian Oceans are important for the MOC and the heat and salt carried by the MOC to the North Atlantic. Existing field programs (e.g., cDrake, Fig. 3) and satellite measurements are believed capable of quantifying the ACC-dominated flow through the Drake Passage (Chereskin et al., 2009). However, the eddy-dominated Agulhas leakage (Fig. 1) is harder to quantify from readily available data. Thus, one proposed component of the broader SAMOC field program will be to continuously monitor the Agulhas ring activity and measure their associated volume, heat and salt fluxes along the Goodhope line (Fig. 4, Table 1; France-ANR).

Additional data from existing observational systems will also provide crucial information for analysis and interpretation of signals observed by the SAMOC field program. These include the high-density XBT transects along 34.5°S (AX18), across Drake Passage (AX22) and south of South Africa (AX25). Other components of the global observing system, particularly the ARGO float network and the global drifter array, along with satellite observations of sea height, sea-surface temperature, sea-surface salinity (SMOS, and upcoming Aquarius), and surface wind will provide horizontal context for the SAMOC field program, as well as information of surface forcing. Together with the RAPID/MOCHA/WBTS array at 26.5°N in the North Atlantic and across the two Southern Ocean choke points (Drake Passage and south of South Africa), the South Atlantic field program will provide the measurements necessary to evaluate inter-gyre, inter-hemispheric, and inter-ocean connectivity of the MOC.

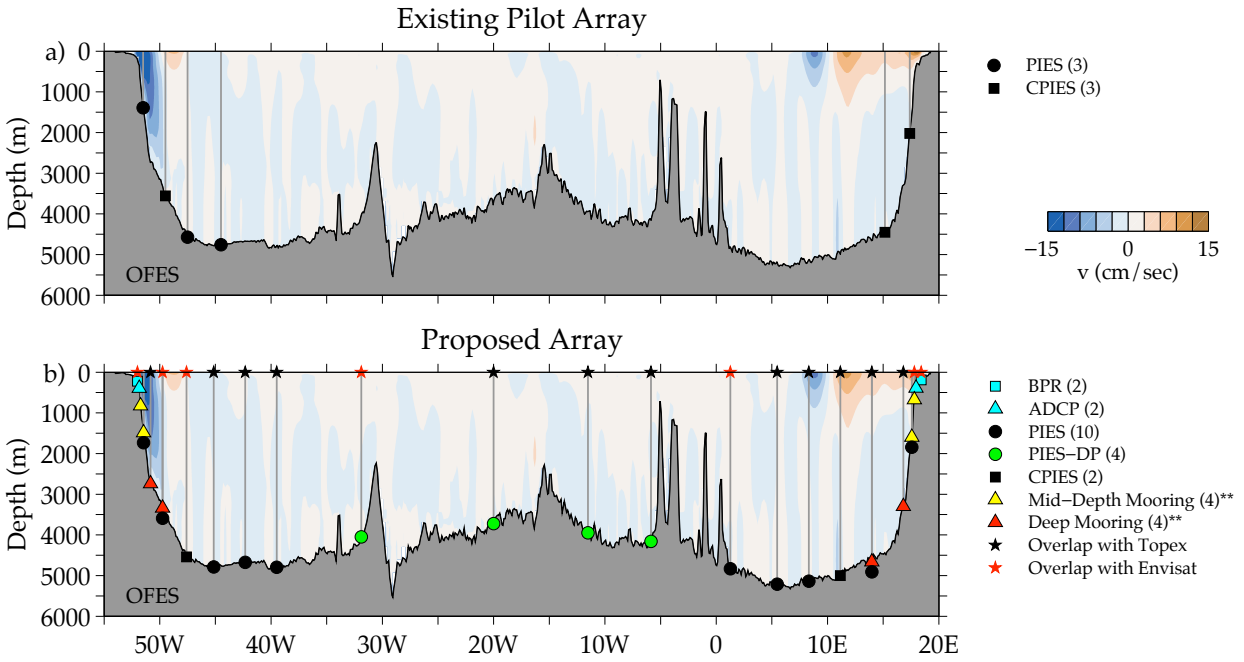

Figure 5. Schematic of the (a) existing pilot current measurement systems as of November 2010 (eastern boundary moorings will be redeployed in 2011), and (b) the proposed trans-basin array along 34.5°S. The proposed array consists of bottom pressure gauges (cyan squares), upward-looking ADCPs, **mid-depth and deep moorings with full water-column T, S, p and discrete current measurements** (**USA-NSF, this proposal, yellow and red triangles, respectively**), PIES (black circles), PIES-with datapods (green circles), and CPIES (black squares). Color contours are of 27-year mean OFES meridional velocity along 34.5°S.

4. The SAMOC Basin-wide Array (SAMBA)

As the main component of the larger SAMOC field program, the primary objectives of the SAMBA experiment are to:

(1) Characterize the time-mean and time-varying components of the AMOC, as well as the heat and salt carried by the AMOC, in the South Atlantic.

(2) Provide a means to observe the ventilation characteristics and relative contributions of different water masses to the MOC in the South Atlantic.

Our working hypothesis is that changes in the upper ocean return flow of the MOC in the South Atlantic could significantly impact the properties of the North Atlantic MOC waters over time.

The U.S., France, Brazil, and Argentina will provide the major instrumentation for the moored array that will serve as the framework for the program, while South Africa, Brazil and Argentina will contribute ship-time and local-expertise for the turn-around and recovery cruises. Fig. 5b and Table 2 summarize the instruments to be deployed as part of SAMBA and their approximate locations.

Table 2. Instruments proposed to be deployed along the trans-basin array and their approximate locations. (T-S: microcat temperature, salinity, and pressure sensors; CM: current meters, BPR: bottom pressure recorder, PIES-DP: PIES with data pods). **Instrumentation requested as part of this proposal is highlighted in yellow.**

Western Boundary		Interior		Eastern Boundary	
Instrument (#)	Location	Instrument	Location	Instrument (#)	Location
BPR (1)	200 m isobath	PIES-DP (1)	West of Rio Grande Rise	BPR (1)	200 m isobath
Upward-looking ADCP (1)	400 m isobath	PIES-DP (1)	West of the mid-ocean ridge	Upward-looking ADCP (1)	400 m isobath
Mid-depth dynamic height mooring (T-S sensors and CM) and BPR/PIES (2)	800 m and 1600 m isobath	PIES-DP (1)	East of the mid-ocean ridge	Mid-depth dynamic height mooring (T-S sensors and CM) and BPR/PIES (2)	800 m and 1600 m isobath
Deep dynamic height mooring (T-S sensors and CM) and BPR/PIES (2)	3000 m and 4000 m isobath	PIES-DP (1)	West of Walvis Ridge	Deep dynamic height mooring (T-S sensors and CM) and BPR/PIES (2)	3000 m and 4000 m isobath
CPIES (1) PIES (5)	East of 4000 m isobath and west of 38°W			CPIES (1) PIES (5)	East of 0°E and west of 4000 m isobath

The full trans-basin array along 34.5°S will consist of a combination of instruments that will be used to directly (ADCPs, point current meters, T, S, P, bottom pressure recorders) and indirectly (PIES/CPIES[2]) estimate the variability of the volume, heat, and salt transport by the MOC (Fig 5b). The trans-basin array can be viewed as three sub-arrays: western boundary, interior, and eastern boundary. The mooring locations for SAMBA were determined through model-based observing system experiments, analysis of data collected from the pilot array on the western boundary (Fig. 5a) and satellite altimetry. The model analysis is an extension of the work done in Perez et al. (2010) in support of this proposal, and is conceptually similar to analyses conducted prior to the deployment of the RAPID/MOCHA array (Hirschi et al., 2003; Baehr et al., 2004).

An extremely dense array of dynamic height moorings would provide a better estimate of the MOC/MHT, but such an array is not logistically/financially feasible. Perez et al. (2010) found that PIES/CPIES virtually deployed with the OGCM For the Earth Simulator (OFES) can

[2] IES produce a time series of vertical acoustic travel times that when combined with local T, S data and the Gravest Empirical Mode (GEM) method produce a time series of dynamic height anomalies (Meinen et al. 2006, and references therein). Including Pressure (PIES) and near-bottom current measurements with a point current meter 50-m above the seafloor (CPIES) in the array allows for the referencing of these geostrophic velocities.

produce similar estimates of the time-mean and time-variability of the MOC as compared with traditional dynamic height moorings. While they reproduce volume transport well, the PIES/CPIES do comparatively less well at reproducing water mass/property variability in the Deep Western Boundary Current (e.g., Meinen et al., 2004), and this illustrates the need for a balanced array of instruments. As such, the proposed SAMBA array will include dynamic height moorings deployed close to the coast, where PIES/CPIES are less successful in reproducing key water mass changes, while PIES and CPIES will be deployed at some of the western and eastern boundary locations (black circles and squares in Fig. 5b) to augment volume transport calculation and provide redundancy in the case of tall mooring failure/loss.

A significant concern of any such array is the ship time required to support and maintain the system. As one effort to reduce this cost, the PIES at each site of the interior region will be equipped with data pods technology (PIES-DP, developed at NOAA/AOML for the SAMOC field program). Data pod capsules will be released periodically, and when they reach the sea surface the data will be transmitted via the Iridium Satellite System (8 capsules are planned at each site). Thus, the PIES at the interior sites need only be deployed and recovered at the end of the SAMOC program, greatly reducing ship time requirements during the turn-around cruises. Ship-time requests are also greatly reduced by partnering with international collaborators who will be contributing ship time for turn-around and mooring recovery cruises and additional hydrographic work in the region (section 4.1, Table 1).

4.1 International Components of SAMBA

SAMBA is an international collaborative effort involving investigators from the U.S., France, South Africa, Brazil, and Argentina. **This proposal specifically seeks funds from USA-NSF for the following major components of SAMBA: four mid-depth and four deep dynamic height moorings to be deployed on the western and eastern boundaries of the trans-basin moored array, bottom pressure sensors to be deployed at the base of each mooring, a 32-day trans-basin mooring deployment and 35-day trans-basin hydrographic cruise.** Specific details of the requested mooring instrumentation, hydrographic measurements and analysis to be carried out under this proposal are found in the following sections. The proposal is designed to span four years including a 30-month deployment of the SAMBA instruments.

Tables 1 and 2 provide a list of the other components of SAMBA and the broader SAMOC field program and principal investigators associated with each project (see attached letters of intent). The field program is designed so that each major component will ‘stand alone’ and provide highly valuable data about the South Atlantic MOC, and heat and salt carried by the MOC, should any other individual component not be initially funded. Nonetheless, the combined data set from the integrated international field program and the supporting observational network will undoubtedly leverage our individual measurements to understand the broad spectrum of variability of the MOC, and the contribution of the South Atlantic volume, heat and salt transport carried by the MOC.

The 32-day mooring deployment and subsequent 35-day trans-basin hydrographic cruises are planned during October 2012 to February 2013 (southern-hemisphere Summer). A ship-time request for a UNOLS vessel for these cruises has been submitted. Brazil and Argentina will contribute ship-time for the western boundary turn-around and recovery cruises, and South Africa for the eastern boundary turn-around and recovery cruises. The 25-day turn-around

cruises are planned for November 2013, and the 30-day recovery cruises are planned for March 2015. The western boundary cruise will recover the PIES-DP west of the Rio Grande Rise and west of the mid-ocean ridge, and the eastern boundary cruise will recover the PIES-DP west of Walvis ridge and east of the mid-ocean ridge. **This proposal also requests funds from USA-NSF for replacement of parts of dynamic height moorings for turn-around cruises, and support for hydrographic measurements during turn-around and recovery cruises.**

4.2 Proposed USA-NSF Contribution to SAMBA: Mid-depth and Deep Mooring Designs

The dynamic height moorings (yellow and red triangles in Fig. 5b) will be deployed with full-water column T, S, P (50 m spacing in mixed layer, 200 m spacing below) and limited point current meters (between 3 and 5 instruments depending on the bathymetric depth) distributed throughout the water column. On each boundary, the mid-depth dynamic height moorings will be located near the 800 m and 1600 m isobaths, and the deep dynamic height moorings will be located near the 3000 m and 4000 m isobaths. All instruments will be set to measure hourly data. To measure variations in barotropic flow, the dynamic height moorings will either have two BPRs or a single BPR with a NOAA-funded PIES deployed within 1 nautical mile of the base of the mooring (dynamic height moorings with nearby PIES have an additional black circle in Fig. 5b). Interleaving of the PIES, BPRs, and dynamic height moorings provides 1) a means to evaluate the performance of the PIES, and 2) a level of redundancy to the array.

4.3 Proposed USA-NSF Contribution to SAMBA: Trans-Basin Hydrographic Cruise

Immediately following the 32-day mooring deployment cruise, a 35-day trans-basin hydrographic cruise is proposed along 34.5°S. **Of the physical and biogeochemical parameters to be collected, T, S, O_2, CFCs, and SF_6 are proposed to USA-NSF,** all other parameters (e.g., nutrients, CO_2) will be proposed to France-ANR. **Also proposed to USA-NSF, the CTD/LADCP component of the cruise** will provide a concurrent estimate of the volume, heat, and salt fluxes; information about the zonal and vertical scales of variability and how eddies/rings impact the transport calculations; and additional data to help build a better T, S climatology and calibration for the PIES/CPIES. Equally important, the baroclinic salt flux obtained during this cruise will allow for estimation of the stability of the MOC (i.e., whether the MOC is in a monostable or bistable regime) as described in Drijfhout et al. (2010). As of February 2011, the 30°S (CLIVAR A10) transect may or may not be done in Fall 2011. It is critical - for meeting the SAMBA objectives - to obtain the proposed data along 34.5°S at the time the mooring arrays are out, and occupation of 34.5°S in 2013 will complement 30°S data if they are collected.

The proposed three transient tracers, chlorofluorocarbons (CFC-11, CFC-12), and sulfur hexafluoride (SF_6) will be measured on board ship using well-known analytical techniques (Bullister and Wisegarver, 2008). The tracers will contribute to the SAMOC objectives by providing observations to evaluate ventilation characteristics and relative contributions of different water masses to the AMOC. In addition to their time scale information used in the process of estimating anthropogenic CO_2 inventory, observing the temporal penetration of transient tracers offers a direct and unequivocal measure of ocean ventilation. Ventilation can be broadly defined as the penetration and sinking of waters from the surface ocean into the interior. Important characteristics of ventilation include the degree of equilibration of dissolved constituents such as CO_2, oxygen and gases used for water mass tracing (e.g., CFCs, SF_6), the

physical pathways of the flow, as well as the timescales for which the water is transported or mixed from the surface to the interior ocean (e.g., Sarmiento, 1983; Jenkins, 1998; O'Connor et al., 2005). During ocean ventilation, characteristics are imprinted on individual water masses through heat, freshwater and gas exchange, both as climatic averages and as anomalies. Characteristic timescales vary from decadal in the thermocline to centennial in the intermediate waters to millennial in the deepest abyssal waters. The tracers proposed offer a direct means of observing the ventilation of the ocean since the middle-to-late 20th century, during which time the ocean took up about two-thirds of its anthropogenic carbon inventory.

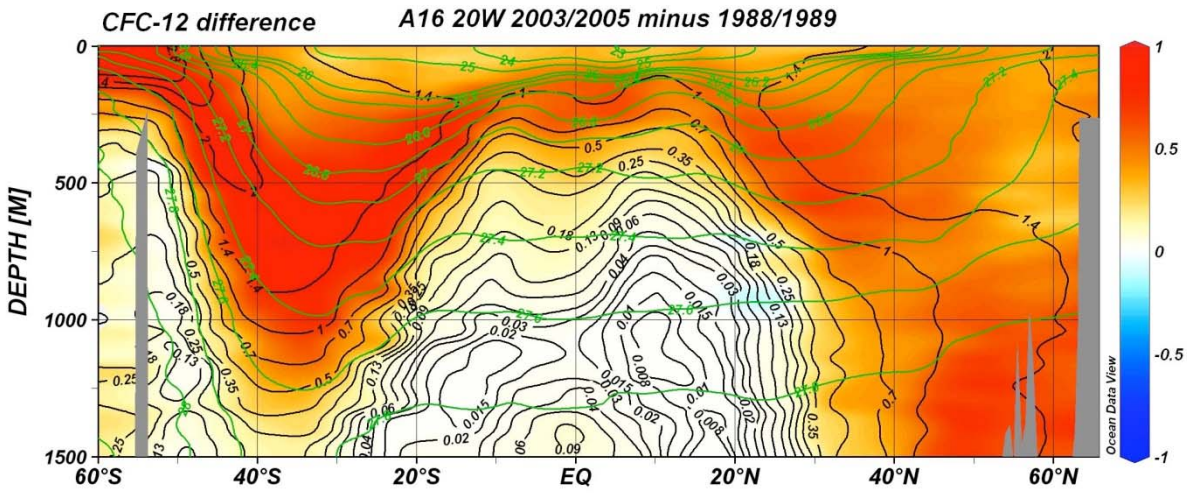

Figure 6. CLIVAR section of dissolved CFC-12 along 20°W (the A16 sections) collected in 2003 and 2005 in black contours, and in color shading difference from WOCE 1988/1989. Green contours are neutral density. Data were plotted using Ocean Data View.

