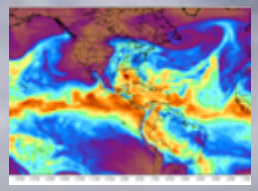
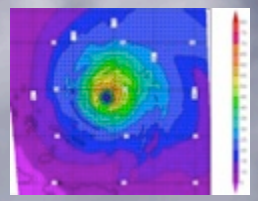
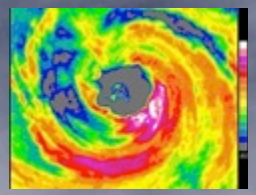
Hurricane Research at AOML & NOAA

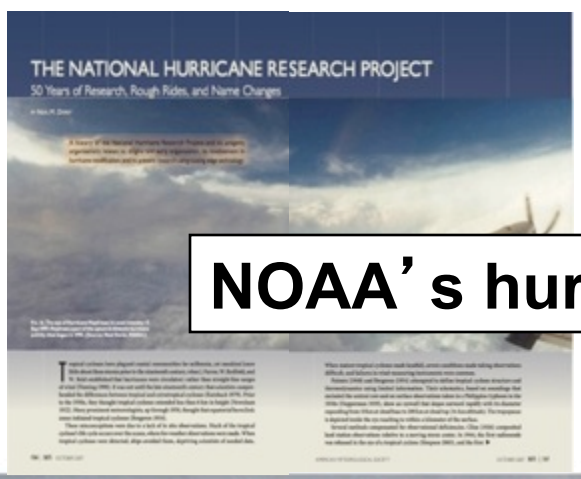
Frank Marks
AOML Program Review
4-6 March 2014

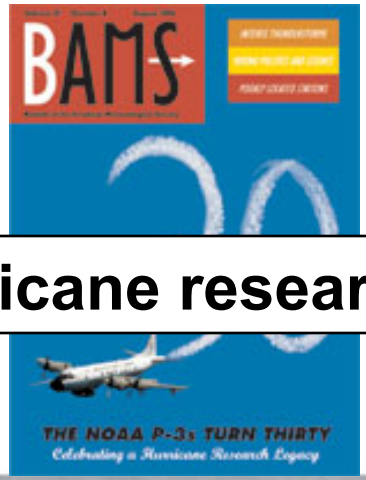
Mission

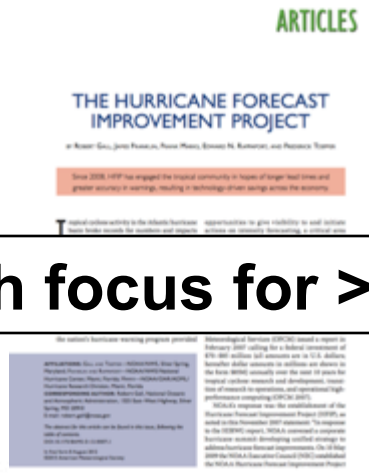
Advance understanding and prediction of TCs through observations, numerical models, and theory, with **emphasis on processes within inner part of storm**.

HRD research supports NOAA's Strategic Plan:

- Advance understanding and prediction of changes in the environment through world class science and observations
- Improve preparedness, response, and recovery from weather and water events by building a **Weather-Ready Nation**

