The NRL Tropical Cyclone Web Page Data Suite

Jeff Hawkins, Tom Lee, Joe Turk,

Kim Richardson, Charles Sampson, John Kent[2]

[1]Naval Research Laboratory, Monterey, CA

[2]Science Applications International Corp, SAIC, Monterey, CA

AMS 26th Conference on Hurricanes and Tropical Meteorology

May 2004

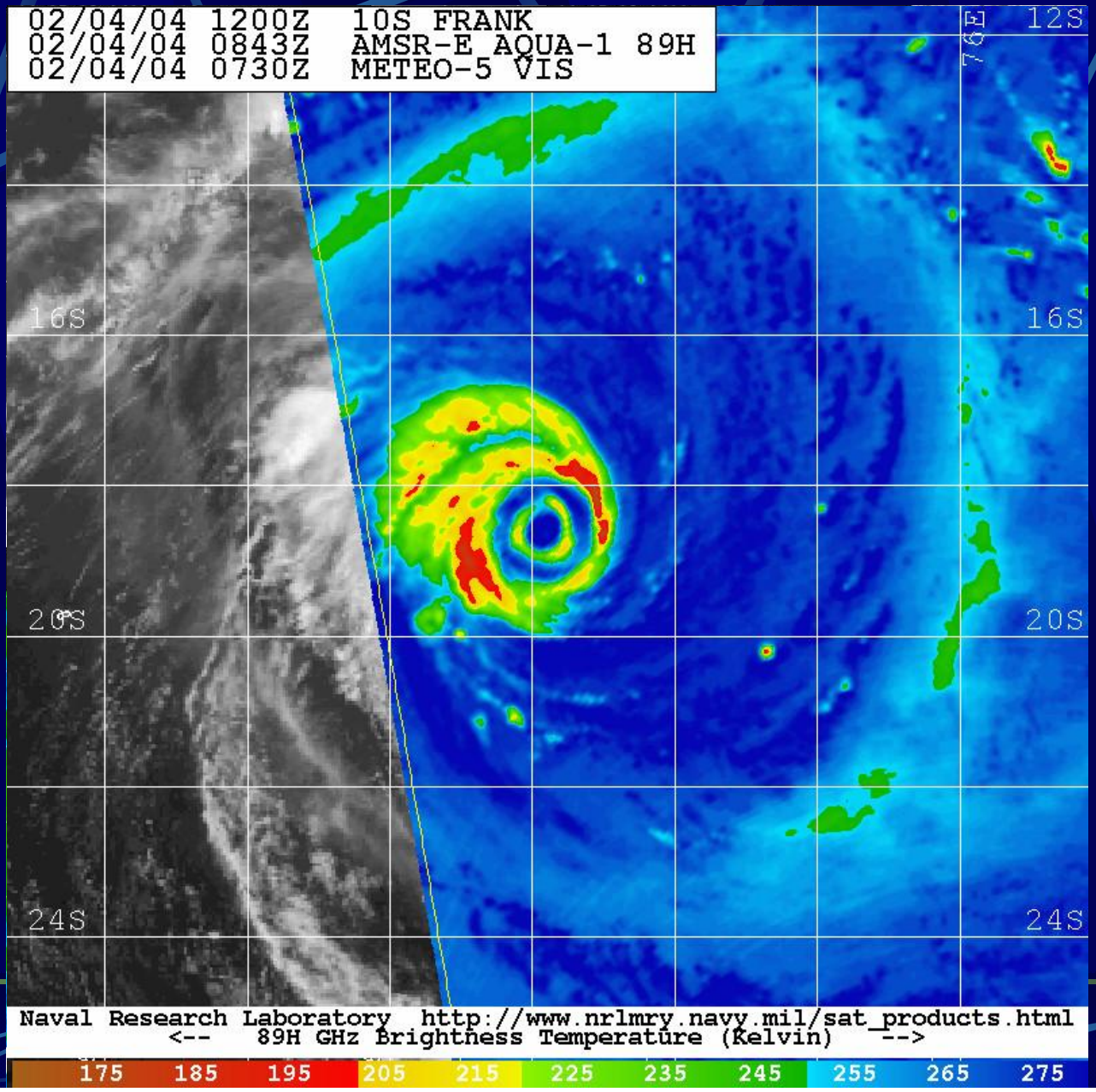
NRL Tropical Cyclone Web Page

Purpose:

- Provide unique “storm following” satellite products in near real-time using multi-sensors (15+) for all active TCs worldwide via the web,

- Unique “microwave” product suite,
- Vis/IR/water vapor imagery,
- Automated Tropical Cyclone Forecasting (ATCF) graphics,
- Create living “online” archive with simple interface.

Understanding TC Structure



http://www.nrlmry.navy.mil/tc_pages/tc_home.html

2004 Storms

All Active Year

Atlantic

East Pacific

Central Pacific

West Pacific

03W.SUDAL

Indian Ocean

Southern Hemisphere

92P.INVEST

91P.INVEST

90S.INVEST

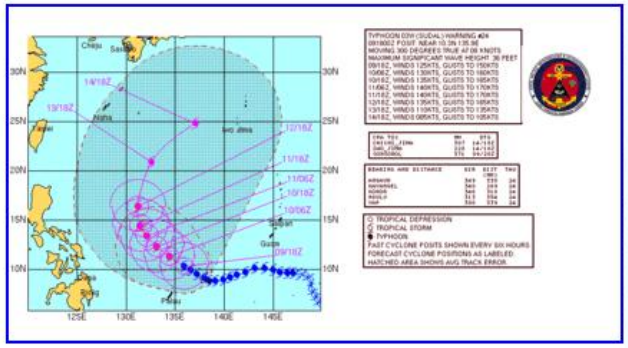
Display: Latest Pass_Mosaic | Warn: Text Track ATCF | 1_km: Track&Image VIS IR WV | Scatt AMSU/B | Info: General

	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:														
TMI:														
AMSR-E:														

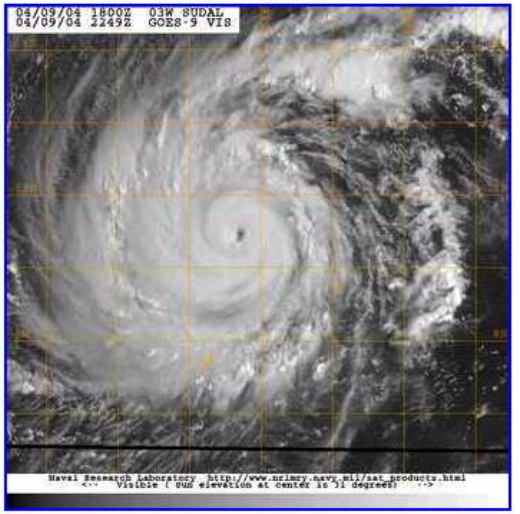
<= 6 hrs. old, <= 12 hrs. old, > 12 hrs. old

03W.SUDAL, TRACK_VIS, 09 APR 2004 2249Z 00:28:52 UTC (Z)

Forecast and Graphic by: Joint Typhoon Warning Center



20040409.2249 latest1km



(Click product for full sized image)

Satellite Pass Info

Sensor	Latest		Next (all)	
SSMI	04/09 2224 Z, F-14	0190	04/09 2359 Z, F-15	0494
TMI	04/09 2116 Z, TRMM	0594	04/10 0706 Z, TRMM	0679
AMSRE	04/09 1653 Z, AQUA-1	0542	04/10 0344 Z, AQUA	1045
AMSUB	04/09 1700 Z, N-16	0497	04/09 2027 Z, N-15	1802
SCATT	04/09 2125 Z, SCAT FNMOC	1016	04/10 0815 Z, QUIK	1178

General Info

NRL Monterey Satellite Photos - Microsoft Internet Explorer

General tc_info information page

This tropical cyclone web page has been created with several goals:
1) Provide the means to merge important remote sensing imagery and data sets derived from both geostationary and polar orbiter sensors that are of prime interest to tropical cyclone (TC) researchers.
2) Include the capability to view the appropriate warning and track forecasts relevant to the times of the satellite data sets. Official warning information derived from the Automated Tropical Cyclone Forecasting (ATCF) system will be used and simply bent-piped from the Joint Typhoon Warning Center (JTWC, Pearl Harbor, HI), Naval Pacific Meteorology and Oceanography Center (NPMOC, Pearl Harbor, HI), the Central Pacific Hurricane Center (CPHC, Honolulu, HI), or the National Hurricane Center (NHC, Miami, FL).
3) The data sets will be GLOBAL in nature and include the standard visible/IR and water vapor geostationary imagery in addition to passive and active microwave data. Tropical cyclones (TCs) in all basins are to be included since the Navy is potentially operating in all domains frequented by TCs. All processing on the web page products is automated! Scripts manage the receipt of new data and product generation, updates to storm positions, addition of new storms and deletions of storms that have decayed and no longer are active.
4) The data sets will be updated in near real-time. This is crucial to the success of the overall effort. The remote sensing data sets contain > 50 GB/day and it is unfeasible to store this quantity of data and extract the desired subsets after the fact. Thus, we have decided to use real-time center locations derived from ATCF messages in an automated manner to access the appropriate satellite data sets.