Tracers can be used to describe and quantify ventilation pathway and water mass formation. CFC data have been used to trace newly-ventilated Labrador Sea Water down the western boundary into the tropical Atlantic (e.g., Smethie et al., 2000; Fine et al., 2002), and to examine the South Atlantic water contribution to the upper limb of the MOC (Rhein et al., 2005). Transient tracer inventories (Willey et al., 2004) yield integral water mass formation rates (Orsi et al., 1999; Smethie and Fine, 2001; Orsi et al., 2002; Rhein et al., 2002; LeBel et al., 2008). Recently, inventories have been used to study temporal variability in AMOC water mass formation rates (Kieke et al., 2006, 2007). A challenge is to measure and understand how this ventilation changes over time. Examination of differences in CFC concentrations over time highlights regions where atmospheric constituents, such as CO_2, and climate anomalies, penetrate into the oceans, and provide data for calculating the time scales of these penetrations. For example, in the nearly 15 years between the WOCE and CLIVAR occupations of A16 (20°W), CFC-11 concentration differences show the large scale downward and equatorward penetration of the transient tracer from high latitude source regions of both hemispheres (Fig. 6). There are increases in CFCs related to the MOC below 1000 m in the North Atlantic. Concentration increases are largest (red/orange/yellow) in subtropical gyre thermocline and intermediate waters. In the upper 1000 m, there are larger increases in the South Atlantic than can be accounted for based on the atmospheric source. These increases are due to a combination of the greater strength of Subantarctic Mode Water and Antarctic Intermediate Water formation compared with the strength of their northern counterparts (e.g., Fine et al., 2001; Fine, 2011), and a recent increase in southern subtropical gyre circulation (Roemmich et al., 2007). Larger CFC

increases in southern hemisphere subtropical gyres since WOCE are observed in the Pacific and Indian Ocean (not shown here), and observed in oxygen. Are these changes affecting the upper ocean return flow of the AMOC? Observations of upper ocean ventilation across 34.5°S will contribute to answering these questions.

4.4 Proposed USA-NSF Contribution to SAMBA: Analysis

Data collected from SAMBA will be used to estimate the time-mean and time-varying volume and heat transport by the MOC over a 30-month period (see the work plan in Section 5). From this continuous-in-time SAMBA data set, we will be able to estimate the amplitude and phase of the seasonal cycle of the MOC and MHT and provide a means to observe the changes in the relative contributions of different water masses to the MOC along 34.5ºS in the South Atlantic. We will compare and contrast our measurements with those obtained by the RAPID/MOCHA/WBTS array at 26.5°N. Is the intra-annual variability as large as that found at 26.5°N? What is the relative balance between the geostrophic and wind-driven components in the South Atlantic? Combined, the SAMBA and RAPID/MOCHA/WBTS measurements will allow us to evaluate the inter-gyre and inter-hemispheric connectivity of the AMOC.

The majority of the moored array data will not be available until the last year of the program. Thus, much work will be done in the early stages to analyze the physical, biogeochemical, and tracer data collected during the trans-basin hydrographic cruise. As data are transmitted via the Iridium Satellite System from the interior PIES-DP systems, we will be able to evaluate their performance and begin to analyze data collected from the interior. Retrospective data analysis will also be conducted on the first few years of data from the pilot boundary current measurement systems, and hydrographic data will be analyzed to construct the GEM fields necessary for converting PIES/CPIES measurements into time series of dynamic height anomalies (e.g., Meinen et al., 2006 and references therein).

After the mooring turn-around cruises are completed in year 3, the time-mean and time-varying MOC and MHT along 34.5°S can begin to be quantified from the first half of the data record. In situ data from the oblique Goodhope PIES, VOS XBT sections, and ARGO floats, together with remotely sensed data (sea height, sea-surface temperature, sea-surface salinity, and surface wind), will also be used to improve estimates of the volume, heat, and salt transported by the MOC and allow for attribution of the observed signals. Note that majority of the instrumentation sites is strategically placed under JASON and Envisat altimetry groundtracks. Blended data from bottom pressure observations and sea height anomalies will serve to evaluate the dynamic height estimates and to produce continuous and unambiguous monitoring of the baroclinic and barotropic contributions to the MHT. These estimates will be extrapolated back in time using more than 15 years of altimetry observations, to help produce the longest time series of MHT across 35°S, and will provide insights to investigate similar baroclinic/barotropic relationships in the South Atlantic in order to assess meridional changes of the MOC. This effort will allow for more streamlined processing of the second half of the data record once the mooring recovery cruises are completed in year 4. Furthermore, the first year of data will be used to assess which SAMBA mooring site locations are crucial for possible sustained measurements of the MOC.

It is intended that the SAMBA moored and hydrographic measurements will be used to improve regional and global ocean general circulation models and coupled climate models. Although beyond the scope of this proposal, model analysis in the South Atlantic will be conducted under

a separate, but closely linked, proposal submitted to NSF with Ricardo Matano as the lead-PI (USA-OSU). In this study, 5-km by 5-km nested models over the Southwest Atlantic and the Cape Basin regions will be run within a Southern hemispheric version of the Regional Ocean Model System and used to study processes that influence the MOC. The proposed simulations are expected to support the measurements collected by the SAMOC field program.

5. Time Line and Work Plan

The proposed work will be accomplished in close collaboration with several researchers playing distinct roles. The USA NOAA/AOML collaborators are Christopher Meinen, Silvia Garzoli, Gustavo Goni, and Molly Baringer. International collaborators include Sabrina Speich (France), Edmo Campos (Brazil), Alberto Piola (Argentina), and Chris Reason and Isabelle Ansorge (South Africa), and additional members from the larger SAMOC community (http://www.aoml.noaa.gov/phod/SAMOC/). The primary responsibilities of each USA-NSF investigator (bold) and collaborators are indicated below in alphabetical order.

Year 1: 10/1/11 – 9/30/12: Purchase and prepare instruments (**Baker-Yeboah, Dong, Perez**, Meinen, **Sprintall**, Speich). Continue ongoing model and data (ARGO, altimetry, etc.) analysis to further optimize SAMBA prior to deployment (Goni, **Perez**). PI planning meeting to be held at SIO to coordinate cruises.

Year 2: 10/1/12 – 9/30/13: US Cruise leg 1: SAMBA deployment (**Dong**, Meinen, **Sprintall**), US Cruise leg 2: trans-basin hydrographic section (Baringer, **Fine, Perez**). Evaluate performance of the data pods (Garzoli, Meinen, **Perez**). Analyze transports derived from trans-basin hydrographic section, and compare with transports estimated from the AX18 XBT transect (**Dong, Perez**). Analyze tracer and biogeochemical data collected from trans-basin hydrographic section and evaluate distribution of water masses (Baringer, **Dong, Fine,** Speich). Construct GEM fields from hydrographic data (**Baker-Yeboah**, Meinen). Estimate baroclinic salt flux for stability of the MOC calculation (Baringer, **Dong**, Garzoli). PI meeting at EGU.

Year 3: 10/1/13 – 9/30/14: Argentina/Brazil Cruise 1: Turn-around cruise on the western boundary (Campos, **Dong,** Meinen, Piola, **Sprintall**). South Africa Cruise 1: Turn-around cruise on the eastern boundary (Ansorge, **Perez**, Reason, Speich, **Sprintall**). Analyze hydrographic data collected at mooring sites (Baringer, **Dong,** Meinen, **Perez**) and biogeochemical data (Baringer, **Dong, Fine**, Speich), and update GEM fields (**Baker-Yeboah**, Meinen). Analyze transports derived from first year of moored data, and compare with transports estimated from the AX18 transect (Baringer, **Dong**, Garzoli, Meinen, **Perez, Sprintall**). Attribution of signals seen along 34.5°S with data from oblique Goodhope PIES, AX22 and AX25 transects, and data from ARGO floats and altimetry (**Baker-Yeboah, Dong,** Goni, Speich). PI meeting at the yearly SAMOC workshop in Argentina.

Year 4: 10/1/14 – 9/30/15: Argentina/Brazil Cruise 2: Mooring-recovery cruise on the western boundary up to the western side of the mid-ocean ridge (Campos, Meinen, **Perez**, Piola, **Sprintall**), South Africa Cruise 2: Mooring-recovery cruise on the eastern boundary up to the eastern side of the mid-ocean ridge (Ansorge, **Dong,** Reason, Speich, **Sprintall**). Analyze hydrographic data collected at mooring sites (Baringer, **Dong,** Meinen, **Perez**) and update GEM fields (**Baker-Yeboah**, Meinen). Analyze transports derived from the approximately 30-month record of moored data, and compare with transports estimated from the AX18 transect (Baringer, **Dong**, Garzoli, Meinen, **Perez, Sprintall**). Publish analysis of hydrographic and biogeochemical

data (Baringer, **Dong, Fine**, Meinen, **Perez**, Speich). Attribution of signals seen along 34.5°S with data from oblique Goodhope PIES, AX22 and AX25 transects, and data from ARGO floats and altimetry (**Baker-Yeboah, Dong**, Goni, Speich). Estimate seasonal cycles of MOC, MHT, and salt transport (**Dong, Perez**). PI workshop in Miami, FL. Publication of initial transport mean and variability analysis (**all PIs**).

6. Broader Impacts

As a major component of the international SAMOC field program, SAMBA provides a means to characterize the time-mean and time-varying components of the MOC, as well as the heat and salt carried by the MOC, and observe the changes in the relative contributions of different water masses to the MOC along 34.5ºS in the South Atlantic. Aligned with new NSF policy, our Data Management Plan is found with the Supplementary Documents in this proposal. Briefly, our plan is to use the SAMOC website to allow all international investigators to post and exchange data collected as part of the field program. All data will be made publicly available to the research community within 2-years after completion of the field program. In particular, our aim is to directly interact with and provide data to the modeling community, to expand our skill in reproducing the observed MOC variability, diagnose the mechanisms that produce MOC variability, and predict the future evolution of the MOC. This program is motivated by the need to understand the impact of the MOC on global climate.

Enhancement of research infrastructure will be achieved through participation in a coordinated international research program. The collective merit for an internationally coherent program has become strongly apparent given the complexity and scope of the field program. While the U.S.-NSF component will primarily focus on the moored array SAMBA measurements and the hydrographic survey, we will work closely with our international colleagues in a fully integrated co-operative effort towards meeting the SAMBA objectives through a series of planned workshops. We will broadly disseminate our results within and beyond the scientific community. Workshops and presentations to the oceanographic community are scheduled in conjunction with EGU meetings and SAMOC workshops. The SAMOC website will serve as an additional forum for the exchange of ideas.

We will promote training and learning through the involvement of graduate students, both in the research and on the cruises, and further educational impact will result from requested funding to support postdoctoral fellows at the University of Miami and MIT. Opportunities to participate in the cruises will also be offered to students of our international collaborators. Many of the PIs participate in the Mentoring Physical Oceanography Women to Increase Retention (MPOWIR) program, and MPOWIR 10-week internships would be offered through the NOAA/AOML laboratory. R. Fine is on the implementation committee of the University of Miami's NSF Advance program.

References:

Baringer, O. M., and S. L. Garzoli, 2007: Meridional heat transport determined with Expendable Bathythermographs. Part I: Error estimates from model and hydrographic data. *Deep-Sea Res. Part I*, **54**, 1390-1401.

Biastoch, A., C. W. Boning, and J. R. E. Lutjeharms, 2008: Agulhas leakage dynamics affects decadal variability in Atlantic Overturning Circulation, *Nature*, **456**, 489-492.

Baehr, J., J. Hirschi, J.-O. Belsmann, and J. Marotzke, 2004: Monitoring the meridional overturning circulation in the North Atlantic: A model-based array design study. *J. Marine Res*., **62**, 283-312.

Baehr, J., A. Stroup, and J. Marotzke, 2009: Testing concepts for continuous monitoring of the meridional overturning circulation in the South Atlantic. *Ocean Modelling*, **29**, 147-153.

Baker-Yeboah, S., G. R. Flierl, G. G. Sutyrin, and Y. Zhang, 2010: Transformation of an Agulhas eddy near the continental slope. *Ocean Sci.*, **6**, 143-159.

Baker-Yeboah, S., G. R. Flierl, and D. R. Watts, 2011: Dipoles and propagation of Agulhas eddies: the effects of laterally and vertically coupled vortices, submitted.

Bryden, H. L., H. R. Longworth, and S. A. Cunningham, 2005: Slowing of the Atlantic Meridional Overturning Curculation at 26.5°N, *Nature*, **438**, 655-657.

Bullister, J.L., and D. P., Wisegarver, 2008: The shipboard analysis of trace levels of sulfur hexafluoride, chlorofluorocarbon-11 and chlorofluorocarbon-12 in seawater. *Deep-Sea Res*. *Part 1*, **55**, 1063-74, doi:10.1016/j.dsr.2008.03.014

Chereskin, T. K., K. A. Donohue, D. R. Watts, K. L. Tracey, Y. L. Firing, and A. L. Cutting, 2009. Strong bottom currents and cyclogenesis in Drake Passage, *Geophys. Res. Lett*., **36**, L23602, doi:10.1029/2009GL040940.

Cunningham, S. A., and coauthors, 2007: Temporal Variability of the Atlantic Meridional Overturning Circulation at 26.5ºN. *Science,* **317**, 935-938.

de Ruijter, W. P. M., A. Biastoch, S. S. Drijfhout, J. R. E. Lutjeharms, R. P. Matano, T. Pichevin, P. J. van Leeuwen, and W. Weijer, 1999, Indian-Atlantic interocean exchange: Dynamics, estimation and impack. *J. Geophys. Res.*, **104**, 20885-20910.

Drifjhout, S. S., S. L. Weber, and E. van der Swaluw, 2010: The stability of the THC as diagnosed from present, past and future climates. *Climate Dyn*., in press.

Dong, S., S. L. Garzoli, M. O. Baringer, C. S. Meinen, and G. J. Goni, 2009: Interannual variations in the Atlantic Meridional Overturning Circulation and its Relationship with the Net Northward Heat Transport in the South Atlantic, *Geophys. Res. Lett*. **36**, L20606, doi:10.1029/2009GL039356.

Dong, S., S. L. Garzoli, and M. O. Baringer, 2010: The role of inter-ocean exchanges on decadal variations of the northward heat transport in the South Atlantic. *J. Phys. Oceanogr.*, in revision.

Fine, R. A., K. A. Maillet, K. F. Sullivan, and D. Willey, 2001: Circulation and ventilation flux of the Pacific Ocean. *J. Geophys. Res.* **106**, 22159-78.

Fine, R. A., 2011: Observations of CFCs and SF_6 as ocean tracers, *Annu. Rev. Mar. Sci.*, **3**, 173-195.

Fine, R. A., M. Rhein, and C. Andrié, 2002: Using a CFC effective age to estimate propagation and storage of climate anomalies in the Deep Western North Atlantic Ocean. *Geophys. Res. Letts.*, **29**, 2227, doi:10.1029/2002 GL015618.

Fine, R. A., W. M. Smethie, J.L. Bullister, D-H. Min, M.J. Warner, M. Rhein, A. Poisson, and R.F. Weiss. 2008: Decadal Ventilation and Mixing of Indian Ocean Waters, *Deep-Sea Res.* I, 54, doi: 10.1016/j.dsr.2007.10.002.