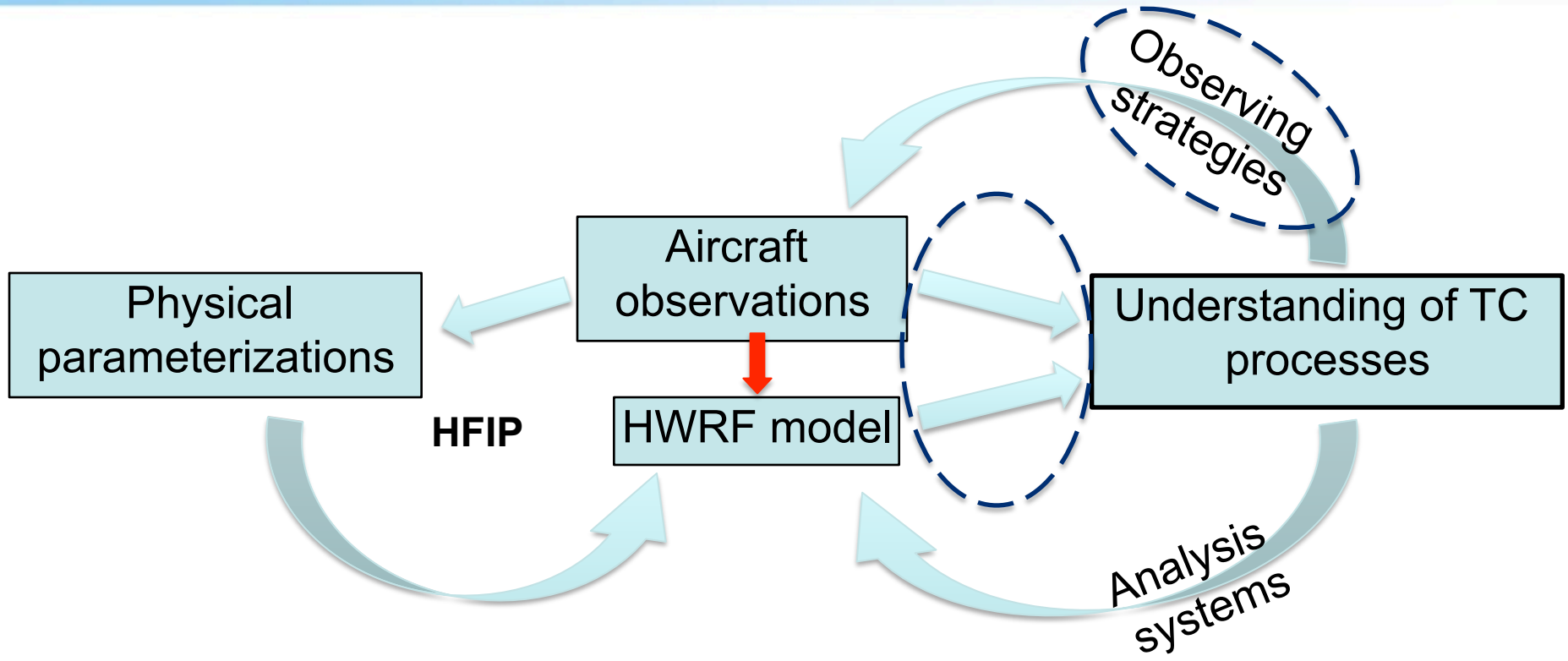






NOAA's hurricane research focus for >50 years

Vision



HRD is uniquely positioned to advance **understanding** of TC processes **in close cooperation** with efforts to improve observing strategies and numerical prediction.

Who We Are: AOML

Staff includes 38 employees with 25 federal and 13 contract

- 21 research scientists
  - 1 post-doc
- 16 support personnel
- 2-3 summer students

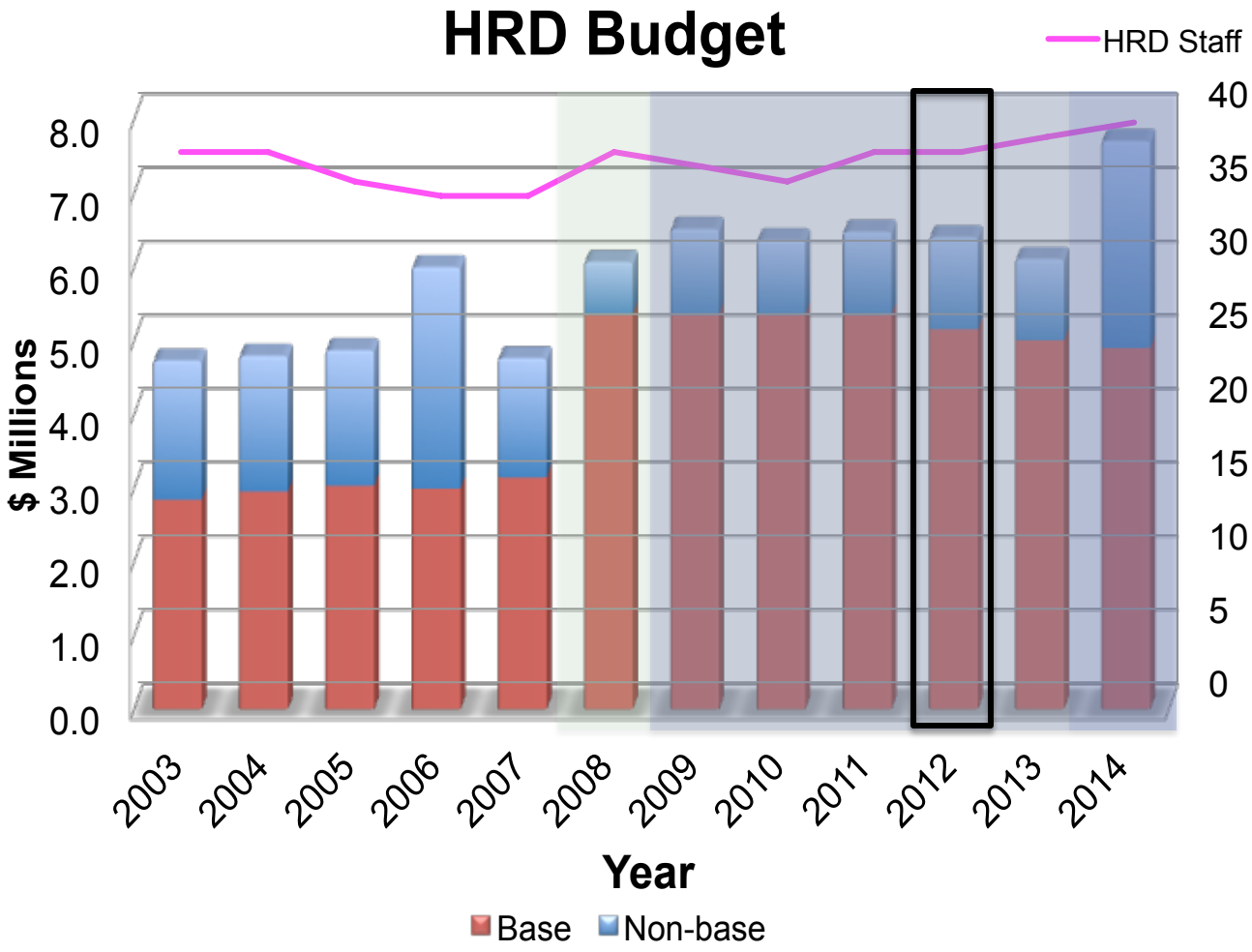
- HRD scientists collaborates locally with scientists in other AOML divisions, **CIMAS**, **UM/RSMAS**, and **FIU**
- HRD coordinates its research with **OAR** laboratories (**ESRL**, **GFDL**, **ARL**, **NSSL**), **AOC**, **NESDIS**, **NWS** (**EMC**, **NHC**, & **WFOs),** and Testbeds (**JHT**, **DTC**, **JCSDA**, & **OSSE**).
- Funded Priorities: NOAA Hurricane Forecast Improvement Project (**HFIP**) & *Sandy Supplemental*.