How to USE and NAVIGATE the TC web page:
a) Select the storm of interest by clicking on storm name in the left frame and the suite of products online for that storm will appear in the main frame,
b) Select the product to view via the appropriate hyperlink, wherever it is located on the main frame,
c) Click again on that product if you wish to view at full resolution,
d) Select another product and it will display that product at the same date and time as the first one selected. If you select another satellite sensor, then the "closest" product in date/time to the original product will be displayed.
e) If you wish to view multiple items from any product, select the product, then click on "mosaic" in the top left display area. A list of all files for that product will be displayed. All users can select up to sixteen (16) items, sequential or otherwise and then have thumbnails of each displayed. The full resolution product can then be accessed by clicking on the thumbnail.
f) If you simply want to see what date/times are available for a given product, select the product and then click on the "Prev" (previous) link. A complete list of all files will be listed and clicking on any given file name will display that product. Use the "BACK" button to return to the directory list and select another example.
g) The file names include all information needed to make them unique. The names include the date and time (GMT) indicating when they overflew the storm center, the satellite, storm number/name, product identification, estimated storm intensity using both maximum sustained surface winds and minimum sea level pressure (MSLP) and the 6-hourly storm center lat/lon from the latest ATCF warning message. The lat/lon may be updated more frequently if the warning centers believe positions need adjustments to recenter the web page products.
h) The "Pass_Mosaic" function provides the quickest means to display the full suite of passive microwave products for a given storm. Pass_Mosaic will display all GOOD passes from SSM/I, TMI, AMSU-B, AMSR-E and QuikSCAT scatterometer. Good overpasses are determined by calculating the closest point of approach (CPA) using the storm center and predicted satellite overpass viewing geometry.
i) All products can be looped using the "animate" link under the display area. The animate function provides the user with some options to optimize the looping by taking into consideration the bandwidth available.
j) All products are saved and can be accessed at anytime quickly. Click on "ALL" in the upper-left frame to view old storms for the current year. Select the storm desired and all products will be available in the right frame. Select "Year" to view storms from 1997 to the present year. Select year and all storms for that year will be listed in the left frame.

The following digital data sets are processed immediately upon receipt of new data anywhere on the globe:

Geostationary visible, Infrared (IR) and water vapor (WV) ranging in spatial resolution of 1-2 km for vis and ~ 4-km for IR.
GOES-10 (GOES-WEST, 135 W), GOES-12 (GOES-EAST, 75 W), GOES-9 (Replaced GMS-5 and now located at 155 E), data available via collaboration with the Fleet Numerical Meteorology & Oceanography Center (FNMOC) collocated in Monterey, CA with NRL and the Air Force Weather Agency (AFWA, Omaha, NE),
Meteosat-5 (63 E) provided via collaboration with NOAA National Environmental Satellite Data & Information Service (NESDIS)
Meteosat-7 (0 E, soon to be replaced by Meteosat Second Generation, MSG), data provided via FNMOC/AFWA
a) **1-km Vis:** NRL-MRY currently has access to full 1 or 1.25 km resolution visible imagery from GOES-9, 10, 12 and Meteosat-5 & 7 satelli tes respectively. All TCs around the globe are thus covered. These images are updated every 30 minutes for GOES-9, 10, & 12 (sometimes every 15 minutes or more [rapid scan periods] depending on where the storm is located within the GOES scanning time table. The data has a histogr am equalization applied to each image to bring out cloud details.
b) **Infrared:** 4-km IR data is available from the same suite of global geostationary satellites. The IR imagery covers a larger domain t han the visible imagery due to the reduced spatial resolution and is output in two versions; 1) standard black/white enhancement and 2) Dvor ak enhancement designed to highlight cold cloud tops associated with active convection near the storm center and routinely used to analyze s torm intensity.
c) **Water Vapor:** 8-km WV data is available from the same suite of global geostationary satellites. The WV imagery represents the amount of water vapor aloft, typically in the layer from 150-450 mb.

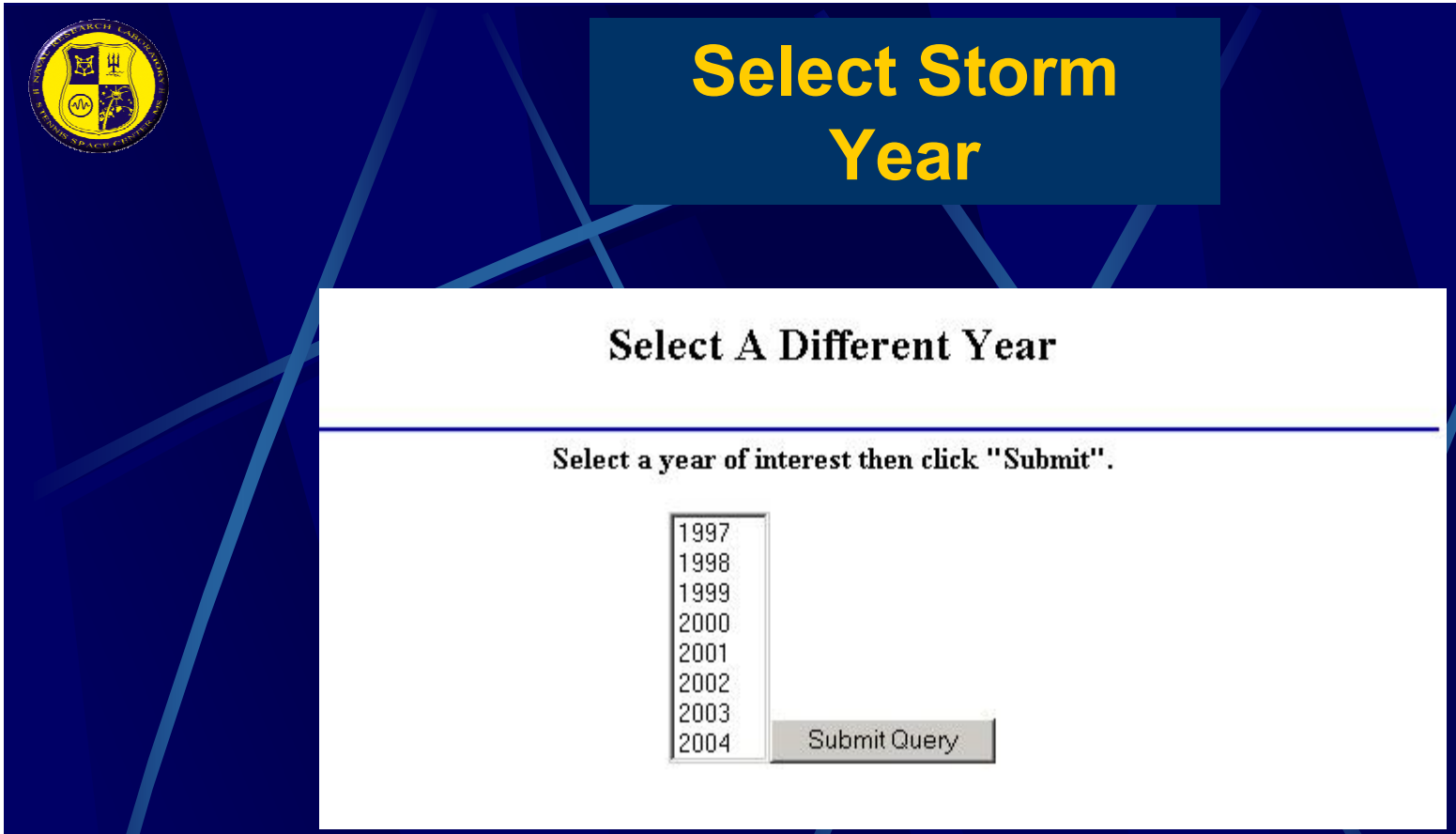
Passive microwave imagery and sounding channel data enable the user to "see through" non-raining clouds and view rainbands, eyewalls and eyes even when obscured by upper-level clouds that hinder the user of visible and IR imagery. Passive microwave data is currently only available on polar orbiter platforms that fly over tropical cyclones at most several times/day/satellite. Thus, NRL uses data from a constellation of sensors to increase the temporal sampling during the coarse of day to map TC structure changes. All data sets arrive at NRL within 1-3 hours of real-time. A training tutorial page has been created to assist users not familiar with passive microwave data and the TC application: Passive Microwave Tutorial

The passive microwave sensors used are:
Special Sensor Microwave/Imager (SSM/I) currently operational on the Defense Meteorological Satellite Program (DMSP) satellites F-13, F-14, and F-15 and is provided by FNMOC. The SSM/I was first launched in 1987 onboard F-8 and F-15 represents the last in the series. The SSM/I is being replaced with the Special Sensor Microwave Imager & Sounder (SSMIS) with the first launch in October 2003. More info about the SSM/I sensor can be found at: SSM/I Info

Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI) operated by the National Aeronautical & Space Administration (NASA) in conjunction with JAXA (Japanese Aerospace Exploration Agency). The data is provided in near real-time by the TRMM Science Data and Information System (TSDIS) located at the Goddard Space Flight Center (GSFC) GSFC and more info about the TRMM program can be found at: TRMM Info

Advanced Microwave Sounding Unit (AMSU-B) sounder channels are used as "imager" data on NOAA polar orbiters N-16, N-15. Data from 89 and 150 GHz are used to map the TC structure. AMSU-B data is provided via the NOAA NESDIS

Select Storm Year



2003 Storm List: All Basins

2003 Storms

All | Active | Year

Atlantic

21L.PETER
20L.ODETTE
19L.NICHOLAS
18L.MINDY
17L.LARRY
16L.NONAME
16L.KATE
15L.JUAN
14L.NONAME
13L.ISABEL
12L.NONAME
12L.HENRI
11L.GRACE
10L.FABIAN
09L.NONAME
08L.ERIKA
07L.NONAME
06L.NONAME
05L.DANNY
04L.CLAUDETTE
03L.BILL
02L.NONAME
01L.ANA

East Pacific

16E.PATRICIA
15E.OLAF
14E.NORA
13E.MARTY
12E.LINDA
11E.NONAME
11E.KEVIN
10E.JIMENA
09E.IGNACIO
08E.HILDA
07E.GUILLERMO
06E.FELICIA
05E.ENRIQUE
04E.DOLORES
03E.CARLOS
02E.BLANCA
01E.ANDRES

Disclaimer **NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3)** Developmen

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_b

Expires: Sat, 01 May 2004 01:33:07 GMT Date: Sat, 01 May 2004 01:18:07 GMT Content-Type: text/html; charset=ISO-8859-1

No Active Storms

<-- You may select a previously archived storm from the list in the left frame.