Garzoli, S. L., and A. L. Gordon, 1996: Origins and Variability of the Benguela Current, *J. Geophys. Res. Oceans*, **101**, 879-906.

Garzoli, S., and M. O. Baringer, 2007: Meridional heat transport determined with expandable bathythermographs. Part II: South Atlantic transport. *Deep-Sea Res. Part I*, **54**, 1402-1420.

Garzoli, S. L., and R. P. Matano, 2011: The South Atlantic and the Atlantic meridional overturning circulation. *Deep Sea Research*, in press.

Garzoli, S. L., S. Speich, A. Piola, and E. Campos, 2010: South Atlantic Meridional Overturning Circulation (SAMOC) – Third Workshop, *Clivar Exchanges*, No. 54 (unpublished manuscript).

Gordon, A. L., 1986: Interocean exchange of thermocline water, *J. Geophys. Res.*, **91**, 5037-5046.

Hirschi, J., J. Baehr, J. Marotzke, J. Stark, S. Cunningham, J.-O. Beismann, 2003; A monitoring design for the Atlantic meridional overturning circulation. *Geophys. Res. Lett*., **30**, 1413, doi:10.1029/2002GL016776.

Jenkins, W. J., 1998: Studying thermocline ventilation and circulation using tritium and ^{3}He. *J. Geophys. Res.,* **103**, 15,817-15,831.

Johns, W. E., and coauthors, 2011: Continuous, array-based estimates of Atlantic Ocean heat transport at 26.5°N. *J. Climate*, in press.

Kanzow, T., and coauthors, 2007: Observed flow compensation associated with the MOC at 26.5°N in the Atlantic. *Science*, **317**, 938–941.

Kanzow, T., and coauthors, 2010: Seasonal variability of the Atlantic meridional overturning circulation at 26.5°N. *J. Climate*, **23**, 5678-5698.

Kieke, D. A., and coauthors, 2007: Changes in the pool of Labrador Sea Water in the subpolar North Atlantic related to changes in the upper North Atlantic circulation. *Geophys. Res. Lett.,* **34,** doi:10.1029/2006GL028959l.

Kieke, D. A., M. Rhein, L. Stramma, W. M. Jr. Smethie, D. A. LeBel, and W. Zenk, 2006: Changes in the CFC inventories and formation rates of Upper Labrador Sea Water, 1997-2001. *J. Phys. Oceanogr.,* **36**, 64-86.

LeBel, D. A., and coauthors, 2008: The Distribution of CFC-11 in the North Atlantic During WOCE: Inventories and Calculated Water Mass Formation Rates. *Deep-Sea Res*. I, **55**, 891-910.

LeBel, D. A., W. M. Smethie, M. Rhein, D. Kieke, and R. A. Fine, 2008: The distribution of CFC-11 in the North Atlantic during WOCE: Inventories and calculated water mass formation rates, *Deep-Sea Res* . I, 55, 891-910.

Manabe, S., and R.J. Stouffer, 1994: Multiple-century response of a coupled ocean-atmosphere model to an increase of atmospheric carbon dioxide. *J. Climate*, **7**, 5-23.

Marsh, R., W. Hazeleger, A. Yool, E. J. Rohling, 2007: Stability of the thermohaline circulation under millennial CO_2 forcing and two alternative controls on Atlantic salinity, *Geophys. Res. Lett.,* **34**, L03605, doi:10.1029/2006GL027815.

Meinen, C. S., S. L. Garzoli, W. E. Johns, and M. O. Baringer, 2004: Transport Variability of the Deep Western Boundary Current and the Antilles Current off Abaco Island, Bahamas, *Deep Sea Res. I*, **51(11)**, 1397-1415.

O'Connor, B. M., R. A. Fine, and D. B. Olson, 2005: A Global comparison of subtropical underwater formation rates. *Deep-Sea Res.* I, **52**, 1569-90.

Orsi, A. J., W. M. Jr. Smethie, and J. L. Bullister, 2002: On the total input of Antarctic waters to the deep ocean: A preliminary estimate from chlorofluorocarbon measurements. *J. Geophys. Res.* **107,** doi:10.1029/2001/C000976.

Orsi, A. J., G. C. Johnson, and J. L. Bullister, 1999: Circulation, mixing, and production of Antarctic Bottom Water. *Prog. Oceanogr.,* **43**, 55-109.

Peeters, F. J. C., R. Acheson, G-J. Brummer, W.P.M. de Ruijter, R. R. Schneider, G. M. Ganssen, E. Ufkes, and D. Kroon, 2004: Vigorous exchange between Indian and Atlantic ocean at the end of past five glacial periods. *Nature*, **430**, 661-665.

Perez, R. C., S. L. Garzoli, C. S. Meinen, and R. P. Matano, 2010: Observing methods for the meridional overturning circulation and meridional heat transport in the South Atlantic. *J. Atmos. Oceanic Technol.*, submitted.

Rhein, M, and coauthors, 2002: Labrador Sea Water: Pathways, CFC inventory and formation rates. *J. Phys. Oceanogr.,* **32**, 648-65.

Rhein, M, K. Kirchner, C. Mertens, R. Steeinfeldt, M. Walter, and U. Fleischmann-Wischnath, 2005: Transport of South Atlantic water through the passages south of Guadeloupe and across 16N, 2000-2004. Deep-Sea Research I, **52**, 2234-2249.

Rintoul, S. R., 1991: South Atlantic interbasin exchange. *J. Geophys. Res.*, **96**, 2675-2692.

Roemmich, D, and coauthors, 2007: Decadal spin-up of the South Pacific subtropical gyre. *J. Phys. Oceanogr*., **37**, 162-73.

Sarmiento, J. L., 1983: A Simulation of Bomb Tritium Entry into the Atlantic Ocean, *J. Phys. Oceanogr*., **13**, 1924-1939.

Sarmiento, J. L., 2004: High-latitude controls of thermocline nutrients and low biological productivity, *Nature*, **427**, 56-60.

Saunders, P. M., and B. A. King, 1995: Oceanic fluxes on the WOCE A11 section, *J. Phys. Oceanogr.*, *25*, 1942-1958.

Schouten, M. W., and R. P. Matano, 2006: Formation and pathways of intermediate water in the Parallel Ocean Circulation Models Southern Ocean. *J. Geophys. Res*., **111**, C06015, doi:10.1029/2004JC00234.57.

Shaffrey, L., and R. Sutton, 2006: Bjerknes compensation and the decadal variability of the energy transports in a coupled climate model. *J. Climate*, *19*, 1167-1181.

Sloyan, B. M., and S. R. Rintoul, 2001: The Southern Ocean limb of the global deep overturning circulation, *J. Phys. Oceanog.*, *31*, 143-173.

Smethie, W. M., R. A. Fine, A. Putzka, and E. P. Jones, 2000: Tracing the flow of North Atlantic deep water using chlorofluorocarbons. *J. Geophys. Res.,* **105**, 14297-323.

Smethie, W. M., and R. A. Fine, 2001: Rates of North Atlantic deep water formation calculated from chlorofluorocarbon inventories. *Deep-Sea Res.*, **48**, 189-215.

Smethie, W. M., D. A. LeBel, R. A. Fine, M. Rhein, and D. Kieke, 2007: Strength and variability of the deep limb of the North Atlantic Meridional Overturning Circulation from chlorofluorocarbon inventories, *AGU Monogr. on Past and future changes of the Ocean's Meridional Overturning Circulation*, Series 173, 119-130.

Smith, R. S., and J. M. Gregory, 2009: A study of the sensitivity of ocean overturning circulation and climate to freshwater input in different regions of the North Atlantic, *Geophys. Res. Lett*., **36**, L15701, doi:10.1029/2009GL038607.

Stommel, H., 1961: Thermohaline convection with two stable regimes of flow. *Tellus,* **13**, 224-230.

Stouffer, R., and coauthors, 2006: Investigating the causes of the response of the thermohaline circulation to past and future climate changes. *J. Climate*, *19*, 1365-1387.

Talley, L. D., J. L. Reid, and P. E. Robbins, 2003: Data-based Meridional Overturning Streamfunctions for the Global Ocean, *J. Climate*, **16**, 3213-3226.

Thorpe, R. B, J. M. Gregory, T. C. Johns, R. A. Wood, and J. F. B. Mitchell, 2001: Mechanisms determining the Atlantic thermohaline circulation response to greenhouse gas forcing in a non-flux-adjusted coupled climate model. *J. Climate*, **14**, 3102-3116.

Trenberth K. E., and J. M. Caron, 2001: Estimates of meridional atmosphere and ocean heat transports. *J. Climate,* **14**, 3433–3443.

Van der Swaluw, E., S. S. Drijfhout, and W. Hazeleger, 2007: Bjerknes compensation at high northern latitudes: The ocean forcing the atmosphere. *J. Climate*, **20**, 6023-6032.

Vellinga, M., and R. A. Wood, 2002: Global climatic impacts of a collapse of the Atlantic thermohaline circulation. *Clim. Change*, **54**, 251-267.

Weaver, A. J., and T. M. Hughes, 1992: Stability and variability of the thermohaline circulation and its link to climate. *Trends Phys. Oceanogr.,* **1**, 15-70.

Weijer, W., W. P. M. de Ruijter, H. A. Dijkstra, and P. J. van Leeuwen, 1999: Impact of interbasin exchange on the Atlantic Overturning Circulation, *J. Phys. Oceanog.*, **29**, 2266-2284.

Weijer, W., W. P. M. de Ruijter, A. Sterl, and S. S. Drijfhout, 2002: Response of the Atlantic overturning circulation to South Atlantic sources of buoyancy. *Global and Planetary Change*, **34**, 293-311.

Willey, D. A., and coauthors, 2004: Global oceanic chlorofluorocarbon inventory. *Geophys. Res. Lett.,* **31,** doi:10.1029/2003GL018816Drushka, K., J. Sprintall, S. T. Gille, and W. S. Pranowo, 2008. Observations of the 2004 and 2006 Indian Ocean tsunamis from the INSTANT pressure gauge array, *J. Geophys. Res.,* **113**, C07038, doi:10.1029/2007JC004662.

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- Member of the AMS Air-Sea Interaction Committee (term January 30, 2009 – January 31, 2012).
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- Reviewer for NSF proposals

RECENT PUBLICATIONS

Dong, S., S. T. Gille, J. Sprintall, and E.J. Fetzer, 2010: Assessing the potential of the Atmospheric Infrared Sounder (AIRS) surface temperature and relative humidity in turbulent heat flux estimates in the Southern Ocean. *J. Geophys. Res*., **115**, C05013, doi:10.1029/2009JC005542.

Wang, C., and S. Dong, 2010: Is the basin-wide warming in the North Atlantic Ocean related to atmospheric carbon dioxide and global warming? *Geophys. Res. Lett*, **37**, L08707, doi:10.1029/2010GL042743

Wang, C., S. Dong, and E. Munoz, 2010: Seawater density variations in the North Atlantic and the Atlantic meridional overturning circulation. Climate Dynamics, 34, 953-968, doi:10.1007/s00382-009-0560-5.

Dong S., S. L. Garzoli, M. O. Baringer, C. S. Meinen, and G. J. Goni, 2009: Interannual variations in the Atlantic Meridional Overturning Circulation and its Relationship with the Net Northward Heat Transport in the South Atlantic, revised for *Geophys. Res. Lett*. **36**, L20606, doi:10.1029/2009GL039356.

Dong S., S. L. Garzoli, and M. O. Baringer, 2009: An assessment of the seasonal mixed-layer salinity budget in the Southern Ocean. *J. Geophys. Res*., **114**, C12001, doi:10.1029/2008JC005258.

Wang, C., Z. Song, F. Qiao, and S. Dong, 2009: What signals are removed and retained by using an anomaly field in climatic research? *Int. J. Oceanogr.*, 329754, doi:10.1155/2009/329754.

Xu, Y., J. Li, and S. Dong, 2009: Ocean circulation from altimetry: progress and challenges. *Ocean Circulation and El Nino: New research*. Edited by F. Columbus, Nova Science Publishers, Inc.

Dong S., J. Sprintall, S. T. Gille, and L. Talley, 2008: Southern Ocean mixed depth from Argo float profiles. *J. Geophys. Res.*, **113**, C06013, doi:10.1029/2006JC004051.

SOME RELEVANT PUBLICATIONS

Dong, S., S.T. Gille, and J. Sprintall, 2007: An assessment of the Southern Ocean mixed layer heat budget. *J. Climate*, **20**, 4425-4442.

Dong, S., S.L. Hautala, and K.A. Kelly, 2007: Interannual variations in upper-ocean heat content and heat transport convergence in the western North Atlantic. *J. Phys. Oceanogr*., **37**, 2682-2697.

Dong S., J. Sprintall, and S. T. Gille, 2006: Location of the Polar Front from AMSR-E Satellite sea surface temperature measurements, *J. Phys. Oceanogr.*, **36**, 2075-2089.

Dong S.,and K. A. Kelly, 2004: Heat budget in the Gulf Stream region: the importance of heat storage and advection, *J. Phys. Oceanogr*., **34***,* 1214-1231.

Membership: American Geophysical Union, American Meteorological Society

Field Experience: Served as co-chief scientist for the U.S. CLIVAR/CO_2 Repeat Hydrography Program's P06 cruise (Leg 1, November 21, 2009-January 2, 2010)

Recent collaborators: Drs. Sarah Gille, Janet Sprintall, Kathryn A. Kelly, Lynne Talley, Susan Hautala, Chunzai Wang, Silvia Garzoli, Molly Baringer, Christopher S. Meinen, Gustavo J. Goni, Eric J. Fetzer

BIOGRAPHICAL SKETCH

RANA A. FINE
Professor, Division of Marine and Atmospheric Chemistry
Rosenstiel School of Marine and Atmospheric Science (RSMAS)
University of Miami
4600 Rickenbacker Causeway, Miami, FL 33149
Tel.: 305-421-4722; E-mail: rfine@rsmas.miami.edu

PROFESSIONAL PREPARATION

Institution	**Major**	**Degree & Year**
New York University	Mathematics	B.A. 1965
University of Miami	Mathematics	M.A. 1973
University of Miami, RSMAS	Marine Science	Ph.D. 1975
Postdoctoral Institution	**Area**	**Inclusive Dates**
University of Miami, RSMAS	Tracer Oceanography	1976 - 1977

APPOINTMENTS

Professor, RSMAS, University of Miami, 1990-present
Chair, Marine and Atmospheric Chemistry, RSMAS, University of Miami, 1990-94
Associate Professor, RSMAS, University of Miami, 1984-90
Associate Program Director, Ocean Dynamics, National Science Foundation, 1981-83
Research Associate Professor, RSMAS, University of Miami, 1980-84
Research Assistant Professor, RSMAS, University of Miami, 1977-80
Systems Analyst, Service Bureau Corporation, subsidiary of IBM Corporation, 1965-69

PUBLICATIONS

5 Publications Most Closely Related to the Proposed Project

Smethie, Jr., W.M., and R.A. Fine. Rates of North Atlantic Deep Water formation calculated from chlorofluorocarbon inventories. *Deep-Sea Res.*, 48: 189-215, 2001.

Fine, R.A., M. Rhein and C. Andrié. Using a CFC effective age to estimate propagation and storage of climate anomalies in the Deep Western North Atlantic Ocean. *Geophys. Res. Letts.*, 29, 2227, 10.1029/2002 GL015618, 2002.

Fine, R.A. Observations of CFCs and SF_6 as ocean tracers, *Annu. Rev. Mar. Sci.*, 3, 173-195, 2011.

Smethie, W.M., R.A. Fine, A. Putzka, E.P. Jones. Tracing the flow of North Atlantic Deep Water using chlorofluorocarbons. *J. Geophys. Res.*, 105: 14,297-14,234, 2000.

LeBel, D.A., W.M. Smethie, Jr., M. Rhein, D. Kieke, R.A.. Fine, J.L. Bullister, D-H. Min, W. Roether, R.F. Weiss, C. Andrie, D. Smythe-Wright, and P. Jones. The formation rate of North Atlantic Deep Water and Eighteen Degree Water calculated from CFC-11 inventories observed during WOCE, *Deep-Sea Res.* I, 55, 891-910, 2008.