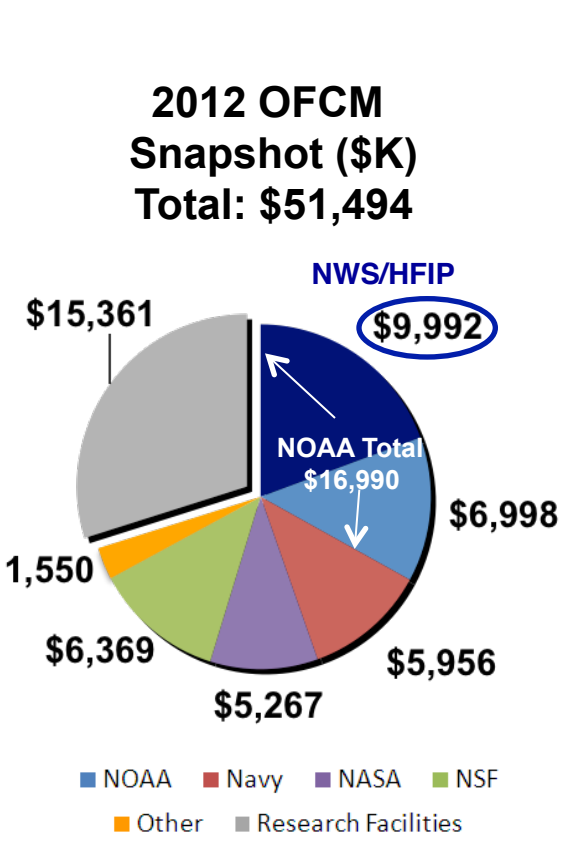
Who We Are: HFIP

- **Unified NOAA approach** to **guide and accelerate improvements in TC forecasts**, with **emphasis on rapid intensity change, and reduction in uncertainty**.
- Improve TC forecasts and increase confidence to **enhance mitigation and preparedness decisions**.
- Responds to input from stakeholders, **NSB**, **OFCM**, and **HIRWG** reports.
- Embraces **strong collaboration** with non-NOAA partners with objective to **transition research into operations**.

http://www.hfip.org

Who We Are: Budget





Who We Are: Partners

- Joint research programs with **NASA**, **NSF**, **ONR**, and **DOE**.
- Cooperative research with scientists at **NCAR**, and **universities**.
- Interact with **WMO WWRP** and **THORPEX**, and cooperative research with other countries.
- Ensure research benefits **NOAA** and **HFIP**.