Sat Home	East Pacific & WestCoast	Global	CONUS	Model Over	Rainrate	Cloud Tops	Training
Trop Cyclones	Color Composite	SSMI-Comp2	Tropics	Cloud Winds	Scatt Winds	Cloud Classification	

Select Isabel: Default ATCF Graphic

2003 Storms

All Active Year

Atlantic

21L.PETER
20L.ODETTE
19L.NICHOLAS
18L.MINDY
17L.LARRY
16L.NONAME
16L.KATE
15L.JUAN
14L.NONAME
13L.ISABEL
12L.NONAME
12L.HENRI
11L.GRACE
10L.FABIAN
09L.NONAME
08L.ERIKA
07L.NONAME
06L.NONAME
05L.DANNY
04L.CLAUDETTE
03L.BILL
02L.NONAME
01L.ANA

East Pacific

16E.PATRICIA
15E.OLAF

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

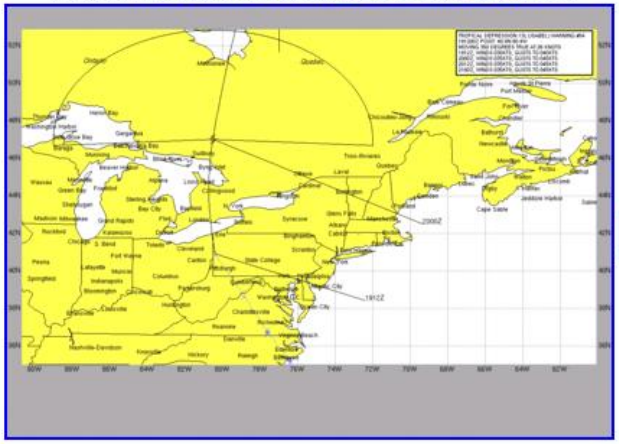
Display: Latest Pass_Mosaic | Warn: Text Track ATCF | 1_km: Track&Image VIS IR WV | Scatt AMSU/B | Info: General

	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:														

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

13L.ISABEL, TRACK_VIS, 20 SEP 2003 0945Z

Forecast by: National Hurricane Center
Graphic by: Naval Atlantic Meteorology and Oceanography Center



latest1km

sm20030908.tar thumbnail

(Click product for full sized image)

ATCF: Buck Sampson

Display 85 GHz Products

2003 Storms

All | Active | Year

Atlantic

21L.PETER
20L.ODETTE
19L.NICHOLAS
18L.MINDY
17L.LARRY
16L.NONAME
16L.KATE
15L.JUAN
14L.NONAME
13L.ISABEL
12L.NONAME
12L.HENRI
11L.GRACE
10L.FABIAN
09L.NONAME
08L.ERIKA
07L.NONAME
06L.NONAME
05L.DANNY
04L.CLAUDETTE
03L.BILL
02L.NONAME
01L.ANA

East Pacific

16E.PATRICIA
15E.OLAF
14E.NORA
13E.MARTY
12E.LINDA
11E.NONAME
11E.KEVIN
10E.JIMENA
09E.IGNACIO
08E.HILDA
07E.GUILLERMO
06E.FELICIA
05E.ENRIQUE
04E.DOLORES
03E.CARLOS
02E.BLANCA

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Display: Latest | Pass_Mosaic | Prev. | Mosaic | Animate Warn: | ATCF 1_km: Track&Image | VIS | IR | WV Scatt | AMSU/B Info: General

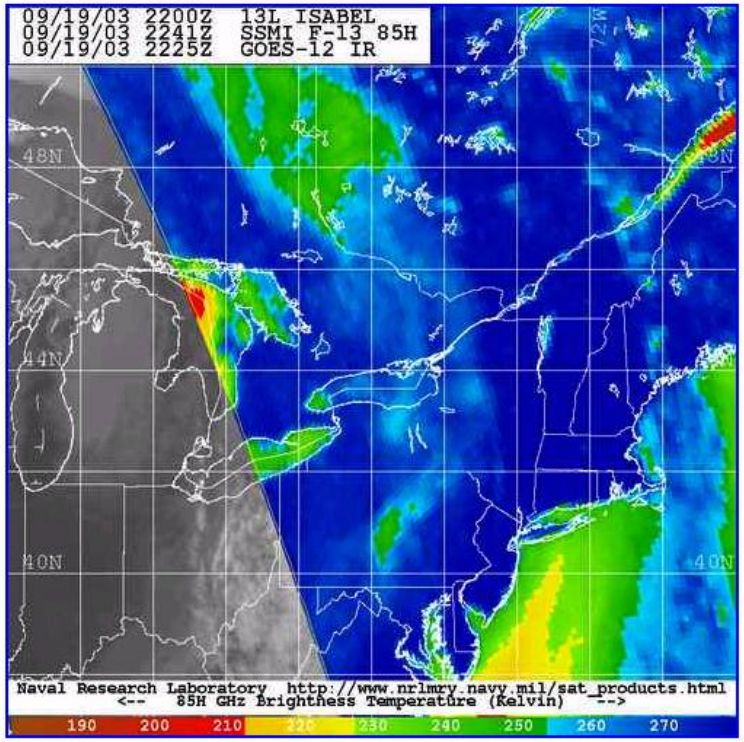
	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:														

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

13L.ISABEL, 85H, 19 SEP 2003 2241Z

Previous | 20030919.2241.f13.85h.85h.13LISABEL.35kts-996mb-440N-780W.jpg | Latest Image

Reduced quality (42 K), click image to get full-quality (355 K).



Sat Home	East Pacific & WestCoast	Global	CONUS	Model Over	Rainrate	Cloud Tops	Training
Trop Cyclones	Color Composite	SSMI-Comp2	Tropics	Cloud Winds	Scatt Winds	Cloud Classification	

List all products for 85 GHz H

2003 Storms

All Active Year

Atlantic

21L.PETER
20L.ODETTE
19L.NICHOLAS
18L.MINDY
17L.LARRY
16L.NONAME
16L.KATE
15L.JUAN
14L.NONAME
13L.ISABEL
12L.NONAME
12L.HENRI
11L.GRACE
10L.FABIAN
09L.NONAME
08L.ERIKA
07L.NONAME
06L.NONAME
05L.DANNY
04L.CLAUDETTE
03L.BILL
02L.NONAME
01L.ANA

East Pacific

16E.PATRICIA
15E.OLAF
14E.NORA
13E.MARTY
12E.LINDA
11E.NONAME
11E.KEVIN
10E.JIMENA
09E.IGNACIO
08E.HILDA
07E.GUILLERMO
06E.FELICIA
05E.ENRIQUE

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Display: Latest Pass_Mosaic Prev. Mosaic Animate | Warn: ATCF | 1_km: Track&Image VIS IR WV | Scatt AMSU/B | Info: General

	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:														