5 Other Significant Publications

Willey, D.A., R.A. Fine, R.E. Sonnerup, J.L. Bullister, W.M. Smethie, Jr., and M.J. Warner. Global oceanic chlorofluorocarbon inventory. *Geophys. Res. Letts.*, 31, L01303, doi: 10.1029/2003GL018816, 2004.

Fine, R.A., W.M. Smethie, Jr., J.L. Bullister, D-H. Min, M.J. Warner, M. Rhein, A. Poisson, and R.F. Weiss. Decadal Ventilation and Mixing of Indian Ocean Waters, *Deep-Sea Res.* I, 54, doi: 10.1016/j.dsr.2007.10.002, 2008.

Fine, R.A., K.A. Maillet, K.F. Sullivan, and D. Willey. Circulation and ventilation flux of the Pacific Ocean. *J. Geophys. Res.-Oceans*, 106(10): 22,159-22,178, 2001.

Sloyan, B.M., L. Talley, T. Chereskin, R.A. Fine, and J. Holte. Subantarctic Mode Water Formation: The role of turbulent mixing, *J. Phys. Oceanogr.*, 40, 1558-1574, 2010.

Qu, T., S. Gao, I. Fukumori, R.A. Fine, and E.J. Lindstrom. The obduction of Equatorial 13ºC Water in the Pacific identified by a simulated passive tracer, *J. Phys. Oceanogr.*, 40, 2282-2297, 2010.

SYNERGISTIC ACTIVITIES

American Association for the Advancement of Science: Fellow 1996; Section on Atmospheric and Hydrospheric Sciences Nominating Committee, 1994-97; Chair-Elect, 2001-02; Chair, 2002-03; Retiring Chair, 2003-04.

American Geophysical Union: Fellow 1993; Secretary of the Ocean Sciences Section, 1986-88; President-elect of the Ocean Sciences Section, 1994-96; President of the Ocean Sciences Section, 1996-98; Program Chairperson, Ocean Sciences Section, Spring Meetings, 1982, 1987; Fall Meeting, 1986; Ocean Sciences Meeting, 1988; Macelwane Award Committee, 1985-86; Union Publications Committee, 1994-96; Chair Ocean Sciences Section Fellows Committee, 1994-00; Chair, Search Committee, *J. Geophys. Res.-Oceans*, 1998-00; Union Special Committee on Section Structure, 2001-02; Ocean Sciences Section Executive Committee, 1994-present; Revelle Medal Committee, 2002-04; Bowie Medal Committee 2004-06, Chair 2007-08; Honors and Recognition Committee 2008-10; Chair 2010-present.

American Meteorological Society Member: Fellow 2001; Governing Council, 2001-04; Fellows Committee, 2004-06; Nominating committee 2006-07, Chair 2008-09; Planning Comm 2009-present.

Geotraces, Scientific Steering Committee 2010-present.

Mentoring Physical Oceanography Women to Increase Retention Steering Committee, 2004-08.

National Oceanic Atmospheric Administration, Climate and Global Change Panel, 2000-04.

National Science Foundation: Division of Polar Programs Advisory Committee, 1987-90; GEO Directorate Vision 2000 Planning, 1998-00; Search Committee for Assistant Director of GEO, 1999; OCE Committee of Visitors, 2006, Chair, 2009.

National Research Council: Geophysics Study Committee, 1989-92; Tropical Ocean Global Atmosphere Oversight Panel, 1990-93; Ocean Studies Board (OSB), 1992-98; Decadal-to-Century Climate Change Panel – Climate Board, 1995-98; Chair, Major Ocean Programs Committee – OSB, 1996-98; Review Panel for Department of Energy Methane Hydrate Program – OSB, 2003-04, Fleet Renewal Committee – OSB, 2008-10, Infrastructure for 2030 Committee – OSB 2010-present.

Inter-American Institute for Global Change, Scientific Advisory Committee, 2004-10.

Provost's Award for Scholarly Activity, University of Miami, 2005

University Corporation for Atmospheric Research (UCAR), Board of Trustees, 2005-present
Vice Chair, 2008, Chair 2008-present.

US National Committee for the International Oceanographic Comm (IOC) 2007- present, Chair 2007-09.

Collaborators and Co-Editors within the last 48 months:

F. Bryan – NCAR; J. Bullister – PMEL; T. Chereskin – SIO; I. Fukumori – JPL; D. Ho – U. Hawaii; W. Jenkins – WHOI; P. Jones – Canada; T. Joyce – WHOI; D. Kieke – U. Bremen, Germany; E. Lindstrom – NASA; M. Maltrud – LANL; D.-H. Min, U. Tex; S. Peacock – NCAR; A. Poisson – LODYC, France; T. Qu – U. Hawaii; M. Rhein – U. Bremen, Germany; W. Roether – U. Bremen, Germany; W. Schneider – U. Concepcion; P. Schlosser – LDEO; D. Smythe-Wright – SOC; J. Swift – SIO: B. Sloyan – WHOI; W. Smethie – LDEO; J. Sprintall – SIO; J. Swift – SIO; L. Talley – SIO; M.J. Warner – U. Washington; R. Weiss – SIO.

Ph.D. Advisor, Frank Millero, RSMAS, University of Miami.
Postdoctoral Advisor, H. Gote Ostlund, RSMAS, University of Miami.
Thesis Advisor and Postgraduate-Scholar Sponsor within the last 5 years:
PhD Committee Member for Derrick Snowden, 2004-present
PhD Committee Member for Hector Bustos-Serrano, 2005-present
PhD Committee Member for Silvia Gremes-Cordero, 2006-present
PhD Committee Member for Mareva Chanson, 2006-09
PhD Chair for Corinne Hartin, 2006-present
PhD Committee Member for Lauren Zamora, 2007-present
Number of Graduate Students Advised: 23
Number of Postdoctoral Scholars Sponsored: 1

Renellys C. Perez

University of Miami, RSMAS/CIMAS
4600 Rickenbacker Causeway, Miami, FL 33149-1098
Email: rcperez@miami.edu Tel: (305) 361-4518

Professional Preparation

University of Miami	Pure Physics and Applied Math	B.S., 1995
University of Miami	Applied Marine Physics	M.S., 1999
Oregon State University	Oceanography	Ph.D., 2006
NRC Postdoctoral Fellow	Physical Oceanography	2006-2008

Appointments

2008-	Assistant Scientist, Univ. of Miami, RSMAS/CIMAS
2006-2008	NRC Postdoctoral Fellow, NOAA/PMEL
2000-2005	Graduate Teaching Assistant, Oregon State Univ., COAS
1998-2005	Graduate Research Assistant, Oregon State Univ., COAS
1995-1998	Graduate Research Assistant, Univ. of Miami, RSMAS

Publications

1. Thompson, L., R. C. Perez, and A. E. Shevenell, 2011: Women in Physical Oceanography: where do they go? Submitted to *Nature Geoscience*.
2. Perez, R. C., S. L. Garzoli, C. S. Meinen, and R. P. Matano, 2011: Observing methods for the Meridional Overturning Circulation and meridional heat transport in the South Atlantic. Submitted to *Journal of Atmos. Oceanic Technol.*.
3. Perez, R. C., M. F. Cronin, and W. S. Kessler, 2010: Tropical cells and a secondary circulation near the northern front of the equatorial Pacific cold tongue. *Journal of Physical Oceanography*, **40**, 2091-2106.
4. Perez, R. C., and W. S. Kessler, 2009: The three-dimensional structure of tropical cells in the central equatorial Pacific ocean. *Journal of Physical Oceanography*, **39**, 27-49.
5. Perez R. C., D. B. Chelton, R. N. Miller, 2005: The effects of wind forcing and background mean currents on the latitudinal structure of equatorial Rossby waves. *Journal of Physical Oceanography*, **35**, 666-682.

Synergistic Activities

Dr. Perez participates in outreach events hosted by NOAA/AOML or by the University of Miami Rosenstiel School of Marine and Atmospheric Science such as the Exploring Marine Science Day for 6-7th grade girls. Dr. Perez is also involved with the Mentoring Physical Oceanographic Women to Increase Retention (MPOWIR) organization.

Collaborators

Meghan F. **Cronin**, National Oceanic and Atmospheric Administration, PMEL; Kathleen **Dohan**, Earth and Space Research; Shenfu **Dong**, University of Miami, CIMAS; Gregory R. **Foltz**, National Oceanic and Atmospheric Administration, AOML; Silvia L. **Garzoli**, National Oceanic and Atmospheric Administration, AOML; Gustavo J. **Goni**, National Oceanic and Atmospheric Administration, AOML; Fabrice **Hernandez**, IRD Mercator Ocean; Verena **Hormann**, University of Miami, CIMAS; Elizabeth **Johns**, National Oceanic and Atmospheric Administration, AOML; William E. **Johns**, University of Miami, RSMAS; William S. **Kessler**, National Oceanic and Atmospheric Administration, PMEL; Marie-Pascale **Lelong**, NorthWest Research Associates; Jonathan M. **Lilly**, NorthWest Research Associates; Claude F. (Rick) **Lumpkin**, National Oceanic and Atmospheric Administration, AOML; Ricardo P. **Matano**, Oregon State University, COAS; Christopher S. **Meinen**, National Oceanic and Atmospheric Administration, AOML; Amelia E. **Shevenell**, University College London; LuAnne **Thompson**, University of Washington

Graduate and Postdoctoral Advisors

Christopher N. K. Mooers	Graduate Advisor
Robert N. Miller	Graduate Advisor
William S. Kessler	Postdoctoral Advisor

JAMES D. HAPPELL

PERSONAL

Office address: Division of Marine and Atmospheric Chemistry,
Rosenstiel School of Marine and Atmospheric Science,
University of Miami,
4600 Rickenbacker Causeway, Miami, FL 33149

Office telephone: (305) 421-4111; fax (305) 4211-4112

E-mail jhappell@rsmas.miami.edu

EDUCATION

BS 1984 Chemistry, State University College at Fredonia, Fredonia, New York

MS 1989 Chemical Oceanography, Florida State University, Tallahassee, Florida

PhD 1992 Chemical Oceanography, Florida State University, Tallahassee, Florida

POSITIONS HELD

Associate Research Professor, RSMAS, Division of Marine and Atmospheric Chemistry, Tritium Laboratory, University of Miami, Miami, Florida, 2006 - Present.

Assistant Research Professor, RSMAS, Division of Marine and Atmospheric Chemistry, Tritium Laboratory, University of Miami, Miami, Florida, 1996 - 2006.

Postdoctoral Research Associate under the direction of D.W.R. Wallace. Brookhaven National Laboratory. Upton, New York, 1994-1996.

Department of Energy Global Change Distinguished Postdoctoral Fellowship under the direction of D.W.R. Wallace. Brookhaven National Laboratory. Upton, New York, 1992-1994.

SIGNIFICANT PUBLICATIONS

Happell, J.D., S Opsahl, Z. Top, and J.P. Chanton, Apparent CFC and $^{3}H/^{3}He$ age differences in water from Floridan Aquifer springs, *J. Hydrology, 319,* 410-426, 2006

Happell, J. D., G. O. Östlund, and A. S. Mason, A history of atmospheric tritium gas (HT): 1950-2002, *Tellus B, 56*, 183-193, 2004.

Happell, J.D., and M. P. Roche, Soils: A global sink of atmospheric carbon tetrachloride, *J. Geophys. Res., 30(2)* 1088-1091*, doi: 10.1029/2002GL015957*, 2003.

Happell, J.D., R.M. Price, Z. Top, and P.K Swart, Evidence for the removal of CFC-11, CFC-12 and CFC-113 at the groundwater-surface water interface in the Everglades, *J. Hydrology*, *279, 94-105, doi: 10.1016/S0022-1694(03)00169-0*, 2003.

Happell J.D. and D.W.R. Wallace, Removal of atmospheric CCl_4 under bulk aerobic conditions in groundwater and soils, *Environ. Sci. Tech., 32*, 1244-1252, 1998.

Happell J.D., J.P. Chanton, and W.J. Showers, Methane transfer across the water-air interface in stagnant wooded swamps of Florida: Evaluation of mass-transfer coefficients and isotopic fractionation, *Limnol. Oceanogr., 40*, 290-298, 1995.

Happell J.D., J.P. Chanton, and W.J. Showers, The influence of methane oxidation on the stable isotopic composition of methane emitted from Florida swamp forests, *Geochim. Cosmochim. Acta, 58*, 4377-4388, 1994.

Happell J.D., J.P. Chanton, G.J. Whiting and W.J. Showers, Stable isotopes as tracers of methane dynamics in Everglades marshes with and without active populations of methane oxidizing bacteria, *J. Geophys. Res., 98*, 14771-14782, 1993.

SYNERGISTIC ACTIVITIES

Development of an analytical system capable of measuring SF_6 and CFCs in the same sample.

COLLABORATORS

Z. Top, R.M. Price, K.Goodwin, J.P. Chanton.

GRADUATE ADVISOR

J.P. Chanton, Dept. of Oceanography, Florida State University.

BIOGRAPHICAL SKETCH
Janet Sprintall

Climate, Atmospheric Science and Physical Oceanography,
Scripps Institution of Oceanography, UCSD
La Jolla CA 92093-0230
ph: (858) 822 0589
fax: (858) 534 9820
email: jsprintall@ucsd.edu
web page: http://www-pord.ucsd.edu/~jsprintall

(i) Professional Preparation:

Griffith University, QLD, Australia; B.Sc.(Environmental Science), 1981
Griffith University, QLD, Australia; B.Sc.(First Class Honors), Applied Mathematics, 1985
University of Sydney, NSW, Australia; M.Sc., Physical Oceanography, conferred 1988
University of Sydney, NSW, Australia; Ph.D., Physical Oceanography, conferred 1993

(ii) Appointments:

Research Oceanographer, Scripps Institution of Oceanography, 2007 - present
Associate Research Oceanographer, Scripps Institution of Oceanography, 2001 – 2007
Assistant Research Oceanographer, Scripps Institution of Oceanography, 1995 – 2001
JIMO Postdoctoral Fellow, Scripps Institution of Oceanography, 1993 - 1995
Visiting Scientist, Flinders University, South Australia, 1993
National Research Council Postdoctoral Associate, NOAA-PMEL Seattle, 1991 - 1993
Research Assistant, CSIRO Division of Oceanography, Hobart, Australia, 1988
Mathematics and Computing Tutor, University of Southern QLD, Australia, 1983 - 1984
Computer Programmer, Earth Sciences Computing Services, QLD, Australia, 1981 - 1982

(iii) Publications:

(a) Five most related:

Sprintall, J., S. E. Wijffels, R. Molcard, and I. Jaya. Direct estimates of the Indonesian Throughflow entering the Indian Ocean: 2004-2006, *J. Geophys. Res.*, 114, C07001, doi: 10.1029/2008JC005257, 2009.

Sprintall, J., Long term trends and interannual variability of temperature in Drake Passage, *Prog. Oceanogr.,* 77, 316-330, 2008.

Lenn, Y.D., T. Chereskin, and J. Sprintall. Improving estimates of the Antarctic Circumpolar Current streamlines in Drake Passage. *J. Phys. Oceanogr.,* 38, 1000-1010, 2008.

Sprintall, J., Seasonal to interannual upper-ocean variability in the Drake Passage, *J. Marine Res.*, 61, 27-57, 2003.

Sprintall, J., J. T. Potemra, S. L. Hautala, N. A. Bray and W. Pandoe. Temperature and salinity variability in the exit passages of the Indonesian Throughflow. *Deep Sea Res.*, 50, 2183-2204, 2003.

(b) Five other publications:

Lenn, Y.D., T. K. Chereskin, J. Sprintall, and J. L. McClean. Near-surface eddy heat and momentum fluxes in the Antarctic Circumpolar Current in Drake Passage, in press , *J. Phys. Oceanogr.,* 2010.

Sprintall, J., S. E. Wijffels, R. Molcard, and I. Jaya. Direct evidence of the South Java Current system in Ombai Strait, Indonesia. *Dynam. Atmosp. Oceans*, 50:2, doi: 10.1016/j.dynatmoce.2010.02.006, 140-156, 2010.