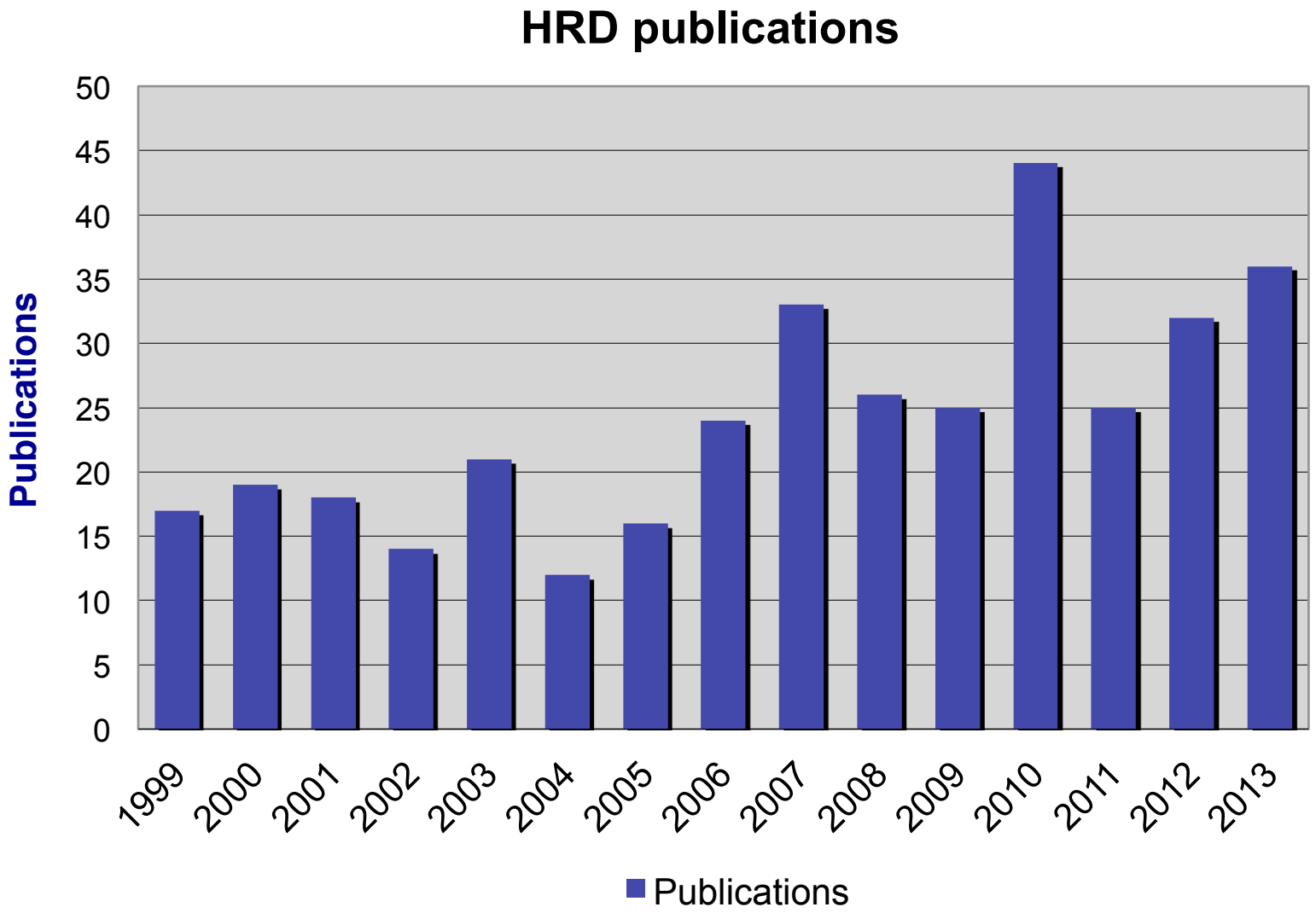

IFEX/PREDICT/GRIP


HFIP Hybrid-DA Workshop


JCSDA-HFIP Workshop

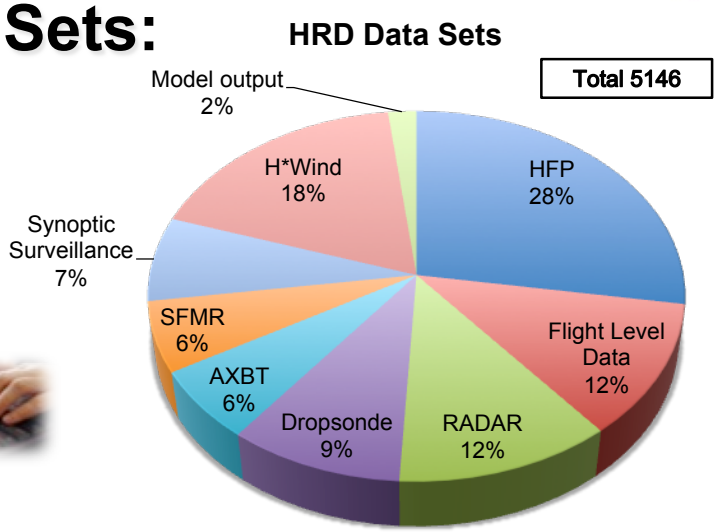

IUSSTF Workshop

Who We Are: Publications



Who We Are: Products

Data Sets:



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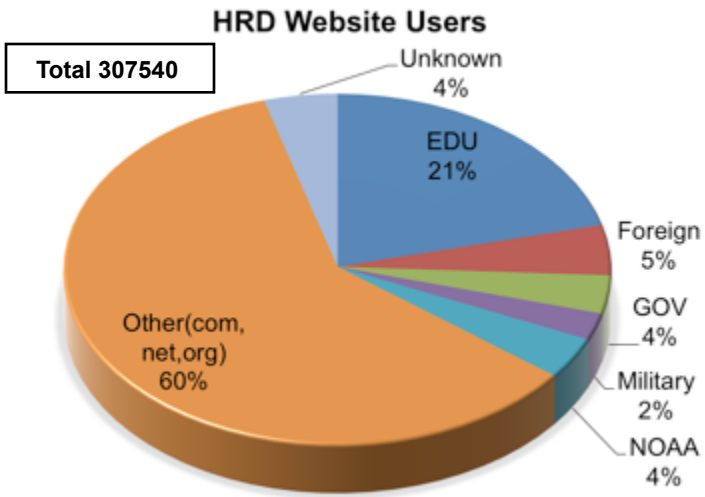
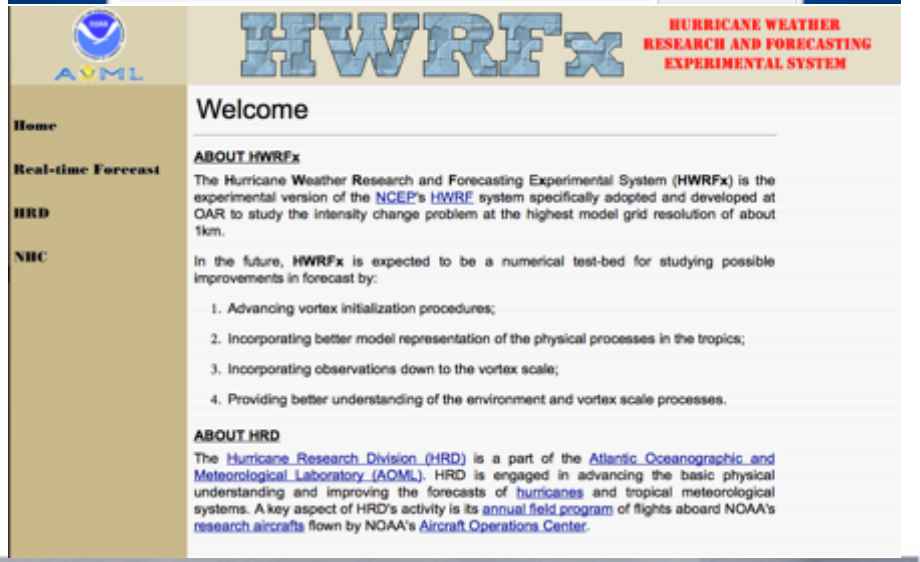