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

Index of: /data/www/tropical_cyclones/tc03/ATL/13L.ISABEL/ssmi/85h

20030919.2241.f13.85h.85h.13LISABEL.35kts-996mb-440N-780W.jpg	(355245)
20030919.1445.f15.85h.85h.13LISABEL.35kts-996mb-409N-804W.jpg	(329788)
20030919.1324.f14.85h.85h.13LISABEL.35kts-996mb-409N-804W.jpg	(359193)
20030919.1256.f13.85h.85h.13LISABEL.35kts-996mb-409N-804W.jpg	(339011)
20030919.0222.f15.85h.85h.13LISABEL.65kts-968mb-367N-776W.jpg	(311910)
20030918.2253.f13.85h.85h.13LISABEL.65kts-968mb-367N-776W.jpg	(336472)
20030918.1502.f15.85h.85h.13LISABEL.85kts-956mb-337N-752W.jpg	(370782)
20030918.1339.f14.85h.85h.13LISABEL.85kts-956mb-337N-752W.jpg	(362577)
20030918.1131.f13.85h.85h.13LISABEL.85kts-957mb-337N-752W.jpg	(311316)
20030918.0236.f15.85h.85h.13LISABEL.90kts-953mb-315N-735W.jpg	(241413)
20030917.2305.f13.85h.85h.13LISABEL.90kts-953mb-315N-735W.jpg	(330875)
20030917.1146.f13.85h.85h.13LISABEL.90kts-957mb-296N-724W.jpg	(352671)
20030917.0110.f15.85h.85h.13LISABEL.90kts-957mb-281N-715W.jpg	(238405)
20030916.2346.f14.85h.85h.13LISABEL.90kts-957mb-281N-715W.jpg	(276989)
20030916.2318.f13.85h.85h.13LISABEL.90kts-957mb-281N-715W.jpg	(264089)
20030916.1353.f15.85h.85h.13LISABEL.95kts-960mb-270N-710W.jpg	(326625)
20030916.1229.f14.85h.85h.13LISABEL.95kts-960mb-270N-710W.jpg	(355734)
20030916.1200.f13.85h.85h.13LISABEL.95kts-960mb-270N-710W.jpg	(297740)
20030916.0125.f15.85h.85h.13LISABEL.110kts-949mb-258N-700W.jpg	(278659)
20030915.2359.f14.85h.85h.13LISABEL.110kts-949mb-258N-700W.jpg	(289900)
20030915.1409.f15.85h.85h.13LISABEL.120kts-945mb-250N-691W.jpg	(352514)
20030915.1243.f14.85h.85h.13LISABEL.120kts-945mb-250N-691W.jpg	(355675)
20030915.1035.f13.85h.85h.13LISABEL.130kts-940mb-246N-687W.jpg	(214829)
20030915.0139.f15.85h.85h.13LISABEL.135kts-933mb-243N-679W.jpg	(328474)
20030915.0013.f14.85h.85h.13LISABEL.135kts-933mb-243N-679W.jpg	(317945)
20030914.2205.f13.85h.85h.13LISABEL.135kts-933mb-243N-679W.jpg	(233201)
20030914.1424.f15.85h.85h.13LISABEL.135kts-939mb-235N-658W.jpg	(327564)
20030914.1257.f14.85h.85h.13LISABEL.135kts-939mb-235N-658W.jpg	(311296)
20030914.1049.f13.85h.85h.13LISABEL.135kts-939mb-235N-658W.jpg	(349702)
20030914.0153.f15.85h.85h.13LISABEL.140kts-932mb-229N-633W.jpg	(251592)
20030914.0026.f14.85h.85h.13LISABEL.140kts-932mb-229N-633W.jpg	(223392)
20030913.2218.f13.85h.85h.13LISABEL.140kts-932mb-229N-633W.jpg	(332253)
20030913.1131.f14.85h.85h.13LISABEL.130kts-935mb-221N-610W.jpg	(288601)
20030913.1103.f13.85h.85h.13LISABEL.130kts-935mb-221N-610W.jpg	(331886)
20030913.0028.f15.85h.85h.13LISABEL.140kts-920mb-218N-591W.jpg	(231014)
20030912.2300.f14.85h.85h.13LISABEL.140kts-920mb-217N-582W.jpg	(248983)
20030912.2231.f13.85h.85h.13LISABEL.140kts-920mb-218N-591W.jpg	(255595)
20030912.1314.f15.85h.85h.13LISABEL.140kts-924mb-216N-574W.jpg	(310279)
20030912.1145.f14.85h.85h.13LISABEL.140kts-924mb-216N-574W.jpg	(319783)
20030912.0043.f15.85h.85h.13LISABEL.140kts-921mb-216N-557W.jpg	(309836)
20030911.2314.f14.85h.85h.13LISABEL.135kts-925mb-215N-549W.jpg	(315025)
20030911.1329.f15.85h.85h.13LISABEL.130kts-930mb-213N-540W.jpg	(293824)
20030911.1159.f14.85h.85h.13LISABEL.130kts-930mb-213N-540W.jpg	(317080)
20030911.0950.f13.85h.85h.13LISABEL.125kts-936mb-212N-532W.jpg	(313775)
20030911.0058.f15.85h.85h.13LISABEL.135kts-925mb-215N-549W.jpg	(319195)
20030910.2327.f14.85h.85h.13LISABEL.120kts-942mb-212N-514W.jpg	(250897)
20030910.2118.f13.85h.85h.13LISABEL.120kts-942mb-212N-514W.jpg	(261589)
20030909.2131.f13.85h.85h.13LISABEL.115kts-948mb-200N-473W.jpg	(268974)
20030909.1219.f15.85h.85h.13LISABEL.115kts-948mb-194N-463W.jpg	(328592)

Sat Home | East Pacific & WestCoast | Global | CONUS | Model Over | Rainrate | Cloud Tops | Training
Trop Cyclones | Color Composite | SSMI-Comp2 | Tropics | Cloud Winds | Scatt Winds | Cloud Classification

Date/Time, Satellite, Product, Intensity, Lat/Lon, File Size

Mosaic Product View

2003 Storms

All | Active | Year

Atlantic

21L.PETER
20L.ODETTE
19L.NICHOLAS
18L.MINDY
17L.LARRY
16L.NONAME
16L.KATE
15L.JUAN
14L.NONAME
13L.ISABEL
12L.NONAME
12L.HENRI
11L.GRACE
10L.FABIAN
09L.NONAME
08L.ERIKA
07L.NONAME
06L.NONAME
05L.DANNY
04L.CLAUDETTE
03L.BILL
02L.NONAME
01L.ANA

East Pacific

16E.PATRICIA
15E.OLAF
14E.NORA
13E.MARTY
12E.LINDA
11E.NONAME
11E.KEVIN
10E.JIMENA

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Display: Latest | Pass_Mosaic | Prev. | Mosaic | Animate Warn: | ATCF 1_km: VIS | IR | WV Scatt | AMSU/B Info: General

	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:														

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

Select Mosaic Images

Choose Images:

Image interval: 7 hrs. 56 min., NOTE: there may be a few minutes delay as the thumbnails are created.

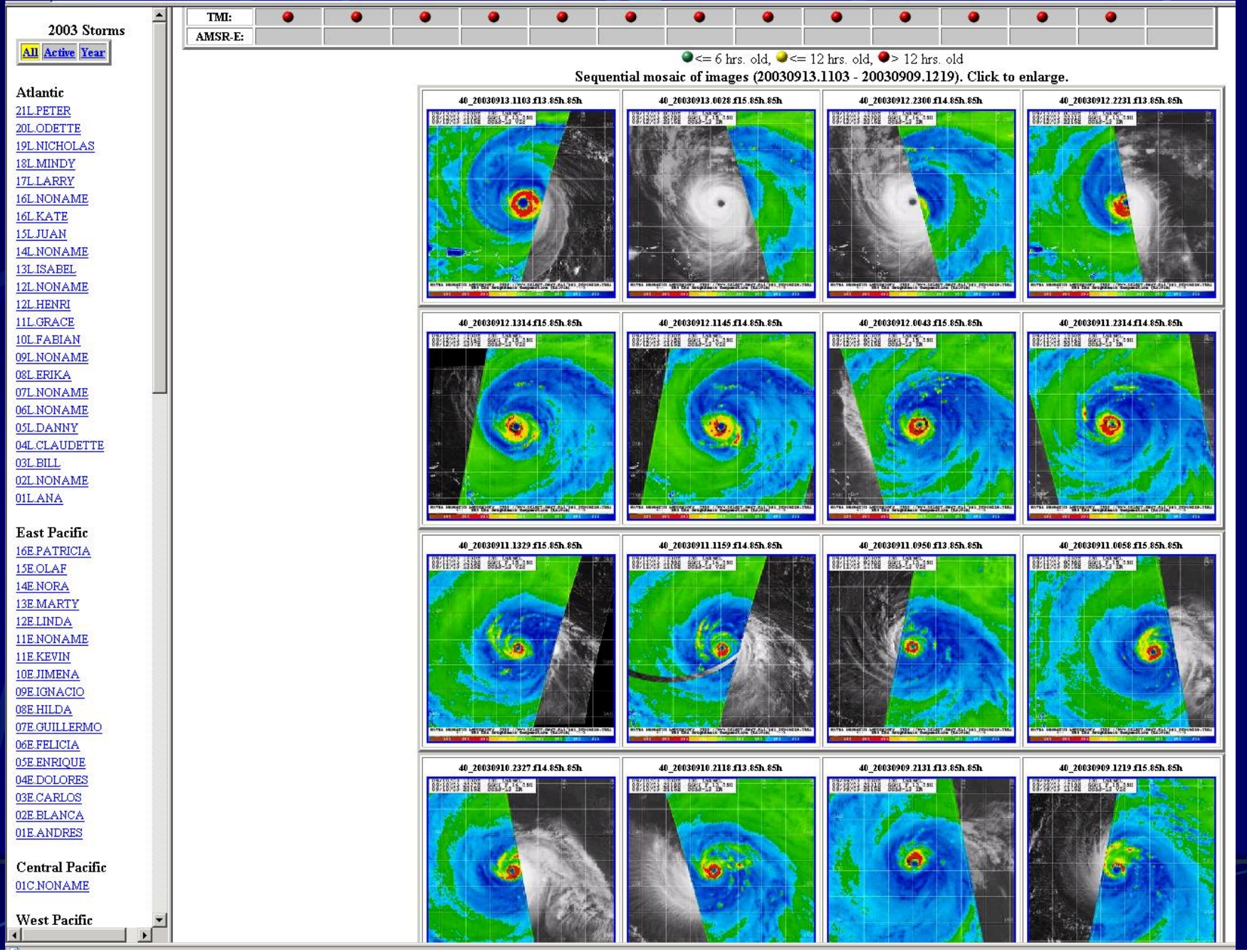
Most_Recent | Every_Other | Every_Fourth

or select 16 images or less to display in the multi-image mosaic.