Sprintall, J., S. Kennan, Y.Y. Kim and P. Niiler. Wind-driven ageostrophic transport in the North Equatorial Counter Current of the Eastern Pacific at 95W, *J. Phys. Oceanogr.*, 39:11, 2985-2998, 2009.

Stramma, L., G.C. Johnson, J. Sprintall, and V. Mohrholz, Expanding oxygen minimum zones in the Tropical oceans. *Science*, 320, 655-658, doi: 10.1126/science.1153847, 2008.

Sprintall, J., S. Wijffels, T. Chereskin and N. Bray, 2002. The JADE and WOCE I10/IR6 Throughflow Sections in the Southeast Indian Ocean. Part 2: Velocity and transports. Deep-sea Research Part II, 49, 1363-1389, 2002.

(iv) Synergistic Activities:

1. Chair, CLIVAR Indonesian Seas Task Team, 2010 – present.
2. Co-Leader, Mentoring Physical Oceanography Women to Increase Retention (MPOWIR) Mentoring Group, 2010 - present
3. Committee member, Antarctic Research Vessels Oversight Committee, 2006-2010.
4. Committee member, Philippines Experiment Science Steering Committee, 2006-present.
5. Committee member, Southwest Pacific Ocean Circulation and Climate Experiment (SPICE) Science Steering Committee, 2007-present.
6. Exhibiter, SIO Women in Science; UCSD Open House.
7. Volunteer, AGU English Language Author Assistance Program, 2002-present.

(v) Collaborators and Other Affiliates:

(a). Collaborators:

S. Wijffels (CSIRO Division Marine Research, Australia); M. Cronin (NOAA/PMEL); R. Molcard (LODYC, France); A. Gordon, D. Susanto, X. Yuan, D. Martinson (Lamont-Doherty Earth Observatory, Columbia University); A. Ffield (ERS); S. Hautala (U. Washington); S. Kennan (NSF); R. Murtugudde (EESIC-NASA Goddard); D. Nof (Florida State University); J. Potemra; P. Flament (U. Hawaii); R. Wajsowicz (U. Maryland).

(b) Graduate Advisor: Prof. Matthias Tomczak (retired)

(c) Post-doctoral Advisors: Dr. Michael J. McPhaden (NOAA-PMEL, Seattle); Prof. Dean Roemmich (SIO-UCSD)

(d) Graduate Students supervised:

Angela Adams (MSc, co-advisor, graduated 2003); Yueng D. Lenn (PhD, committee member, graduated 2006); Andrew Thompson (PhD, committee member, graduated 2006); Gabriela Chavez (MSc, co-advisor, graduated 2009); Kyla Drushka (PhD, co-advisor, 2006 – present); Gordon Stephenson (PhD, co-advisor, 2007 - present); Yvonne Firing (PhD, committee member, 2008 – present); Geoffrey Gearheart (PhD, committee member, 2009 – present); Andrew Delman (PhD, co-advisor, 2010 – present).

Biosketch

Glenn R. Flierl

Education:

B.A. with highest honors in physics, Oberlin College, 1970

Ph.D. in physics, Harvard University, 1975

Positions:

Research fellow and lecturer in physical oceanography, Harvard, January 1975 to June 1976.

Assistant Professor, Department of Meteorology, M.I.T., July 1976 to June 1980.

Associate Professor, Department of Earth, Atmospheric, and Planetary Sciences, M.I.T., July 1980 to June 1988.

Professor, Department of Earth, Atmospheric, and Planetary Sciences, M.I.T., June 1988 —

Related Publications:

Charney, J.G. and G.R. Flierl (1981) 'Oceanic Analogues of Large-scale Atmospheric Motions.' In *Evolution of Physical Oceanography (Scientific Surveys in Honor of Henry Stommel)*, Ed. B.A. Warren and C.Wunsch, MIT Press, Cambridge, Mass, pp. 504-548.

Flierl, G.R. (1999) Thin Jet and Contour Dynamics Models of Gulf Stream Meandering. *Dyn. Atmos. Oc.*, **29**, 189-215.

Silveira, I. C. A. da, W. S. Brown and G. R. Flierl (2000), Dynamics of the North Brazil Current Retroflection from the Western Tropical Atlatic Experiment observations. *J. Geophys. Res.*, **105**, 28,559-583.

Silveira, I. C. A. da and G. R. Flierl (2002), Eddy Formation in $2\frac{1}{2}$-layer, Quasi-geostrophic Jets. *J. Phys. Oceanogr.*, **32**, 729-745.

Baker-Yeboah, S., G. Flierl, G. Sutyrin, and Y. Zhang (2010) Transformation of an Agulhas eddy near the continental slope. *Ocean Science*, **6**, 143-159.

Other Publications:

Flierl, G. and J. Pedlosky (2007) The nonlinear dynamics of Time-Dependent, Subcritical Baroclinic Currents. *J. Phys. Oceanogr.*, **37** 1001-1021.

Arbic, B.K., G.R. Flierl, and R.B. Scott(2007) Cascade Inequalities for Forced-Dissipated Geostrophic Turbulence. *J. Phys. Oceanogr.*, **37**, 1470-1487.

Kaspi, Y. and G. Flierl(2007) Formation of jets by baroclinic instability on gas planet atmospheres. *J. Atm. Sci.*, **64** 31773194

Poulin, F.J. and Flierl, G.R. (2008) The Stochastic Mathieu's Equation, Proc. R. Soc. Lond. A., 464 , 1885-1904

Barton, A.D., S. Dutkiewicz, G. Flierl, J. Bragg, and M.J. Follows (2010) Patterns of diversity in marine phytoplankton. *Science*, **327**, 1509-11, *Science*, **329**, 512-d.

Synergistic Activities

Geosystems program, MIT (http://geosys.mit.edu): teaching Jovian Atmospheres and Ocean Ecosystems sections of the course and development of lab software (http://puddle/~glenn/mocha/mocha.html).

Teaching to broader student audiences: *Large-scale Flow Dynamics Laboratory, 1995-2006:* using atmospheric and ocean data, rotating tank experiments, and numerical models to study synoptic-scale processes; *Turbulence and Nonlinear Waves course, 2003-6:* Atmospheric and oceanic turbulence on the full range of scales. *Modelling the Biology and Physics of the Ocean, 2004, 2007, 2009:* Introducing biological and physical oceanographers to models of the coupled problem. *Stability Theory for Oceanic and Atmospheric Flows, 2006, 2008:* Linear and nonlinear stability theory.

Developed generalized surface QG/QG model and making it available for general use.

Supervised PhD students from Physics and Mathematics Depts. Serve on thesis committees in Biological Oceanography.

Collaborators

Brian Arbic, U. Mich.
Dennis McGillicuddy, WHOI
Phillip Morrison, U. Texas, Austin
Mercedes Pascual, U. Mich.
Joseph Pedlosky, WHOI
Francis Poulin, Waterloo
Rob Scott, U. Texas, Austin
Ilson da Silveira (supervisor of thesis), Sao Paolo
William Hubbard, U. Ariz.
Adam Showman, U. Ariz.
Georgi Sutyrin, U.R.I.

Graduate and Postdoctoral Advisor:

Allan Robinson, Harvard

Supervisor of Ph.D. theses in past five years:

Brian Arbic
Francis Poulin
Ariane Verdy
Christie Wood
Yohai Kaspi
Yu Zhang

Supervised nineteen graduate students and six post-docs.

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Miami Rosenstiel School of Marine&Atmospheric Sci

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Shenfu Dong

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Shenfu Dong - Principal Investigator**	1.00	0.00	0.00	$ **0**	$
2. **Rana A Fine - Co-Principal Investigator**	1.00	0.00	0.00	**0**	
3. **James Happell - Senior Personnel**	0.00	0.00	0.00	**0**	
4. **Renellys C Perez - Co-Principal Investigator**	3.00	0.00	0.00	**0**	
5. **Aggregate Salary**	0.00	0.00	0.00	**42,133**	
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**5**) TOTAL SENIOR PERSONNEL (1 - 6)	5.00	0.00	0.00	**42,133**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**1**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	12.00	0.00	0.00	**58,833**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**100,966**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**35,057**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**136,023**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Computers $ **20,000**					
Deck Unit for Communications **10,000**					
Deployment Cruise Supplies **50,000**					
Others (See Budget Comments Page…) **1,015,000**					
TOTAL EQUIPMENT				**1,095,000**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**13,500**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**0**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**1,244,523**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 53.5000, Base: 149523)**					
TOTAL INDIRECT COSTS (F&A)				**79,995**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**1,324,518**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **1,324,518**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Shenfu Dong

ORG. REP. NAME*
Kimberly miller

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

**** D- Equipment**
Dynamic Height Moorings (Amount: $ 985000)
Hydrography Cruise Supplies (Amount: $ 30000)

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Miami Rosenstiel School of Marine&Atmospheric Sci

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Shenfu Dong

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Shenfu Dong - Principal Investigator**	4.00	0.00	0.00	$ **0**	$
2. **Rana A Fine - Co-Principal Investigator**	1.00	0.00	0.00	**0**	
3. **James Happell - Senior Personnel**	3.00	0.00	0.00	**0**	
4. **Renellys C Perez - Co-Principal Investigator**	4.00	0.00	0.00	**0**	
5. **Aggregate Salary**	0.00	0.00	0.00	**101,819**	
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**5**) TOTAL SENIOR PERSONNEL (1 - 6)	12.00	0.00	0.00	**101,819**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	12.00	0.00	0.00	**51,240**	
2. (**7**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	22.00	0.00	0.00	**201,645**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**354,704**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**126,780**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**481,484**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Dynamic Height Moorings $ **327,650**					
Hydrography Cruise Supplies **25,000**					
TOTAL EQUIPMENT				**352,650**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**2,500**	
2. FOREIGN				**113,840**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**10,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**10,000**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**64,000**	
TOTAL OTHER DIRECT COSTS				**84,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**1,034,474**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
MTDC (Rate: 53.5000, Base: 681824)					
TOTAL INDIRECT COSTS (F&A)				**364,776**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**1,399,250**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **1,399,250**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Shenfu Dong

ORG. REP. NAME*
Kimberly miller

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Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Miami Rosenstiel School of Marine&Atmospheric Sci

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Shenfu Dong

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Shenfu Dong - Principal Investigator**	6.00	0.00	0.00	$ **0**	$
2. **Rana A Fine - Co-Principal Investigator**	1.00	0.00	0.00	**0**	
3. **James Happell - Senior Personnel**	0.00	0.00	0.00	**0**	
4. **Renellys C Perez - Co-Principal Investigator**	6.00	0.00	0.00	**0**	
5. **Aggregate Salary**	0.00	0.00	0.00	**97,899**	
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**5**) TOTAL SENIOR PERSONNEL (1 - 6)	13.00	0.00	0.00	**97,899**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	12.00	0.00	0.00	**53,802**	
2. (**3**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	20.00	0.00	0.00	**217,818**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**369,519**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**137,599**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**507,118**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Hydrography Cruise Supplies $ **25,000**					
TOTAL EQUIPMENT				**25,000**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**6,000**	
2. FOREIGN				**74,500**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**13,000**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**24,500**	
TOTAL OTHER DIRECT COSTS				**37,500**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**650,118**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
MTDC (Rate: 53.5000, Base: 625118)					
TOTAL INDIRECT COSTS (F&A)				**334,438**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**984,556**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **984,556**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Shenfu Dong

ORG. REP. NAME*
Kimberly miller

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

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PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Miami Rosenstiel School of Marine&Atmospheric Sci

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Shenfu Dong

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Shenfu Dong - Principal Investigator**	6.00	0.00	0.00	$ **0**	$
2. **Rana A Fine - Co-Principal Investigator**	1.00	0.00	0.00	**0**	
3. **James Happell - Senior Personnel**	0.00	0.00	0.00	**0**	
4. **Renellys C Perez - Co-Principal Investigator**	6.00	0.00	0.00	**0**	
5. **Aggregate Salary**	0.00	0.00	0.00	**102,391**	
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**5**) TOTAL SENIOR PERSONNEL (1 - 6)	13.00	0.00	0.00	**102,391**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	12.00	0.00	0.00	**56,492**	
2. (**3**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	20.00	0.00	0.00	**213,436**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**372,319**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**140,510**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**512,829**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**11,000**	
2. FOREIGN				**55,000**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**13,000**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**24,500**	
TOTAL OTHER DIRECT COSTS				**37,500**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**616,329**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 53.5000, Base: 616329)**					
TOTAL INDIRECT COSTS (F&A)				**329,736**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**946,065**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **946,065**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Shenfu Dong

ORG. REP. NAME*
Kimberly miller

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Miami Rosenstiel School of Marine&Atmospheric Sci

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Shenfu Dong

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Shenfu Dong - Principal Investigator**	17.00	0.00	0.00	$ **0**	$
2. **Rana A Fine - Co-Principal Investigator**	4.00	0.00	0.00	**0**	
3. **James Happell - Senior Personnel**	3.00	0.00	0.00	**0**	
4. **Renellys C Perez - Co-Principal Investigator**	19.00	0.00	0.00	**0**	
5. **Aggregate Salary**	0.00	0.00	0.00	**344,242**	
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**5**) TOTAL SENIOR PERSONNEL (1 - 6)	43.00	0.00	0.00	**344,242**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**3**) POST DOCTORAL SCHOLARS	36.00	0.00	0.00	**161,534**	
2. (**14**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	74.00	0.00	0.00	**691,732**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**1,197,508**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**439,946**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**1,637,454**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) **$ 1,472,650**					
TOTAL EQUIPMENT				**1,472,650**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**33,000**	
2. FOREIGN				**243,340**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**10,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**36,000**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**113,000**	
TOTAL OTHER DIRECT COSTS				**159,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**3,545,444**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**1,108,945**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**4,654,389**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **4,654,389**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Shenfu Dong

ORG. REP. NAME*
Kimberly miller

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C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

A: Budget Justification for S. Dong and R. Perez:

1. Personnel: Funds are requested for 1 month of salary for S. Dong, 3 months of salary for R. Perez, and one full-time technician in Year 1 to purchase and prepare instruments, and to analyze observations and models to further optimize mooring locations prior to deployment. For Year 2, funds are requested for 4 months of salary for S. Dong and R. Perez, 6 months of salary for a technician and a programmer, and 12 months of salary for a postdoctoral researcher to process and analyze data collected from the trans-basin hydrographic cruise, as well as data from existing observing systems. Funds (regular salary and overtime) are also requested for salary for four personnel to conduct shipboard surveys during the 32-day deployment and 35-day hydrographic cruise. Funds are requested in Year 3 for 6 months of salary for S. Dong and R. Perez, 12 months of salary for a postdoctoral researcher and a programmer to process and analyze hydrographic and tracer data, and the first year of moored data, as well as to compare with transports estimated from AX18 XBT transects. Funds are requested for 6 months of salary of a technician to prepare instruments for eastern and western boundary turn-around cruises. Funds (regular salary and overtime) are also requested for four personnel to conduct shipboard surveys during the 25-day eastern boundary and 25-day western boundary turn-around cruises. For Year 4, funds are requested for 6 months of salary for S. Dong and R. Perez, 12 months of salary for a postdoctoral researcher and a programmer to process and analyze the moored data and data from other existing observing systems. Funds are requested for 6 months of salary for a techinican to service instruments after the recovery cruises. Funds (regular salary and overtime) are also requested for four personnel to conduct shipboard surveys during the 30-day eastern boundary and 30-day western boundary recovery cruises.

2. Travel: Travel funds are requested in Year 1 for S. Dong and R. Perez to attend PI meeting in San Diego and for two techinicans to travel to San Diego to be trained for preparing dyanmic height moorings. For Year 2 travel funds are requested for S. Dong and R. Perez to attend EGU meeting in Vienna, Austria, and for the postdoctoral fellow to attend AGU meeting in San Francisco. Travel funds are also requested to send and to return four personnel to/from research vessel for each Leg of the deployment (Leg 1) and hydrographic (Leg 2) cruise. For Year 3, travel funds are requested for S. Dong and R. Perez to attend SAMOC meeting in Argentina, for the postdoctoral fellow to attend AGU Ocean Science meeting, and to send and to return four personnel to/from research vessel for eastern and western boundary turn-around cruises. Travel funds are requested in Year 4 for S. Dong, R. Perez, and the postdoctoral fellow to attend AGU meeting in San Francisco. Travel funds are also requested to send and to return four personnel to/from research vessel for eastern and western boundary recovery cruises.