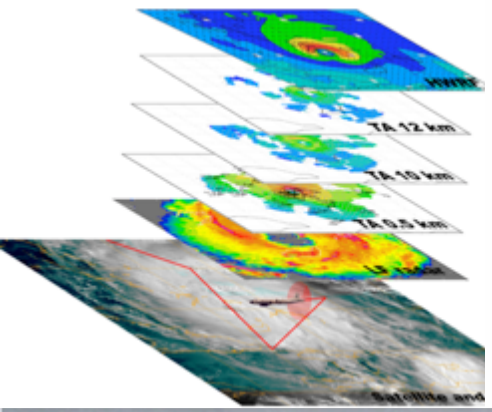


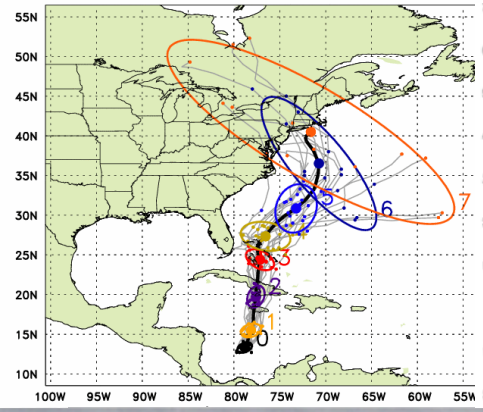
Who We Are: Transitions

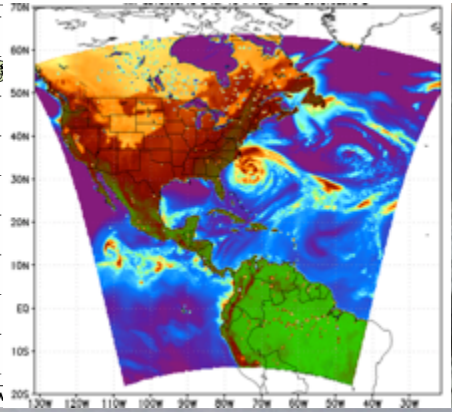
2013-2014 JHT & HFIP Transitions:	Customer	Collaborator
• Improved Rapid Intensity Index (JHT)	NHC/NCEP	CIRA, CIMSS
• Improved SFMR Surface Wind Measurements in Intense Rain Conditions (JHT)	NHC/NCEP, USAF, AOC	
• Development of a Probabilistic TC Genesis Prediction Scheme (JHT)	NHC/NCEP	CIRA, CIMSS
• Improvements in Statistical-Dynamical TC Forecast Models (JHT)	NHC/NCEP	CIRA, CIMSS
• High resolution basin-scale HWRF system at 27 km with multiple moving nests at 9:3 km (HFIP)	EMC/NCEP/DTC	EMC/NCEP
• Advanced nest motion algorithm for high resolution HWRF system (HFIP)	EMC/NCEP/DTC	EMC/NCEP
• Advanced vortex initialization for the 3-km moving nest in the basin scale HWRF (HFIP)	EMC/NCEP/DTC	EMC/NCEP
• Advanced PBL physics package for TC addressing horizontal and vertical diffusion (HFIP)	EMC/NCEP/DTC	EMC/NCEP
• Idealized HWRF framework with 1-D HYCOM ocean model (HFIP)	EMC/DTC/TC research community	ESRL/PSD
• Advanced diagnostics for high resolution HWRF system (HFIP)	NCEP/ WFO/DTC/IMD, India	EMC/NCEP
• Advanced diagnostic web-based products from high resolution HWRF system (HFIP)	HFIP/TCMT/TC research community	EMC/NCEP

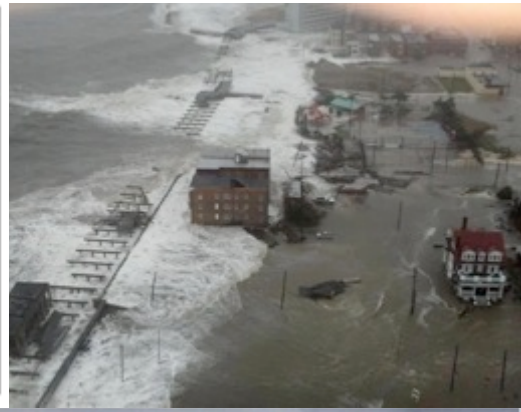
Research Themes

- **Observing Techniques**: Designing, testing, and transitioning data collection to improve initialization/evaluation of TC models and further basic understanding;
- **Modeling & Prediction**: R&D on dynamical and statistical-dynamical models for real-time TC forecasting;
- **Data Assimilation**: Use of observations for analysis of TCs and their environments to improve understanding & forecasts;
- **Dynamics & Physics**: Improve understanding of TCs through application of fundamental physical principles; and
- **Impacts on life & property**: Through wind, rain, waves, and storm surge.









Questions?

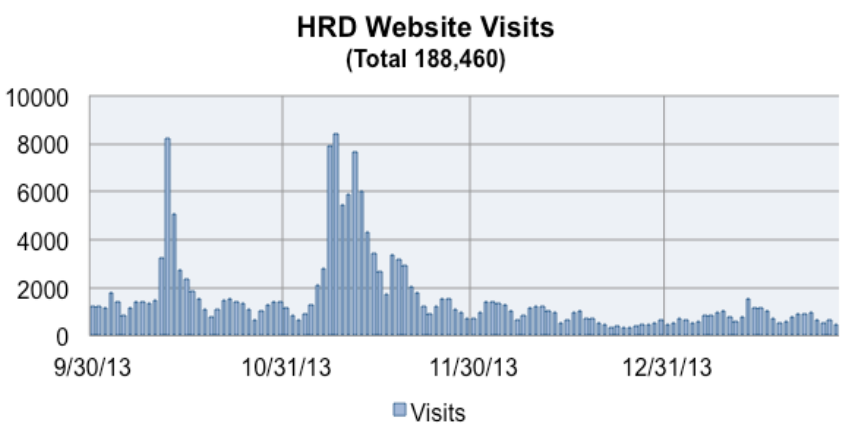
Presentations on key HRD Research Thrusts:

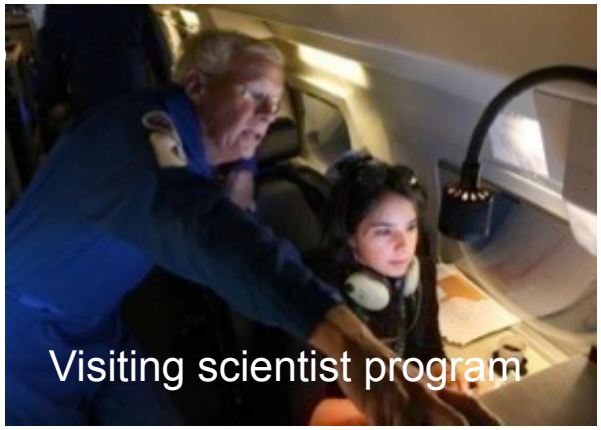
1. What is the role of convective-scale processes in TC intensity change? – **Rob Rogers**
2. How can high-resolution models be improved to best represent structure & intensity change in TCs? – **Sundararaman Gopalakrishnan (Gopal)**
3. What observations will result in accurate and precise representation and forecasts of the TC inner core in numerical models? – **Tomislava Vukicevic (Tomi)**
4. How does the interaction of a TC with vertically sheared flow contribute to intensity change? – **Paul Reasor**
5. How can we improve TC forecasts through systematic evaluation to document & understand model biases using observations? – **Joe Cione**

Extra

Who We Are: Outreach

- Our blog
http://noaahrd.wordpress.com
- HRD Web page
http://www.aoml.noaa.gov/hrd
- Facebook (2,689 likes)
http://www.facebook.com/noaahrd
- Twitter (11,118 followers)
http://twitter.com/#!/HRD_AOML_NOAA

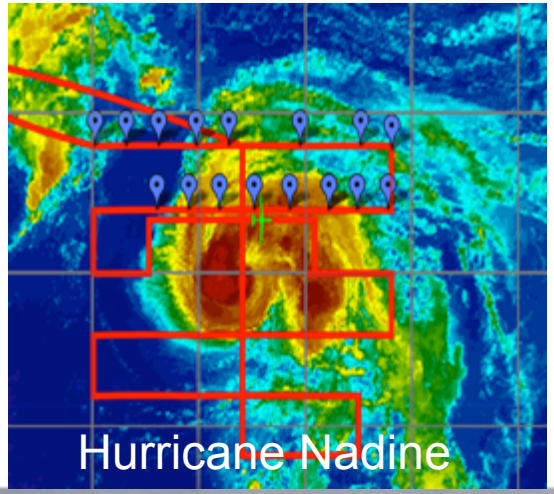


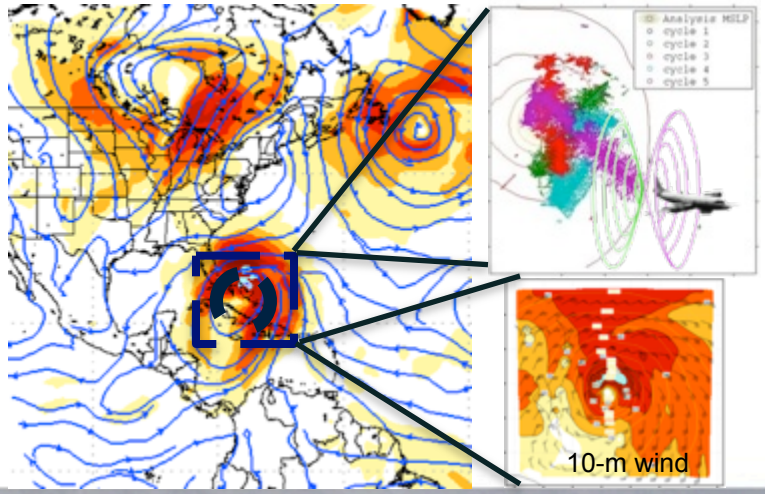


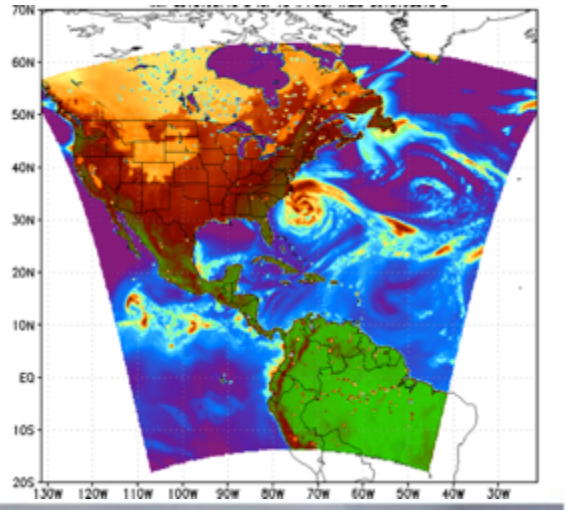
Research Thrusts

Accomplished through:

- **Research experiments in hurricane (IFEX)**
- **Improving hurricane observing strategies**
- **Developing & evaluating numerical models**
- **New technology and applications**
- **Outreach to the public.**