20030919.2241.f13.85h.85h.13LISABEL.35kts-996mb-440N-780W.jpg
20030919.1445.f15.85h.85h.13LISABEL.35kts-996mb-409N-804W.jpg
20030919.1324.f14.85h.85h.13LISABEL.35kts-996mb-409N-804W.jpg
20030919.1256.f13.85h.85h.13LISABEL.35kts-996mb-409N-804W.jpg
20030919.0222.f15.85h.85h.13LISABEL.65kts-968mb-367N-776W.jpg
20030918.2253.f13.85h.85h.13LISABEL.65kts-968mb-367N-776W.jpg
20030918.1502.f15.85h.85h.13LISABEL.85kts-956mb-337N-752W.jpg
20030918.1339.f14.85h.85h.13LISABEL.85kts-956mb-337N-752W.jpg
20030918.1131.f13.85h.85h.13LISABEL.85kts-957mb-337N-752W.jpg
20030918.0236.f15.85h.85h.13LISABEL.90kts-953mb-315N-735W.jpg
20030917.2305.f13.85h.85h.13LISABEL.90kts-953mb-315N-735W.jpg
20030917.1146.f13.85h.85h.13LISABEL.90kts-957mb-296N-724W.jpg
20030917.0110.f15.85h.85h.13LISABEL.90kts-957mb-281N-715W.jpg
20030916.2346.f14.85h.85h.13LISABEL.90kts-957mb-281N-715W.jpg
20030916.2318.f13.85h.85h.13LISABEL.90kts-957mb-281N-715W.jpg
20030916.1353.f15.85h.85h.13LISABEL.95kts-960mb-270N-710W.jpg

Submit Query

View “16” Mosaic Products

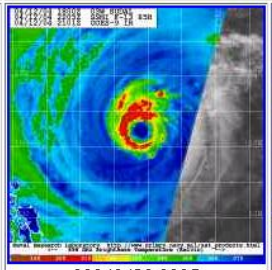
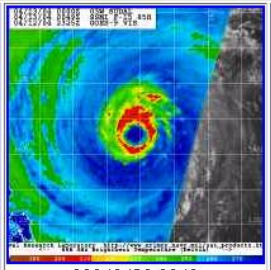
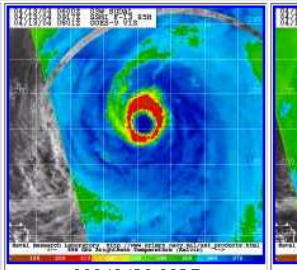
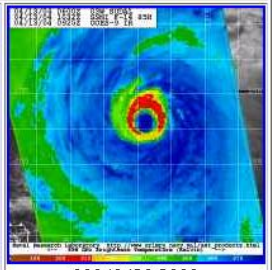
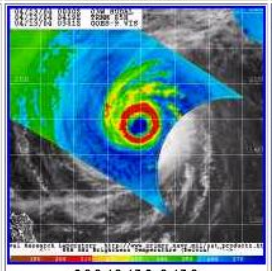
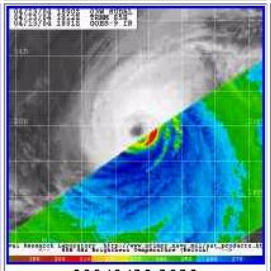
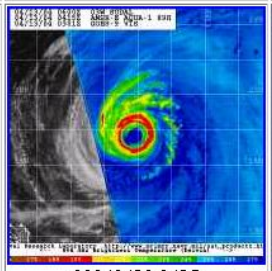
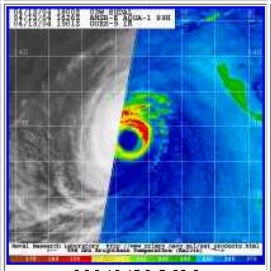
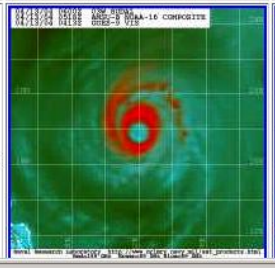
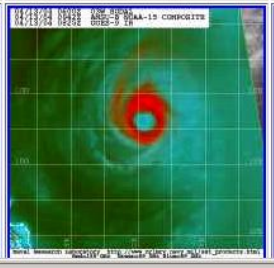
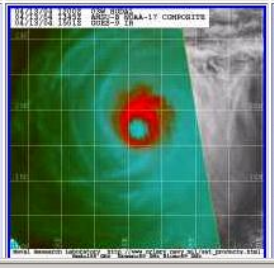
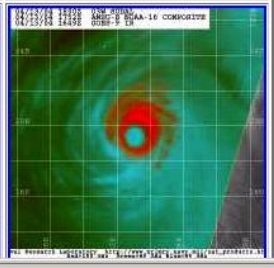


Data Visualization
(Pass_Mosaic)

West Pacific
- 90W.INVEST
- 03W.SUDAL

Indian Ocean

Southern Hemisphere
- 97P.INVEST

Sensor/Prod	03W.SUDAL Latest Good Passes (CPA < 800 km)			
ssmi/ 85h				
	20040412.2205	20040413.0049	20040413.0917	20040413.1032
tmi/ tmi_85h				
	20040413.0419	20040413.1912		
amsre/ 89h				
	20040413.0415	20040413.1626		
amsub/ color_89_150				

ATCF Track Graphic

2003 Storms

All | Active | Year

Atlantic

21L.PETER
20L.ODETTE
19L.NICHOLAS
18L.MINDY
17L.LARRY
16L.NONAME
16L.KATE
15L.JUAN
14L.NONAME
13L.ISABEL
12L.NONAME
12L.HENRI
11L.GRACE
10L.FABIAN
09L.NONAME
08L.ERIKA
07L.NONAME
06L.NONAME
05L.DANNY
04L.CLAUDETTE
03L.BILL
02L.NONAME
01L.ANA

East Pacific

16E.PATRICIA
15E.OLAF
14E.NORA
13E.MARTY
12E.LINDA
11E.NONAME
11E.KEVIN
10E.JIMENA
09E.IGNACIO
08E.HILDA
07E.GUILLERMO
06E.FELICIA
05E.ENRIQUE
04E.DOLORES
03E.CARLOS
02E.BLANCA
01E.ANDRES

Central Pacific

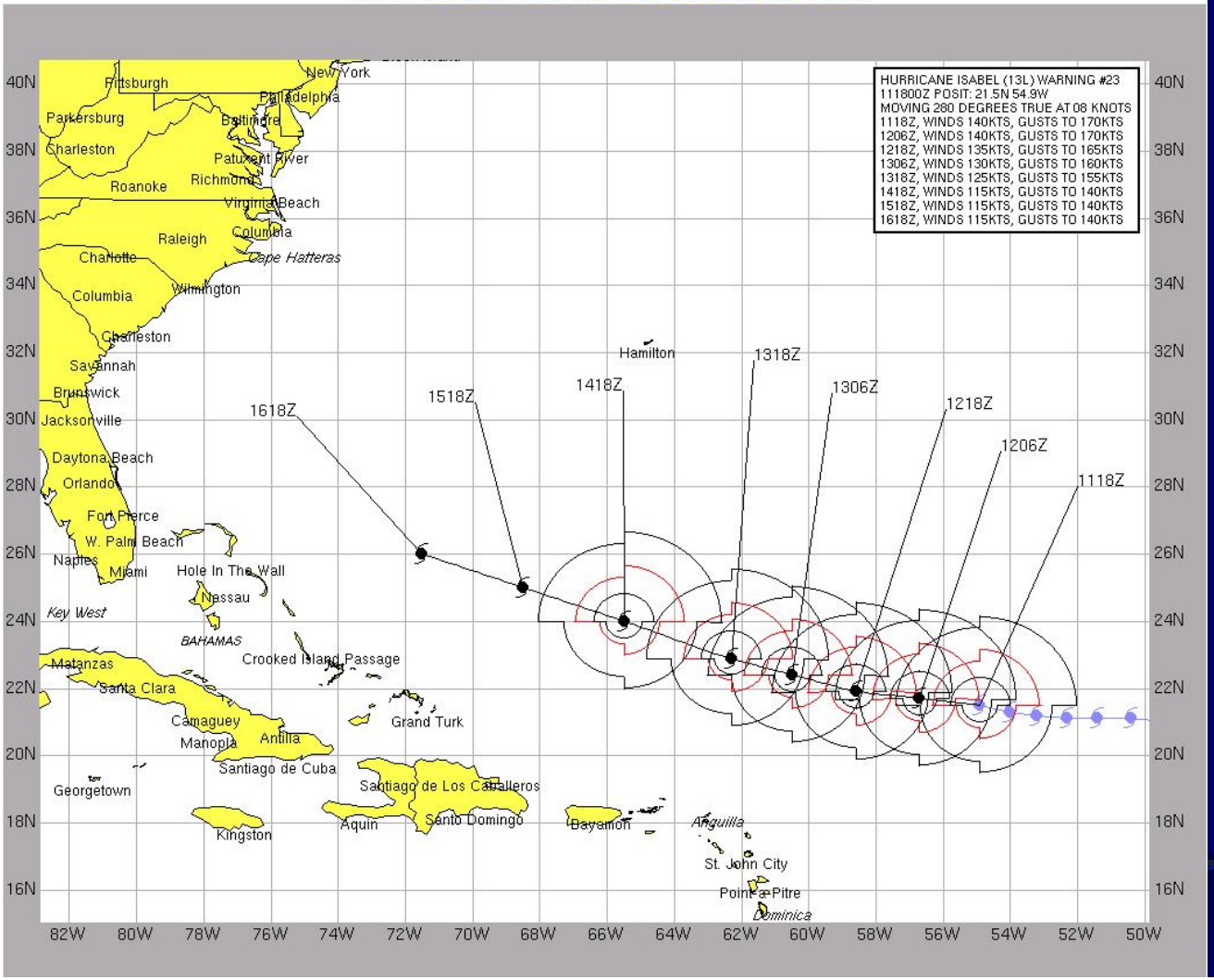
01C.NONAME

TMI:
AMSR-E:

<= 6 hrs. old, <= 12 hrs. old, > 12 hrs. old

al132003.03091112.gif Legend

Forecast by: National Hurricane Center
Graphic by: Naval Atlantic Meteorology and Oceanography Center



Animation/Looping

2003 Storms

All Active Year

Atlantic

21L.PETER
20L.ODETTE
19L.NICHOLAS
18L.MINDY
17L.LARRY
16L.NONAME
16L.KATE
15L.JUAN
14L.NONAME
13L.ISABEL
12L.NONAME
12L.HENRI
11L.GRACE
10L.FABIAN
09L.NONAME
08L.ERIKA
07L.NONAME
06L.NONAME
05L.DANNY
04L.CLAUDETTE
03L.BILL
02L.NONAME
01L.ANA

East Pacific

16E.PATRICIA
15E.OLAF
14E.NORA
13E.MARTY
12E.LINDA
11E.NONAME
11E.KEVIN
10E.JIMENA
09E.IGNACIO
08E.HILDA
07E.GUILLERMO
06E.FELICIA
05E.ENRIQUE
04E.DOLORES
03E.CARLOS
02E.BLANCA

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Developme

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_

Display: Latest Pass_Mosaic Prev. Mosaic Animate | Warn: ATCF | 1_km: VIS IR WV | Scatt AMSU/B | Info: Gener

	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H
SSMI:	●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●
AMSR-E:													

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

Select Animation

Choose Animation Type:

(•) Java Script ( ) Gif89a (Allows you to save movie, ~ 3-5 x as big as javascript)

Choose Size:

The larger the image, the more time it will take to create thumbnails and download to your computer.