3. Equipment**:** Funds are requested in Year 1 to purchase equipment charges for 4 dynamic height moorings (including microcat, current meter, acoustic release, pressure recorder, flotation, shackles, anchors, etc.), deck unit for communications. Funds are also requested for ten computer servers to be used duing the deployment and hydrographic cruise in Year 1 and to download data from moorings in Year 3 and Year 4. In Year 2, equipment funds are requested for dynamic height mooring replacement gear and batteries for the turn-around cruises in Year 3.

4. Materials and Supplies: Funds are requested for standard water, oxygen chemicals, LADCP batteries, bottles, etc., for material consumed during the hydrographic and deployment cruise (Year 2), as well as for the turn-around (Year 3) and recovery (Year 4) curises.

5. Shipping: Funds are requested in Year 2, Year 3, and Year 4 to ship equipments, materials and supplies to and from research vessel. Shiping cost request in Year 2 includes the shipment of the four deep dynamic height moorings from SIO/UCSD along with the four mid-depth dynamic height moorings from UM/RSMAS.

6. Publications: Funds are requested in Year 2 to Year 4 to cover the cost of page charges for the dissemination of the results in a peer-reviewed journal.

B: Budget Justification for Rana A. Fine

The PI will be responsible for CFC and SF_6 measurements on designated 34.5S trans-basin cruise planned for 2013. This is a proposal for a large and complex collaborative project. The work proposed will involve substantial collaboration with the PIs from the University of Miami with Scripps Institution of Oceanography, NOAA/AOML, and with PIs in Brazil, Argentina and France. Two chlorofluorocarbons (CFC-11, CFC-12) and SF_6 will be measured on board ship providing near real time data to use to guide sampling strategies. The CFCs and SF_6 will be measured by established analytical procedures. As we have done in the past, analysis will be made to WOCE standards. Preliminary tracer data will be made available to the group on board ship, and in final form within the required 6 months. In the text below "CFC measurements" refers to CFC-11, CFC-12 and SF_6.

In year 2 (FY2013), the PI will be responsible for CFC measurements, data processing for 35 day cruise between Argentina and Capetown RSA. The CFC analytical system will be used to measure the full water column at most stations.

All CFC technicians are to be paid sea pay. To meet scientific objectives, it will be necessary for each technician to work a 12 hour watch, seven days/week. Supplies include laboratory items of compressed gases, valves, glass syringes for sampling, etc. Foreign travel is budgeted for CFC personnel to participate in the cruises. Domestic travel is budgeted to collaborate with the other PIs around the US, and to attend scientific meetings to present initial descriptions of our results. Funds are also budgeted for printing and copying in order to be able to distribute material related to this project to the other PIs. RSMAS computer charges are budgeted for internet connections for a stand-alone computer work station, which will be dedicated mainly to this project. These charges pay for the needed access to these data while the PI and others in the research group are on travel and at locations remote from the Rosenstiel School. Long distance phone calls are budgeted to coordinate logistics and speak with the co-PIs and collaborators.

The PI has overall responsibility for the CFC measurements and data quality. She will be involved in all phases of the cruises from overseeing preparation to post cruise quality control and distribution of data to co-PIs, collaborators, and to national data facilities (NODC and Scripps). J.Happell is lead Miami CFC person and is scheduled to participate in the cruise. He will be doing cruise preparation, participating in the cruises as the analyst in charge, and will oversee laboratory supplies and equipment. J.Happell and the PI will do logistics for the cruise, including shipping, and travel arrangements, and be involved in the final data calibration. After the cruise, under the PI's supervision J.Happell will be checking the data for consistency with other oceanographic data from earlier cruises and other regions. He will prepare various plots for checking the data for quality, locating bad data points, working with the PI to correct or flag any questionable data, and working with the PI on the final data quality check. She is also responsible for merging the CFC and SF_6 data with the hydrographic data and distributing the data to other PIs and data archives.

In years 3 and 4, the PI will participate fully in the data analysis with other SAMOC PIs. Travel to PI meetings are budgeted: in year 1 to Scripps Institution of Oceanography, in year 2 to Vienna, Australia, and in year 3 to Buenos Aires, Argentina.

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-San Diego Scripps Inst of Oceanography

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Janet Sprintall

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Janet Sprintall - Researcher**	1.00	0.00	0.00	$ **13,269**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	1.00	0.00	0.00	**13,269**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**2**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	3.00	0.00	0.00	**31,465**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**44,734**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**44,734**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
Fabrication for SAMBA Mooring $ **1,806,195**					
TOTAL EQUIPMENT				**1,806,195**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**27,077**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**500**	
5. SUBAWARDS				**0**	
6. OTHER				**880**	
TOTAL OTHER DIRECT COSTS				**28,457**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**1,879,386**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
Modified Total Direct Cost 07/01/12 - 09/30/12 (Rate: 55.0000, Base: 18298) (Cont. on Comments Page)					
TOTAL INDIRECT COSTS (F&A)				**39,981**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**1,919,367**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **1,919,367**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Janet Sprintall

ORG. REP. NAME*
Nancy Wilson

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

1 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

**** I- Indirect Costs**
Modified Total Direct Cost 10/01/11 - 06/30/12 (Rate: 54.5000, Base 54894)

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-San Diego Scripps Inst of Oceanography

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Janet Sprintall

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Janet Sprintall - Researcher**	2.00	0.00	0.00	$ **27,084**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	2.00	0.00	0.00	**27,084**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**3**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	7.00	0.00	0.00	**76,058**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**1**) OTHER				**2,578**	
TOTAL SALARIES AND WAGES (A + B)				**105,720**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**105,720**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**2,830**	
2. FOREIGN				**21,607**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**19,047**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**500**	
5. SUBAWARDS				**0**	
6. OTHER				**1,280**	
TOTAL OTHER DIRECT COSTS				**20,827**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**150,984**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Modified Total Direct Cost (Rate: 55.0000, Base: 150984)**					
TOTAL INDIRECT COSTS (F&A)				**83,041**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**234,025**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **234,025**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Janet Sprintall

ORG. REP. NAME*
Nancy Wilson

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-San Diego Scripps Inst of Oceanography

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Janet Sprintall

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Janet Sprintall - Researcher**	3.00	0.00	0.00	$ **41,738**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	3.00	0.00	0.00	**41,738**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**4**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	14.50	0.00	0.00	**149,581**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**1**) OTHER				**2,669**	
TOTAL SALARIES AND WAGES (A + B)				**193,988**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**193,988**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**34,826**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**20,787**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**500**	
5. SUBAWARDS				**0**	
6. OTHER				**1,920**	
TOTAL OTHER DIRECT COSTS				**23,207**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**252,021**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Modified Total Direct Cost (Rate: 55.0000, Base: 252021)**					
TOTAL INDIRECT COSTS (F&A)				**138,612**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**390,633**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **390,633**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Janet Sprintall

ORG. REP. NAME*
Nancy Wilson

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-San Diego Scripps Inst of Oceanography

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Janet Sprintall

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Janet Sprintall - Researcher**	3.00	0.00	0.00	$ **43,501**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	3.00	0.00	0.00	**43,501**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**4**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	18.50	0.00	0.00	**169,907**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**1**) OTHER				**2,763**	
TOTAL SALARIES AND WAGES (A + B)				**216,171**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**216,171**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,020**	
2. FOREIGN				**36,620**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**44,495**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**4,000**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**500**	
5. SUBAWARDS				**0**	
6. OTHER				**2,000**	
TOTAL OTHER DIRECT COSTS				**50,995**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**304,806**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Modified Total Direct Cost (Rate: 55.0000, Base: 304806)**					
TOTAL INDIRECT COSTS (F&A)				**167,643**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**472,449**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **472,449**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Janet Sprintall

ORG. REP. NAME*
Nancy Wilson

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-San Diego Scripps Inst of Oceanography

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Janet Sprintall

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Janet Sprintall - Researcher**	9.00	0.00	0.00	$ **125,592**	$
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	9.00	0.00	0.00	**125,592**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**13**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	43.00	0.00	0.00	**427,011**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**3**) OTHER				**8,010**	
TOTAL SALARIES AND WAGES (A + B)				**560,613**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**0**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**560,613**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.) $ **1,806,195**					
TOTAL EQUIPMENT				**1,806,195**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**3,850**	
2. FOREIGN				**93,053**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**111,406**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**4,000**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**2,000**	
5. SUBAWARDS				**0**	
6. OTHER				**6,080**	
TOTAL OTHER DIRECT COSTS				**123,486**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**2,587,197**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**429,277**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**3,016,474**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **3,016,474**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Janet Sprintall

ORG. REP. NAME*
Nancy Wilson

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C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

Budget Justification

Salary:

Partial salary support is requested for the PI, Janet Sprintall, primarily for cruise preparation, participation in the SAMBA mooring deployment, turn-around and recovery cruises in budget years 2,3 and 4; and the scientific data analysis. Dr. Sprintall will take on the overall lead and supervision of this project at SIO.

Salary time for Development Engineers (Paul Harvey, and Spencer Kawamoto) and Development Technician (Dave Aglietti) of the SIO Hydrolab facility are requested to undertake the instrument preparation, calibration and cruise participation.

Salary for the Programmer/Analyst is for quality control of the data.

Salary for the Research Project Assistant is for tasks that will specifically benefit this project, and will be assigned by the PI and charged on a time reported basis. These tasks should normally include technical typing and editing, copying project literature, making travel arrangements, and co-ordination of efforts between project participants.

SIO Salaries used are based on annualized recharge rates. Salary recharge rate is charged for actual productive time only (except for non-faculty academic sick leave, which is charged as direct). The rates include components for employee benefits, provisions for applicable merit increases and range adjustments in accordance with University policy. Staff overtime or remote location allowance may be required in order to meet project objectives, and separate rates are used in those cases. This method of proposing is consistent with method of charging as required by the Cost Accounting Standards.

Equipment – Fabrication of SAMBA Mooring:

In the first year of the budget, funds for equipment required for the four dynamic height moorings have been included in this budget. Subsurface and surface flotation, acoustic releases; SBE39 T-P; SBE37 T-S-p Microcat sensors, SBE-53 Bottom Pressure recorder and Aquadopp current meters will be purchased under this grant. Each mooring will have a subsurface recovery buoy fitted with a flasher, radio beacon and ARGOS transmitter to aid in recovery. All mooring hardware (anchors, instrument batteries, wire, spectra and nylon) is also budgeted.

The details of the equipment fabrication costs appear in the "Supplementary Documents" section of this proposal.

Travel:

Travel and per diem are requested in year 2 to Mar del Plata, Argentina for Sprintall, Engineer Harvey and 2 students to participate in the mooring deployment cruise; and for 2 students to participate in the hydrographic cruise. Travel and per diem are requested in year 3 to Mar del

Plata, Argentina for Sprintall, Engineers Harvey and Kawamoto, and 2 students to participate in the mooring turn-around cruise of the western array; and to Cape Town, South Africa for Sprintall, Harvey, Kawamoto and 1 student to participate mooring turn-around cruise of the eastern array. Travel and per diem are requested in year 4 to Mar del Plata, Argentina for Sprintall, Engineers Harvey and Kawamoto, and 1 students to participate in the mooring recovery cruise of the western array; and to Cape Town, South Africa for Sprintall, Harvey, Kawamoto and 1 student to participate mooring recovery cruise of the eastern array.

Other foreign and domestic travel expenses are for attendance at PI meetings and presentation at workshops and conferences (e.g. EGU, Ocean Sciences).

Other Direct Costs:

Materials and Supplies: Funds are requested for supplies and materials in support of the SAMBA cruises and research analysis. Additional supplies are listed in years 2, 3 and 4 when deployments are occurring. The additional supplies include instrument supplies (i.e. batteries, cables, connectors, etc) as well as additional mooring and cruise supplies. During the cruise years additional costs in this category include vehicle rentals for the transportation of instrumentation for shipping, shipping expenses, H Lab Fees, medical exams necessary for international travel, and transit insurance for foreign shipments.

Shipment costs of the instruments from their manufacturers to SIO, and from SIO to Miami are included in the first and last year's budget. All equipment will be staged at U. Miami for collective shipment to the cruise port.

Publications: Funds (year 4) to cover the cost of publishing results in a scientific journal.

Computer Costs: Funds are requested for computer support in each budget year, which cover cost of software maintenance, network support and facilities, storage devices, internet connections, etc. that are necessary in order to perform the proposed project research tasks.

Other Expenses: Project specific costs that include telephone equipment, tolls, voice and data communication charges, photocopying, faxing, postage, and other miscellaneous research supplies are requested. Supply and expense items, categorized as project specific, are for expenses that specifically benefit this project, are reasonable and necessary for the performance of this project and can be readily allocable to this project

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Massachusetts Institute of Technology

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Glenn R Flierl

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Glenn R Flierl - PI**	0.00	0.00	0.00	$ **0**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	1.00	0.00	0.00	**4,167**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**4,167**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**1,458**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**5,625**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**2,010**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,200**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**1,000**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**4,200**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**11,835**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC on campus (Rate: 67.5000, Base: 10835)**					
TOTAL INDIRECT COSTS (F&A)				**7,314**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**19,149**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **19,149**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Glenn R Flierl

ORG. REP. NAME*
Nancy Sahagian

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Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Massachusetts Institute of Technology

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Glenn R Flierl

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Glenn R Flierl - PI**	0.00	0.00	0.50	$ **6,772**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.50	**6,772**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	2.00	0.00	0.00	**8,667**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**15,439**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**6,022**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**21,461**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**7,000**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**520**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**3,800**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**1,050**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**5,370**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**33,831**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC on campus (Rate: 67.5000, Base: 32781)**					
TOTAL INDIRECT COSTS (F&A)				**22,127**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**55,958**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **55,958**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Glenn R Flierl

ORG. REP. NAME*
Nancy Sahagian

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Massachusetts Institute of Technology

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Glenn R Flierl

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Glenn R Flierl - PI**	0.00	0.00	0.50	$ **7,043**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.50	**7,043**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	3.00	0.00	0.00	**13,520**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**20,563**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**8,020**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**28,583**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**541**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**3,952**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**1,103**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**5,596**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**34,179**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC on campus (Rate: 67.5000, Base: 33076)**					
TOTAL INDIRECT COSTS (F&A)				**22,326**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**56,505**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **56,505**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Glenn R Flierl

ORG. REP. NAME*
Nancy Sahagian

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Massachusetts Institute of Technology

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Glenn R Flierl

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Glenn R Flierl - PI**	0.00	0.00	0.50	$ **7,325**	$
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.50	**7,325**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	6.00	0.00	0.00	**28,122**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**35,447**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**13,824**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**49,271**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**2,250**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**563**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**4,110**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**1,158**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**5,831**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**57,352**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC on campus (Rate: 67.5000, Base: 56194)**					
TOTAL INDIRECT COSTS (F&A)				**37,931**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**95,283**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **95,283**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Glenn R Flierl

ORG. REP. NAME*
Nancy Sahagian

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Massachusetts Institute of Technology

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Glenn R Flierl

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Glenn R Flierl - PI**	0.00	0.00	1.50	$ **21,140**	$
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	1.50	**21,140**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**4**) POST DOCTORAL SCHOLARS	12.00	0.00	0.00	**54,476**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**75,616**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**29,324**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**104,940**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**4,260**	
2. FOREIGN				**7,000**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**4,824**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**11,862**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**4,311**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**20,997**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**137,197**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**89,698**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**226,895**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				$ **226,895**	$

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Glenn R Flierl

ORG. REP. NAME*
Nancy Sahagian

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C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

BUDGET JUSTIFICATION

In this proposed collaborative work, we will participate over a period of four years. During Period 1 (10/1/11 -- 9/30/12) the instruments will be shipped to the University of Rhode Island (URI) and refurbished for deployment. Sheekela Baker-Yeboah will participate in pre-cruise training at URI for deployment and recovery of the instruments. During Period 2 (10/1/12 -- 9/30/13), we will review the hydrographic data for the region of study and collect any additional recent data for the analysis and generate parameter (specific volume anomaly, temperature, and salinity) fields. Sheekela will participate in the deployment cruise (the GoodHope cruise) with French PI Sabrina Speich. During Period 3 (10/1/13 -- 9/30/14) we will update the parameter fields in collaboration with Chris Meinen (PI at NOAA/AOML in Miami, Florida) with newly collected data, and we will begin analyzing part of the data from the instruments for surface and deep ocean eddies. We plan to submit a manuscript, following the analysis. Lastly, during Period 4 (10/1/14 -- 9/30/15), we will complete our analysis and publications.