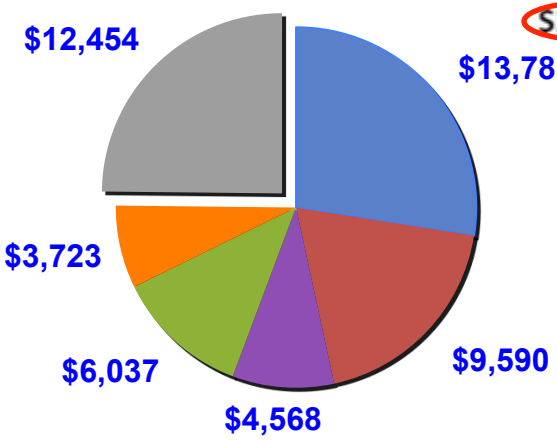
Challenges

1. Increase high performance computing
2. Accelerate TC Forecast System (TCFS) improvements
   - Accelerate NOAA operational TCFS Development
   - R&D to improve TCFS
   - R&D for TCFS ensemble systems
3. Fully fund transition of research to operations
   - Broaden Testbed charter and increase support
   - Enhance interactions between JHT, DTC, JCSDA, & OSSE Testbed
4. Develop observing system strategy analysis capability
   - Optimal use of TC inner core observations
   - R&D to improve observing strategy to inform NOAA investments
5. Coordinate with research community and stakeholders
   - Broaden base of expertise in TC research community
   - Coordinate with federal, academic, and private sector communities

Total Support by Agency

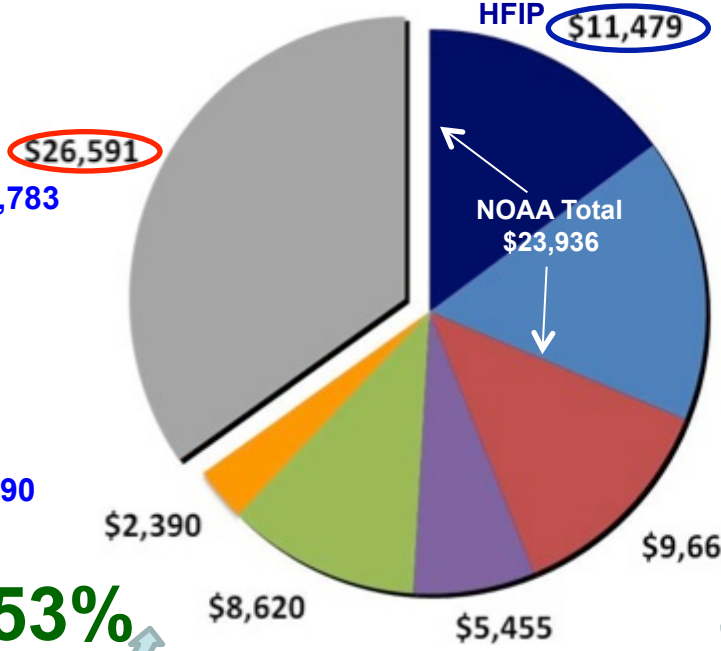
2008 Snapshot
Total: $50,155K

Field Experiments: IFEX, TCS-08



2010 Snapshot
Total: $76,658K

Field Experiments: PREDICT, GRIP, IFEX, ITOP & Research Computer System (HFIP)



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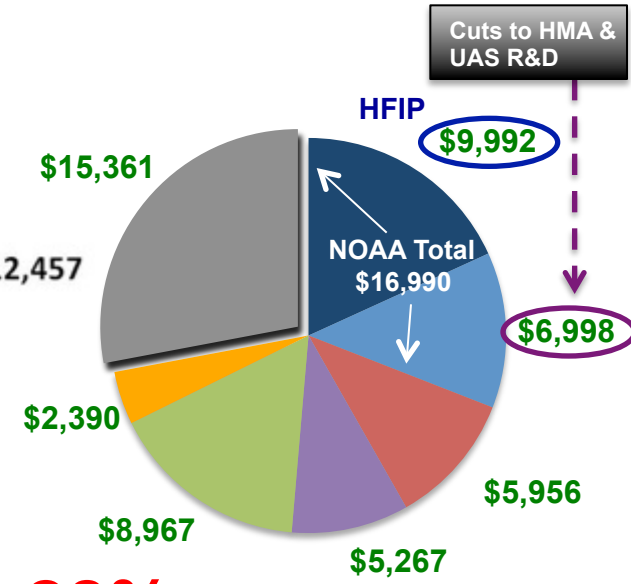
2012 Snapshot
Total: $54,931K

Field Experiments: IFEX, HS3 & Research Computer System (HFIP)



-28%

NOAA Navy NASA NSF
Other Research Facilities

+10%