( ) FULL SIZED: (100 %) of orig.
( ) LARGE: (80 %) of orig.
( ) MEDIUM: (60 %) of orig.
(•) SMALL: (40 %) of orig.

Next, Choose Images:

Image interval: 7 hrs. 56 min. NOTE: there may be a few minutes delay as the thumbnails are created.

Most_Recent | Every_Other | Every_Fourth

or, select up to 16 individual images to be seen in the Animation:

Files in /data/www/tropical_cyclones/tc03/ATL/13L.ISABEL/ssmi/85h:

20030919.2241.f13.85h.85h.13LISABEL.35kts-996mb-440N-780W.jpg
20030919.1445.f15.85h.85h.13LISABEL.35kts-996mb-409N-804W.jpg
20030919.1324.f14.85h.85h.13LISABEL.35kts-996mb-409N-804W.jpg
20030919.1256.f13.85h.85h.13LISABEL.35kts-996mb-409N-804W.jpg
20030919.0222.f15.85h.85h.13LISABEL.65kts-968mb-367N-776W.jpg
20030918.2253.f13.85h.85h.13LISABEL.65kts-968mb-367N-776W.jpg
20030918.1502.f15.85h.85h.13LISABEL.85kts-956mb-337N-752W.jpg
20030918.1339.f14.85h.85h.13LISABEL.85kts-956mb-337N-752W.jpg
20030918.1131.f13.85h.85h.13LISABEL.85kts-957mb-337N-752W.jpg
20030918.0236.f15.85h.85h.13LISABEL.90kts-953mb-315N-735W.jpg

Reset | Submit Query

Visible Imagery

2004 Storms

All | Active | Year

Atlantic
01L.NONAME

East Pacific

Central Pacific

West Pacific
03W.SUDAL
02W.NONAME
01W.NONAME

Indian Ocean
91B.INVEST

Southern Hemisphere
95S.INVEST
94S.INVEST
22P.NONAME
21S.NONAME
20S.OSCAR-ITSE
19P.GRACE
18S.FAY
17S.NICKY
16S.GAFILO
15P.EVAN
14S.MONTY
13P.IVY
12P.FRITZ
11S.LINDA
10S.FRANK
09S.ELITA
08S.KEN
07P.HETA
06S.DARIUS
05P.DEBBIE
04S.JANA
03S.CELA
02S.BENI

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Display: Latest | Pass_Mosaic | Prev. | Mosaic | Animate Warn: | ATCF 1_km: Track&Image | VIS | IR | WV Scatt | AMSU/B Info: General

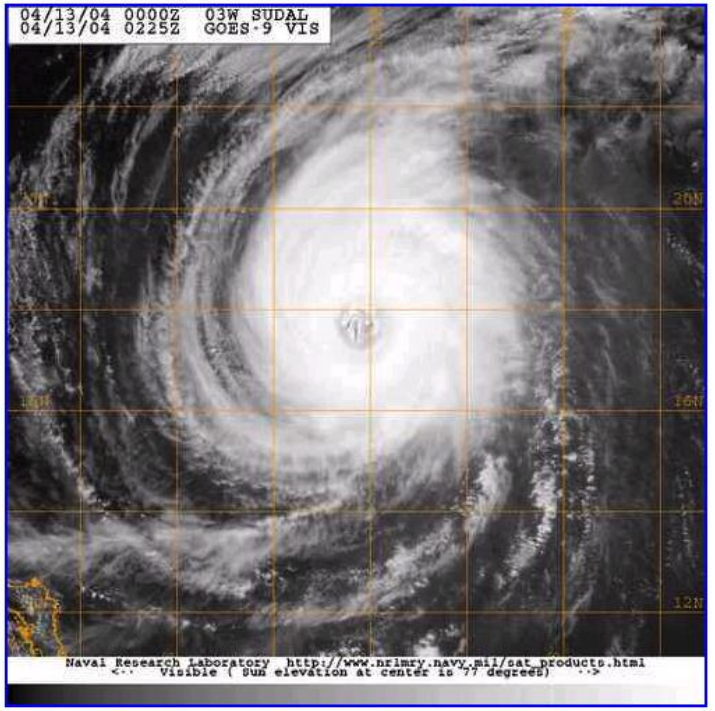
	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:		●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:	●	●	●	●	●	●	●	●			●	●	●	

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

03W.SUDAL, VIS1KM, 13 APR 2004 0225Z

Previous | 20040413.0225.goes-9.vis2.x.03WSUDAL.120kts-922mb-171N-1317E.jpg | Next

Reduced quality (27 K), click image to get full-quality (209 K).



Infrared Imagery

2004 Storms

All | Active | Year

Atlantic

01L.NONAME

East Pacific

Central Pacific

West Pacific

03W.SUDAL

02W.NONAME

01W.NONAME

Indian Ocean

91B.INVEST

Southern Hemisphere

95S.INVEST

94S.INVEST

22P.NONAME

21S.NONAME

20S.OSCAR-ITSE

19P.GRACE

18S.FAY

17S.NICKY

16S.GAFILO

15P.EVAN

14S.MONTY

13P.IVY

12P.FRITZ

11S.LINDA

10S.FRANK

09S.ELITA

08S.KEN

07P.HETA

06S.DARIUS

05P.DEBBIE

04S.JANA

03S.CELA

02S.BENI

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Display: Latest | Pass_Mosaic | Prev. | Mosaic | Animate | Warn: | ATCF | 1_km: Track&Image | VIS | IR | WV | Scatt | AMSU/B | Info: General

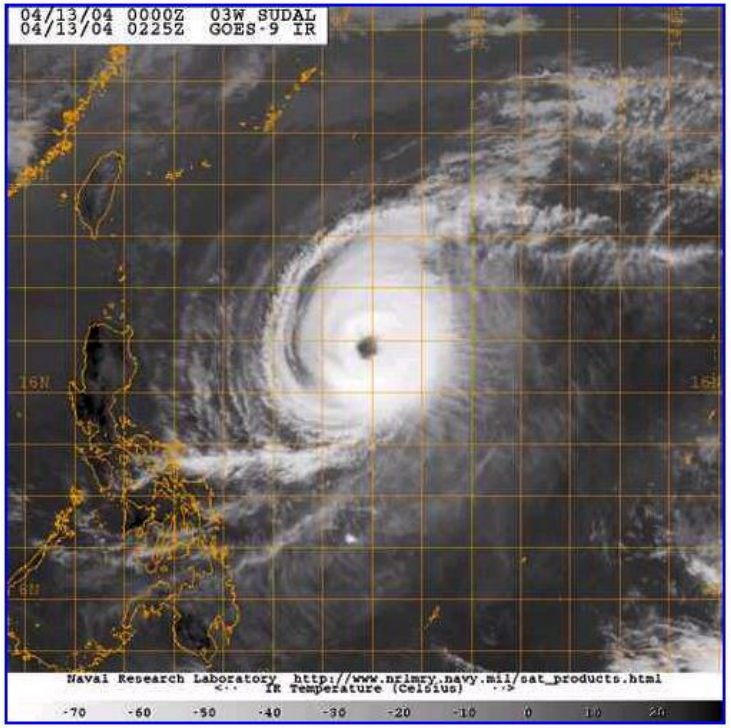
	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:		●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:	●	●	●	●	●	●	●	●			●	●	●	

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

03W.SUDAL, IR1KM_BW, 13 APR 2004 0225Z

Previous | 20040413.0225.goes-9.ir_bw.x.03WSUDAL.120kts-922mb-171N-1317E.jpg | Next

Reduced quality (28 K), click image to get full-quality (206 K).