PERSONNEL

Postdoctoral Associate Sheekela Baker-Yeboah (Yr 1: 1; Yr 2: 2; Yr 3: 3, Yr 4: 6), with her supervisor Professor Glenn Flierl (Yr 1: 0; Yr 2-4: 0.5), plan to contribute to the SAMOC effort as follows: We will analyze historical hydrographic data and combine these with recent data to generate a look-up table and parameter fields, called GEM fields, which will be used to process data from the PIES instruments. We will analyze the PIES data for surface and deep ocean eddies and compare these with what is known about the eddy field for this region based on the literature, numerical and theoretical model data, satellite and in-situ data.

Salaries are increased by 4% annually.

FRINGE BENEFITS

MIT's employee benefit rate is 26% and vacation accrual is 9% for FY2012 and 30% and 9% for FY2013. The Employee Benefits rates for FY12 are based on a negotiated provisional rate. The rates for FY13 and beyond are based on estimated rates and are for budget purposes only. MIT charges actual rates to awards.

TRAVEL – DOMESTIC		$4,260
	AGU conference year 1 & 4 in San Francisco, CA	
	Airfare (coach)	$500
	Accommodation	$900
	Meals	$300
	Ground transport (shuttles, taxis)	$110
	Registration & abstract fees	$350
TRAVEL – INTERNATIONAL		$7,000
Year 2 - Airfare (coach, refundable) 2,200 x 2 Good Hope cruise		$4,400
	Accommodation	$2,200

Meals	$300	
Ground transport (shuttles, taxis)	$100	

MATERIALS AND SERVICES $4,824

Software	$200
Lab Supplies	$250
Xeroxing	$50

Year 1 2,700 requested for tech training (2 days) and up-to-date PIES processing (1 day) at the University of Rhode Island.

Each consecutive year is increased by 4%

PUBLICATION COST $11,862

15 pages @ $185=$2,775 and 5 color pages@ $205 = $1,025 totaling $3,800 in year Two.
Year three is increased by 4% - $3,952
Year four is increased by 4% - $4,110

COMPUTER MAINTENANCE $4,311

Consists of hardware/software maintenance, software licenses, computer support, and maintenance of PC workstations and systems.
Each consecutive year is increased by 4%.

F&A (overhead rate)
MIT's negotiated F&A rate with the Office of Naval research is 67.5% on-campus and 5.5% off-campus. The cognizant officer is Linda Shipp, ONR, (703) 696-8559, shippl@onr.navy.mil).

Current & Pending Support – Shenfu Dong

Current Support

1. Title: Collaborative Research: Dynamics of Eighteen Degree Water from CLIMODE Observations and its Climate Implications
   Agency: National Science Foundation
   Award Time Period: 04/01/2010 – 03/31/2013
   Award Amount: $254,671
   Person Months: 6.0 months

2. Title: Assessing the Sensitivity of Northward Heat Transport/Atlantic Meridional Overturning Circulation to Forcing in Existing Numerical Model Simulations
   Agency: NOAA
   Award Time Period: 08/01/2010 – 07/31/2013
   Award Amount: $233,983
   Person Months: 6.0 months

Pending Funding

1. Title: Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic (this Proposal)
   Agency: National Science Foundation
   Proposed Time Period: 10/01/2011 – 09/30/2015
   Requested Funds: $4,654,389
   Person Months: 4.25 months

Current & Pending Support

Investigator: Rana Fine, PhD

Current Support:

Project/Proposal Title:	Collaborative Research: Global Ocean Repeat Hydrography, Carbon and Tracer Measurements, 2009-2014 (PI)
Source of Support:	Lamont-Dohetry Earth Observatory, Columbia University (Sub-Contract)
Total Award Amount:	$480,254
Location of the Project:	University of Miami
Start & End Date:	12/10/08 – 01/31/12

Person-Month per Year Committed to the Project: Cal: 0.08

Project/Proposal Title:	Line W: A Sustained Measurement Program Sampling the North Atlantic Deep Western Boundary Current and Gulf Stream at 39°N (PI)
Source of Support:	Woods Hole Oceanographic Institution (Sub-Contract)
Total Award Amount:	$87,062.00
Location of the Project:	University of Miami
Start & End Date:	03/01/10 – 02/28/11

Person-Month per Year Committed to the Project: Cal: 0.5

Pending Support:

Project/Proposal Title:	Role of eddies in ventilation of the Southern Ocean (Co-PI)
Source of Support:	NSF
Total Award Amount:	$ 620,346
Location of the Project:	University of Miami
Start & End Date:	06/01/11 – 05/31/14

Person-Month per Year Committed to the Project: Cal: 1.0

Project/Proposal Title:	Surface Ocean Alkalinity: Temporal and Spatial Variability from Satellite Derived Products (PI)
Source of Support:	NASA
Total Award Amount:	$ 725,040
Location of the Project:	University of Miami
Start & End Date:	06/01/11 – 05/31/14

Person-Month per Year Committed to the Project: Cal: 1.0

Project/Proposal Title:	Observing the Meridional Overturning Circulation in the South Atlantic (Co-PI) *(this proposal)*
Source of Support:	NSF
Total Award Amount:	$ 4,654,389
Location of the Project:	University of Miami
Start & End Date:	10/01/11 – 09/30/15

Person-Month per Year Committed to the Project: Cal: 1.0

Project/Proposal Title:	Collaborative Research: Downstream Impacts of South Pacific Tropical Water (Co-PI)
Source of Support:	University of Hawaii
Total Award Amount:	$ 397,826
Location of the Project:	University of Miami
Start & End Date:	10/01/11 – 09/30/2014

Person-Month per Year Committed to the Project: Cal: 1.0

RENELLYS PEREZ

Current

Title: Collaborative Research: Global Impacts of Eddies on Inertial Oscillations of the Mixed Layer
Agency: National Science Foundation
Amount of Award: $66,313
Award Period: 10/1/10-9/30/14
Person Months Committed to Project: 1 month

Title: Remote Sensing in Support of Climate Research
Agency: National Oceanic and Atmospheric Administration
Amount of Award: $116,000
Award Person: 10/1/10-9/30/11
Person Months Committed to Project: 0 month

Pending

Title: Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic (Co-PI)
Agency: National Science Foundation (this proposal)
Requested Amount: $4,654,389
Requested Period: 10/1/11-9/31/15
Person Months Committed to Project: 4 months

Current & Pending Support

Investigator: James Happell, PhD

Current Support:

Project/Proposal Title:	Operation SWAB: Monitoring of ship, van, and laboratory 14C
Source of Support:	National Science Foundation
Total Award Amount:	$618,446.00
Location of the Project:	University of Miami
Start & End Date:	10/01/2006 - 09/30/2011

Person-Month per Year Committed to the Project: Cal: 1.2

Pending Support:

N/A

Current Support

Investigator: **Sprintall, Janet**

Project/Proposal Title: The Interaction of the Indonesian ThroughFlow with Smaller Scale Variability in Lombok Strait (includes award ONR-20073508)

Source of Support: ONR - N000140610690
Total Award Amount: $ 539,119
Location of Project: UCSD/SIO
Total Award Period Covered: 4/21/06 - 9/30/11
Person-Months Per Year Committed to the Project. Cal: 1, 2,2 Acad: Sumr:

Project/Proposal Title: Collaborative Research: Sampling the Ocean-Sea Ice Interaction in the Pacific Center of the Antarctic Dipole

Source of Support: NSF - NSF ANT07-39522
Total Award Amount: $ 373,247
Total Award Period Covered: 6/1/08 - 5/31/13
Location of Project: UCSD/SIO
Person-Months Per Year Committed to the Project. Cal: 3, 2, 2, 2, 3 Acad: Sumr:

Project/Proposal Title: Collaborative Research: Analysis of the INSTANT Observations of the Indonesian Throughflow

Source of Support: NSF - OCE0725476
Total Award Amount: $ 271,449
Total Award Period Covered: 9/15/07 - 8/31/11
Location of Project: UCSD/SIO
Person-Months Per Year Committed to the Project. Cal: 4, 4, 2 Acad: Sumr:

Project/Proposal Title: Renewal of the Drake Passage High Density XBT/XCTD Program

Source of Support: NSF - OPP0337998
Total Award Amount: $ 573,968
Total Award Period Covered: 7/1/04 - 6/30/11
Location of Project: UCSD/SIO
Person-Months Per Year Committed to the Project. Cal: 3, 3, 3, 3, 3, 3 Acad: Sumr:

Project/Proposal Title: Spatial and Temporal Patterns of Upper Ocean Variability form the Drake Passage High-resolution XBT/XCTD Observations

Source of Support: NSF-ANT0943818
Total Award Amount: $ 297,188
Location of Project: UCSD/SIO
Total Award Period Covered: 9/15/10 - 8/31/13
Person-Months Per Year Committed to the Project. Cal: 2, 2, 2, 2, 2 Acad: Sumr:

Project/Proposal Title: RAPID: Evaluating Fine-Structure Estimates of Diapycnal Mixing from the DIMES 2010 Research Cruise

Lead PI: Gille, Sarah
Source of Support: NSF - OCE0957342
Co-PI: MacKinnon, Jennifer
Total Award Amount: $ 148,369
Total Award Period Covered: 9/15/09 - 8/31/11
Location of Project: UCSD/SIO
Person-Months Per Year Committed to the Project. Cal: 0, 0 Acad: Sumr:

Project/Proposal Title: MoorSPICE: Moorings for the Southwest Pacific Circulation Experiment

Source of Support: NSF- OCE1029487
Total Award Amount: $ 1,772,819
Location of Project: UCSD/SIO
Total Award Period Covered: 10/1/10 - 9/30/14
Person-Months Per Year Committed to the Project. Cal: 2, 1, 3, 2 Acad: Sumr:

Project/Proposal Title: Air-Sea Exchange in the Southern Ocean

Source of Support: NSF - OCE0850350
Lead PI: Gille, Sarah
Total Award Amount: $ 384,211
Location of Project: UCSD/SIO
Total Award Period Covered: 6/1/09 - 5/31/12
Person-Months Per Year Committed to the Project. Cal: 1, 1, 1 Acad: Sumr:

Pending Support

Investigator: **Sprintall, Janet**

Project/Proposal Title: Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic (THIS PROPOSAL)

Source of Support: NSF - UCSD 20112990
Total Award Amount: $ 3,016,474
Total Award Period Covered: 10/1/11 - 9/30/15
Location of Project: UCSD/SIO
Person-Months Per Year Committed to the Project. Cal: 1, 2, 3, 3 Acad: Sumr:

Project/Proposal Title:	Autonomous observations in the tropical Atlantic surface salinity maximum in tests of wind driven circulation theories				
		Lead PI: Centurioni, Luca			
Source of Support:	UCSD 20113038	Co-PI: McClean, Julie			
Total Award Amount:	$ 985,965				
Location of Project:	UCSD/SIO	Total Award Period Covered:			
Person-Months Per Year Committed to the Project.		Cal: 0, 1, 1	Acad:	Sumr:	

Project/Proposal Title:	An Oceanographic Context for the Dispersal of Leatherback Sea Turtles (Dermochelys coriacea) of West Papua, Indonesia				
Source of Support:	NSF- 20102989	Co-PI:	Geoffrey Gearheart		
Total Award Amount:	$ 733,233				
Location of Project:	UCSD/SIO	Total Award Period Covered:		9/1/11 - 8/31/14	
Person-Months Per Year Committed to the Project.		Cal: 2, 2, 2	Acad:	Sumr:	

CURRENT AND PENDING SUPPORT
GLENN FLIERL

CURRENT:

1. Title: "Collaborative Proposal: Models of the Deep Circulation of Gas Giants: Solar Heating, Convection, and Zonal Flows"

Source -- contract/grant number:	NSF/AST-0708106
Contact:	Michael Briley, 703-292-4901, email: mbriley@nsf.gov
Amount of funding:	$404,794
Start/End dates:	07/07-06/11
Location:	MIT
Effort -- summer months:	1

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2. Title: Dynamics of Eddies and Dipoles in the South Atlantic

Source -- contract/grant number:	NSF/OCE-0752346
Contact:	Eric Itsweire, 703-292-8218, eitsweir@nsf.gov
Amount of funding:	$474,607
Start/End dates:	02/08-01/12
Location:	MIT
Effort -- summer months:	1

---

3. Title: "Cloud-computing infrastructure and technology for education (C.I.T.E)"

P.I.	Chris Hill
Source:	NSF/ OCI-0926191
Contact:	Abani K. Patra, Tel: 703-292-8970
Amount of funding:	$783,063
Start/End dates:	9/09-8/12
Location:	MIT
Effort -- person-months (calendar year):	1/2

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4. Title: "Collaborative Research: Impact of bottom boundary layer drag and topographic wave drag on the eddying general circulation"

P.I.	Glenn Flierl
Source	NSF/ OCE-0960826
Amount of funding:	$114,068
Start/End dates:	6/1/2010-5/31/2013
Location:	MIT
Effort -- summer months:	1

PENDING:

1. Title: "Virtual interactive textbooks for beginning geoscience - a pilot weather and climate primer"

P.I.	Chris Hill
Source -- contract/grant number:	NSF
Amount of funding:	$147,345
Start/End dates:	9/1/10-8/31/12
Location:	MIT
Effort -- person-months (calendar year):	1/4

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2. Title: " Collaborative Research Type 2 L02170291 MOBY: Modeling Ocean Variability and Biogeochemical Cycles"

P.I.	John Marshall
Source -- contract/grant number:	NSF
Amount of funding:	$2,658,648
Start/End dates:	1/1/11-12/31/15
Location:	MIT
Effort -- person-months (calendar year):	Yr 1-2: 0, Yr 3-5: 1/2

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3. Title: "Collaborative Proposal: Observing the Meridional Overturning Circulation in the South Atlantic"

P.I.	Glenn Flierl
Source -- contract/grant number:	NSF (this proposal)
Amount of funding:	$226,895
Start/End dates:	10/1/11-9/30/1
Location:	MIT
Effort -- person-months (calendar year):	.50 Yrs 2,3 & 4

2/8/11

CURRENT AND PENDING SUPPORT
SHEEKELA BAKER-YEBOAH

CURRENT:

None

PENDING:

1. Title: "Collaborative Proposal: Observing the Meridional Overturning Circulation in the South Atlantic"

P.I.	Glenn Flierl
Source -- contract/grant number:	NSF (this proposal)
Amount of funding:	$226,895
Start/End dates:	10/1/11-9/30/15
Location:	MIT
Effort -- person-months (calendar year):	1 mo yr 1, 2 mos yr 2, 3 mos yr 3 and 6 mos yr 4

1/26/11

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

Laboratory: N/A

Clinical: N/A

Animal: N/A

Computer: Computer needs other than those explicitly requested within this proposal will be supported by the University of Miami/RSMAS and NOAA Atlantic Oceanographic and Meteorological Laboratory.

Office: Office needs will be supported by the University of Miami/RSMAS and NOAA Atlantic Oceanographic and Meteorological Laboratory at no cost to this proposal.

Other: N/A

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

PIES/CPIES deployed on the western boundary (USA-NOAA funded) and eastern boundary (FRANCE-IFREMER funded) along 34.5S in the South Atlantic, and PIES belonging to MIT are the major equipment already available for this project.

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

The University of Miami/RSMAS and NOAA Atlantic Oceanographic and Meteorological Laboratory have instrumentation groups and machine shops qualified to prepare the instrumentation requested in this NSF proposal and in a related proposal submitted to NOAA to seek funds for additional PIES/CPIES.

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. USE additional pages as necessary.

Laboratory: Sprintall has laboratory space in Neirenberg Hall Room 112 and the SIO Hydraulics Laboratory will be used for instrument preparation and cruise preparation.

Clinical: n/a

Animal: n/a

Computer: Sprintall?s existing network of UNIX machines and the purchase of a field computer for data acquisition and processing will be available.

Office: Sprintall has office space in Nierenberg Hall Room 349

Other: n/a

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate identifying the location and pertinent capabilities of each.

The instruments purchased under this proposal will be stored in the SIO Hydraulics Laboratory facilities

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual arrangements with other organizations.

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. Use additional pages if necessary.

Laboratory:

Clinical:

Animal:

Computer:

Office: MIT Physical Oceanography office staff, shared between five faculty members and their groups, consists of two full time Project Support Staff.

Other: _____

As a large research university, MIT has numerous resources and facilities available

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate, identify the location and pertinent capabilities of each.

The MIT group has a networked set of analysis and development desktop workstations running Linux. These are currently connected via a switched 100Mb/s ethernet fabric to a central storage facility with present capacity of around 2TB. A dedicated fiber link connects the desktop development and analysis network to a cluster computing facility that consists of 64 Pentium 4 nodes with a Myrinet interconnect. The cluster facility includes 8TB of temporary storage that is accessible to all nodes in the cluster. Software used in the facility includes Matlab, Ferret and Grads for analysis and Fortran, C and C++ for application development. The facilities also include dedicated data servers that support LAS and Ingrid based remote queries to access data products and dedicated distributed development servers that are used to support MITgcm modeling collaborations both internally and worldwide.

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project. Include an explanation of any consortium/contractual/subaward arrangements with other organizations.

Data Management Plan

The proposed program involves several countries, institutions and investigators, and it will be closely connected to the existing monitoring array at 26.5°N, a potential monitoring array at subpolar North Atlantic, and programs across the Southern Ocean choke points. The data-sharing plan has been discussed during the SAMOC3 meeting held in May 2010. A SAMOC web site (http://www.aoml.noaa.gov/phod/SAMOC/) has already been developed and is publically available. A password-protected system will be established to allow SAMOC investigators to post data to the web site and to access all available data. Data collected under the SAMOC field program (SAMBA, oblique Goodhope transect, and cruise data) will be made public within two years, and will be available on the SAMOC web site and submitted to national data centers in adherence with the NSF policy on the dissemination and sharing of research results. As has been done for the WOCE and CLIVAR programs, final tracer data will be made available to the community within 6 months of the end of the cruise. These data also will be sent to the CCHDO at UCSD, they will put data on website http://cchdo.ucsd.edu/.

Postdoctoral Researcher Mentoring Plan

Support for two postdoctoral researchers is requested on this project. Their development will be enhanced through a program of structured mentoring activities following the guidance of the National Academies of Science and Engineering on how to enhance the postdoctoral experience [1]. The goal of the mentoring program will be to provide the skills, knowledge and experience to prepare the postdoctoral researcher to excel in his/her career path. Specific elements of the mentoring plan include:

1) Working with the postdoctoral researcher to develop an **Individual Development Plan** as they begin their postdoctoral experience.
2) Participation in planning, deployment, and analysis of data from at least **one cruise per year**, with the goal of developing the skills necessary for being a sea-going scientist.
3) Participation in the PI's weekly research group meetings, with the goal of helping the postdoctoral researcher to **progress in their research and to develop communication and presentation skills**.
4) Travel to at least **one conference each year**, with the goal that the postdoctoral fellow present a poster or paper at the conference.
5) Opportunities to **write articles for publication and grant proposals**, to enable them to successfully transition into an independent researcher.
6) Opportunities to **network with visiting scholars** by scheduling meetings with them and having lunch or dinner with them when they participate in the department's visiting speaker series.
7) Participation in a bi-weekly **journal club** for graduate students and postdoctoral researchers, in which participants meet, along with faculty members, to discuss and critique recent journal articles in the field.
8) Participation in career-planning seminars and workshops, frequently offered by University of Miami's Post-doctoral Association [2] and the Mentoring Physical Oceanography Women to Increase Retention (**MPOWIR**) [3].

Success of this mentoring plan will be assessed by tracking the progress of the postdoctoral fellow through her/his Individual Development Plan, annual discussions with the postdoctoral fellow to assess satisfaction with the mentoring program, and tracking of the postdoctoral fellow's career after finishing the postdoc.

[1] National Academy of Science, National Academy of Engineering, Institute of Medicine, "Enhancing the Postdoctoral Experience for Scientists and Engineers: A Guide for Postdoctoral Scholars, Advisers, Institutions, Funding Organizations, and Disciplinary Societies," National Academies Press, 2000.

[2] http://postdocs.med.miami.edu/

[3] http://www.mpowir.org/

UNIVERSIDADE DE SÃO PAULO

Instituto Oceanográfico

São Paulo, February 4, 2011

To Whom It May Concern:

This letter is in support to a proposal entitled ***"Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic"****, to be submitted to the U.S. National Science Foundation by the following Principal investigators: Shenfu Dong, Renellys Perez, Janet Sprintall, Rana Fine, Glenn Flierl, Sheekela Baker-Yeboah*

In result of a series of Workshops organized by the South Atlantic Meridional Overturning Circulation (SAMOC) Program, the deployment of a trans-basin array and lines that will monitor the inter-ocean exchanges was decided based on the analysis of numerical moorings and in the already existing efforts, in which I have been collaborating together with colleagues from the University of São Paulo (USP) and the Universidade Federal do Rio Grande (FURG), with the most valuable support from the Brazilian Navy's Directorate of Hydrography and Navigation (DHN).

In this context, a pilot experiment started in 2007 as collaboration between AOML and institutions from France, Brazil and Argentina. The collaboration consists in the deployment and maintenance of an array of PIES/CPIES and ADCP/BPR near the western and eastern sides of the South Atlantic, along 34.5°S. In Brazil we have submitted a Proposal to the Brazilian Ministry of Science and Technology (MCT)'s National Council for Scientific and Technological Development (CNPq) and will submit shortly another Project to the São Paulo State Foundation for Scientific Research (FAPESP), to augment the number of instruments and to provide ship support western side of the line.

Prof. Dr. Edmo J. D. Campos
Depto. de Oceanografia Física, Química e Geológica
Instituto Oceanográfico, Universidade de São Paulo

Departamento Oceanografía - Servicio de Hidrografía Naval
Av. Montes de Oca 2124, 1271, Buenos Aires, Argentina
Tel 54 11 4301 2590 - Fax 54 11 4303 2299 - e-mail: apiola@hidro.gov.ar

7 February 2011

Dr. Shenfu Dong
Cooperative Institute of Marine and Atmospheric Studies
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149 USA

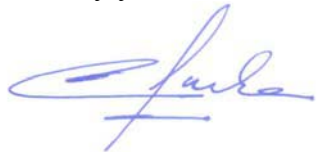
Dear Shenfu,

I am pleased to endorse your proposal entitled **Observing the Meridional Overturning Circulation in the South Atlantic** being submitted to the US National Science Foundation. It has been a long way since our initial meeting held at Angra dos Reis, Brazil, in February 2002, when the scientific basis for establishing a South Atlantic meridional overturning array were first discussed. It is quite pleasing now to see that proposals for a basin-wide array are being submitted, as only if full transatlantic observations are collected we will be able to accurately determine the mass and heat fluxes into the Atlantic Ocean.

I am particularly interested in the western boundary current component of the proposal and the contribution of intermediate and deep waters to the meridional fluxes and their time variability. To this end, I wish to enhance the vertical resolution of the moorings to be deployed in the western boundary current, located nominally on the 800, 1600, 3000 and 4000 meter isobaths. These instruments are already available. In addition, I wish to continue monitoring the physical and chemical characteristics of the water masses contributing to the western boundary current in the northern Argentine Basin. To achieve this I will propose the occupation of full-depth hydrographic sections along 34.5º S from the continental shelf break to roughly 40ºW.

Your proposal, if funded, will significantly enhance our understanding of the role of the Subtropical South Atlantic on regional and global climate. I look forward to the success of this challenging endeavor and hope to be able to contribute through ongoing and future collaborations.

Sincerely yours,



Alberto R. Piola
Senior Scientist - SHN
and Professor of Oceanography - Universidad de Buenos Aires

Laboratoire de Physique des Océans
Unité Mixte de Recherche n°6523
CNRS - IFREMER- IRD- UBO
Institut Universitaire Européen de la Mer

February 6 2011

To Whom It May Concern:

This letter is in support to a proposal entitled "**Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic**", to be submitted to the U.S. National Science Foundation by the following Principal investigators: Shenfu Dong, Renellys Perez, Janet Sprintall, Rana Fine, Glenn Flierl, Sheekela Baker-Yeboah

The U.S. CLIVAR Atlantic Meridional Overturning Circulation (MOC) implementation strategy calls for a MOC and meridional heat transport monitoring array across the South Atlantic, and three South Atlantic MOC (SAMOC) workshops have been held to design the basis for an observational program. The workshops were attended by scientists from Argentina, Brazil, France, Germany, Russia, South Africa, the United Kingdom, Uruguay and the United States. Discussions were aimed at the establishment of international collaborations and at determining what parameters should be observed, how to implement the best possible observation strategies, where are the observations were needed, and who will be interested in carrying them out. More details about SAMOC can be obtained at http://www.aoml.noaa.gov/phod/SAMOC/. At the conclusion of the SAMOC 3 workshop, it was proposed to instrument and sustain a zonal trans-basin South Atlantic line. The main objective of this integrated field program is to characterize the time-mean and time-varying components of the MOC, as well as the heat and salt carried by the MOC, in the South Atlantic. Together with the existing programs at 26.5°N and across the two choke points (Drake Passage and south of South Africa), the South Atlantic program will provide the measurements necessary to evaluate inter-gyre, inter-hemispheric, and inter-ocean connectivity of the MOC.

This is a collaborative effort involving investigators from the U.S., France, South Africa, Brazil, and Argentina, with the U.S. and France as the major contributors for instrumenting a trans-basin moored array along 34.5°S that will serve as the backbone of the integrated field program. Observational systems already in place include a pilot experiment started in 2007 as collaboration between AOML and the *Laboratoire de Physique des Océans* (Brest, France). In conjunction with this proposal submitted by Drs. Shenfu Dong, Renellys Perez and collaborators to the National Science Foundation to augment the number of instruments along the line, the *Laboratoire de Physique des Océans* (supported by the Ifremer, the CNRS, the IRD and the University of Brest) will submit a proposal to the French Science Fundation (*Agence Nationale pour la Recherche*). AOML will be submitting a proposal to the US NOAA, and University of Sao Paulo will be submitting a proposal to the Brazilian Ministry of Science and Technology and FAPESP. It is our sincere hope that Drs. Dong , Perez and collaborators' proposal will receive serious consideration and support.

Sabrina Speich

Université de Bretagne Occidentale, UFR Sciences et Techniques, 6 av. Le Gorgeu 29238 Brest Cédex 3 France
Tel. +33 2 98 01 65 11; Fax. +33 2 98 01 64 68
Email: speich@univ-brest.fr

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Atlantic Oceanographic and Meteorological Laboratory
4301 Rickenbacker Causeway Miami FL 33149

Miami, February 7, 2011

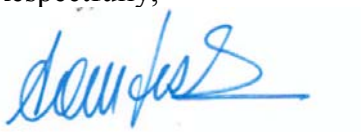
Dear NSF program manager and reviewers,

I am writing this letter in support of the NSF proposal "Collaborative Research: Observing the Meridional Overturning Circulation in the South Atlantic" by Shenfu Dong, Renellys Perez, Janet Sprintall, Rana Fine, Glenn Flierl, and Sheekela Baker-Yeboah.

Research on the Atlantic Meridional Overturning Circulation has been designated as a critical near-term priority for the US Ocean research community and it is a high priority for study at NOAA. As part of the international agreements developed during the three South Atlantic MOC (SAMOC) workshops held between 2007 and 2010, NOAA/AOML will be submitting, along with partners at the University of Miami, a proposal to NOAA to support additional instrumentation for the international SAMOC field program. NOAA support will be sought for PIES and CPIES (pressure- and current-equipped inverted echo sounders), and for some equipped with data retrieval systems, to augment the dynamic height moorings funded via this NSF proposal. Funding will also be sought from NOAA to integrate the measurements made by the in situ instruments with data collected by key components of the Global Ocean Observing System, including the repeat eXpendable BathyThermograph (XBT) transects, satellite altimetry and sea-surface temperature, and the Argo and surface drifter programs.

I have strong confidence on the integrated, multi-agency, international approach, and in the exceptional observational and research work proposed by the PIs. I hope you give this proposal serious consideration.

Respectfully,



Dr. Gustavo J. Goni
Director
Physical Oceanography Division
Atlantic Oceanographic and Meteorological Laboratory
National Oceanic and Atmospheric Administration

Email: Gustavo.Goni@noaa.gov
Phone: 305-361-4339

University of Cape Town

Oceanography

University of Cape Town
Rondebosch 7701
South Africa
Tel : +27 21 650 3280
Fax : +27 21 650 3979

6th February 2011

To whom it may concern,

On behalf of the Oceanography Department at the University of Cape Town I would like to offer our full support for the implementation of a SAMOC dedicated array across the South Atlantic. South Africa is currently operating 2 annual repeat lines into the South Atlantic. These lines will be incorporated into the SAMOC array and provide further information from XBT and UCTD, as well as ARGO float and SVP drifter deployments and the retrieval of PIE moorings. Furthermore, it is expected that a new SA National Antarctic Programme call will be opened during the course of 2011 and a proposal supporting South Africa's involvement in the SAMOC array will be submitted.

Yours faithfully,

Dr Isabelle Ansorge
South African Representative for SAMOC

10/01/11 - 09/30/12
HYDRAULICS LABORATORY - TAG/FAB QUOTATION

ITEM NAME - SAMBA Moorings Fabrication

LABOR COSTS	MONTHLY SALARY RECHARGE RATE	MONTHS	TOTAL
Harvey, Paul Assoc. Development Engineer	$11,336	6.00	$68,016
Kawamoto, Spencer Asst Development Engineer	$7,356	3.00	$22,068
Aglietti, Dave Development Technician	$8,793	2.00	$17,586

*Salary recharge rate is charged for actual productive time only (except for non-faculty academic sick leave, which is charged as direct). The rates include components for employee benefits, provisions for applicable merit increases and range adjustments in accordance with University policy. Staff overtime or remote location allowance may be required in order to meet project objectives, and separate rates are used in those cases.

TOTAL LABOR	$107,670

EQUIPMENT COMPONENTS - 1 ea SAMBA Moorings Fabrication including the following components:	**$1,538,659**
Ocean Sensor Array fabricated from:	
4 surface buoy assemblies (MSI)	$89,000
210 glass spheres (Teledyne Benthos)	$130,898
8 wire rope assemblies (MSI)	$67,136
8 S-moor synthetic line assemblies (MSI)	$164,000
Mooring hardware (Crosby)	$22,750
5 bottom mount lander moorings (SIO MSDC)	$11,375
Anchors (Progress Rail)	$30,000
Mooring location instruments (MetOcean)	$24,600
Lander location instruments (Seimac)	$30,600
18 Acoustic releases (Teledyne Benthos)	$212,400
1 A/R deck box (Teledyne Benthos)	$12,850
Instruments:	
14 AquaDopp Current Meters (Nortek)	$157,400
86 SBE37SM C+T+P Loggers (SeaBird electronics)	$492,350
5 SBE-53 Bottom Pressure (SeaBird electronics)	$93,300
Items above include tax and may be substituted with equivalent items	

TOTAL EQUIPMENT	$1,538,659

PROJECT SPECIFIC SUPPLIES, MATERIALS & OTHER	
Instrument Fabrication Parts (batteries, cables, connectors)	$136,510
Mooring Fabrication Parts (hardware, clamps, connectors, frames, spools)	$11,500
Data Acquistion Computer + multi-port I/O data boxes	$6,000
Hlab Fees (shop hours)	$1,170
IOD Computer Support Costs	$3,586
Other Project Specific Costs	$1,100

TOTAL PROJECT SPECIFIC SUPPLIES, MATERIALS & OTHER	$159,866
TOTAL TAG/FAB COSTS	**$1,806,195**