Water Vapor Imagery

2004 Storms

All | Active | Year

Atlantic

01L.NONAME

East Pacific

Central Pacific

West Pacific

03W.SUDAL
02W.NONAME
01W.NONAME

Indian Ocean

91B.INVEST

Southern Hemisphere

95S.INVEST
94S.INVEST
22P.NONAME
21S.NONAME
20S.OSCAR-ITSE
19P.GRACE
18S.FAY
17S.NICKY
16S.GAFILO
15P.EVAN
14S.MONTY
13P.IVY
12P.FRITZ
11S.LINDA
10S.FRANK
09S.ELITA
08S.KEN
07P.HETA
06S.DARIUS
05P.DEBBIE
04S.JANA
03S.CELA
02S.BENI

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Display: Latest | Pass_Mosaic | Prev. | Mosaic | Animate | Warn: | ATCF | 1_km: Track&Image | VIS | IR | WV | Scatt | AMSU/B | Info: General

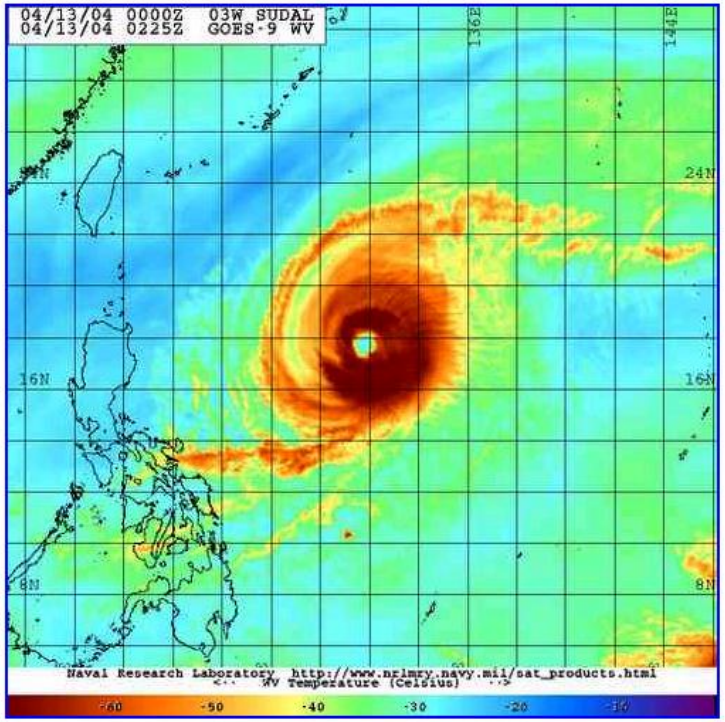
	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:		●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:	●	●	●	●	●	●	●	●			●	●	●	

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

03W.SUDAL, WV1KM, 13 APR 2004 0225Z

Previous | 20040413.0225.goes-9.wv.x.03WSUDAL.120kts-922mb-171N-1317E.jpg | Next

Reduced quality (32 K), click image to get full-quality (208 K).



85 GHz H-pol Imagery

2004 Storms
All Active Year

Atlantic
01L.NONAME

East Pacific

Central Pacific

West Pacific
03W.SUDAL
02W.NONAME
01W.NONAME

Indian Ocean
91B.INVEST

Southern Hemisphere
95S.INVEST
94S.INVEST
22P.NONAME
21S.NONAME
20S.OSCAR-ITSE
19P.GRACE
18S.FAY
17S.NICKY
16S.GAFILO
15P.EVAN
14S.MONTY
13P.IVY
12P.FRITZ
11S.LINDA
10S.FRANK
09S.ELITA
08S.KEN
07P.HETA
06S.DARIUS
05P.DEBBIE
04S.JANA
03S.CELA
02S.BENI
01L.NONAME

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Display: Latest Pass_Mosaic Prev. Mosaic Animate | Warn: ATCF | 1_km: Track&Image VIS IR WV | Scatt AMSU/B | Info: General

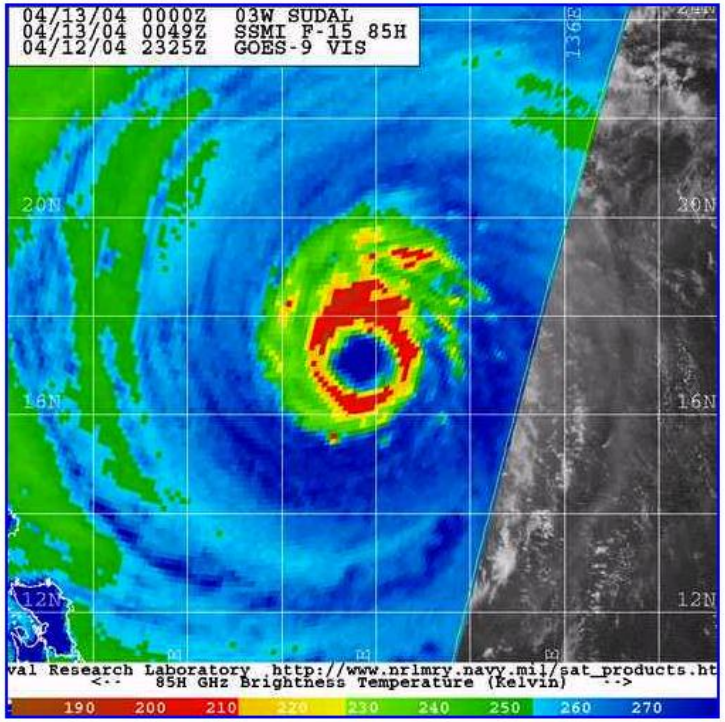
	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:		●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:	●	●	●	●	●	●	●	●			●	●	●	

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

03W.SUDAL, 85H, 13 APR 2004 0049Z

Previous | 20040413.0049.f15.85h.85h.03WSUDAL.120kts-922mb-171N-1317E.jpg | Next

Reduced quality (36 K), click image to get full-quality (341 K).



Sat Home | East Pacific & WestCoast | Global | CONUS | Model Over | Rainrate | Cloud Tops | Training
Trop Cyclones | Color Composite | SSMI-Comp2 | Tropics | Cloud Winds | Scatt Winds | Cloud Classification

85 GHz "Color" Product

2004 Storms

All Active Year

Atlantic
01L.NONAME

East Pacific

Central Pacific

West Pacific
03W.SUDAL
02W.NONAME
01W.NONAME

Indian Ocean
91B.INVEST

Southern Hemisphere
95S.INVEST
94S.INVEST
22P.NONAME
21S.NONAME
20S.OSCAR-ITSE
19P.GRACE
18S.FAY
17S.NICKY
16S.GAFILO
15P.EVAN
14S.MONTY
13P.IVY
12P.FRITZ
11S.LINDA
10S.FRANK
09S.ELITA
08S.KEN
07P.HETA
06S.DARIUS
05P.DEBBIE
04S.JANA
03S.CELA

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Display: Latest Pass_Mosaic Prev. Mosaic Animate | Warn: ATCF | 1_km: Track&Image VIS IR WV | Scatt AMSU/B | Info: General

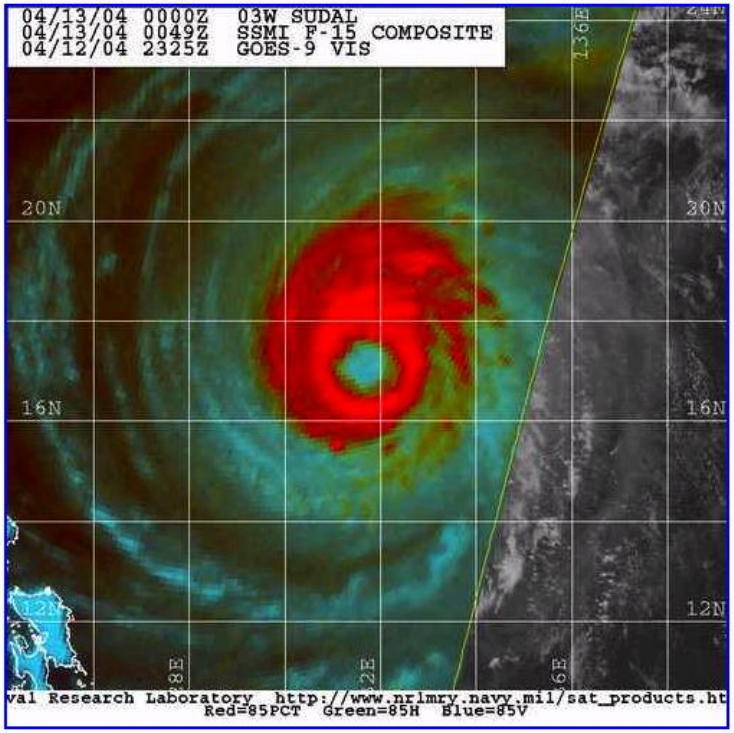
	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:		●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:	●	●	●	●	●	●	●	●			●	●	●	

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

03W.SUDAL, COLORPCT_85H_85V, 13 APR 2004 0049Z

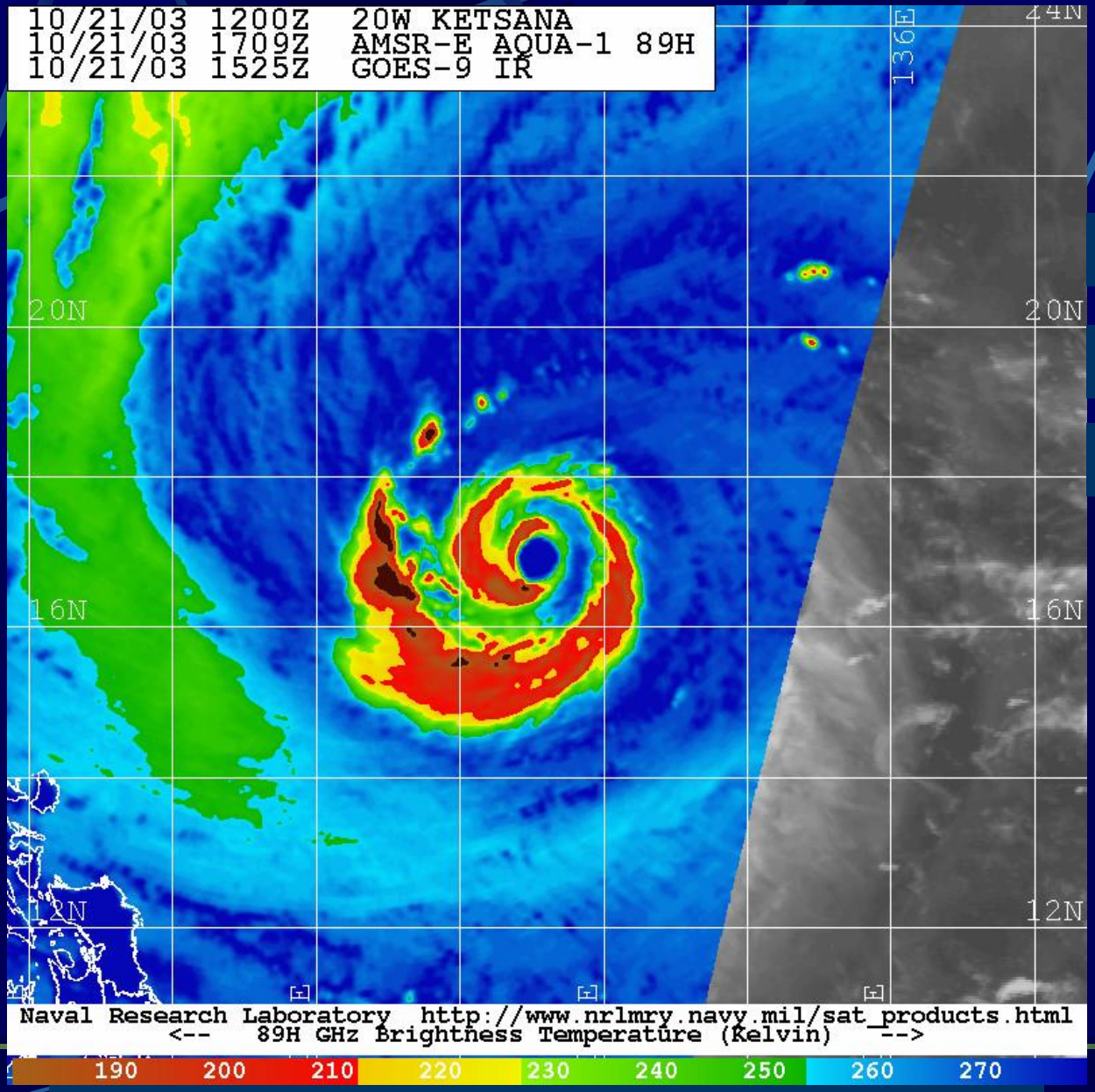
Previous | 20040413.0049.f15.x.colorpct_85h_85v.03WSUDAL.120kts-922mb-171N-1317E.jpg | Next

Reduced quality (29 K), click image to get full-quality (255 K).



AMSR-E Enhanced Resolution: 89 GHz

Typhoon Ketsana (20W)



SSM/I

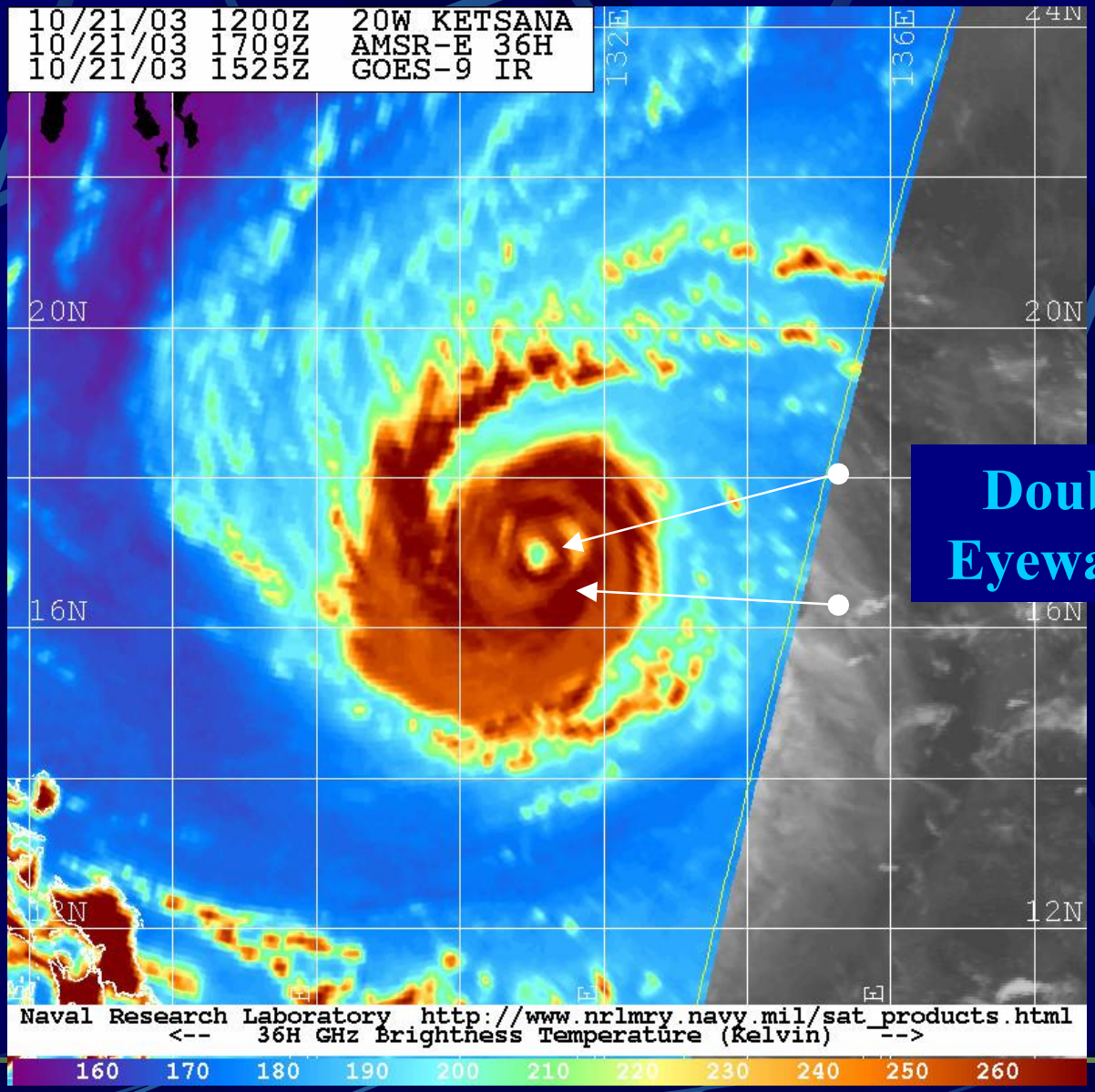
TRMM

AMSR-E

Conical Scan – no edge of swath degradation

AMSR-E Enhanced Resolution: 36 GHz

Typhoon Ketsana (20W)



Double Eyewalls?

QuikSCAT Data

2004 Storms

All | Active | Year

Atlantic

01L.NONAME

East Pacific

Central Pacific

West Pacific

03W.SUDAL
02W.NONAME
01W.NONAME

Indian Ocean

91B.INVEST

Southern Hemisphere

95S.INVEST
94S.INVEST
22P.NONAME
21S.NONAME
20S.OSCAR-ITSE
19P.GRACE
18S.FAY
17S.NICKY
16S.GAFILO
15P.EVAN
14S.MONTY
13P.IVY
12P.FRITZ
11S.LINDA
10S.FRANK
09S.ELITA
08S.KEN
07P.HETA
06S.DARIUS
05P.DEBBIE
04S.JANA
03S.CELA
02S.BENI

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Display: Latest | Pass_Mosaic | Prev. | Mosaic | Animate | Warn: | ATCF | 1_km: Track&Image | VIS | IR | WV | Scatt | AMSU/B | Info: General

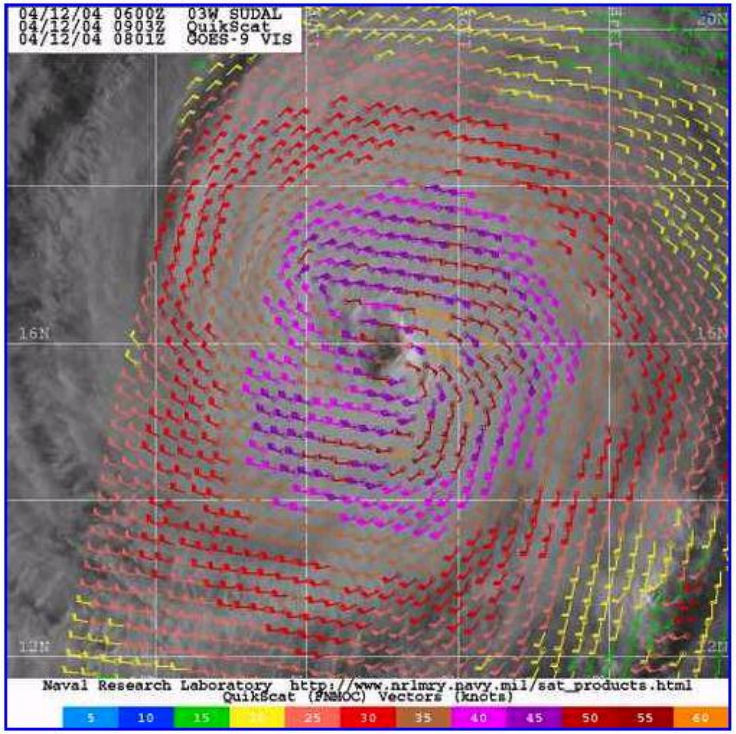
	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:		●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:	●	●	●	●	●	●	●	●			●	●	●	

● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

03W.SUDAL, SCAT, 12 APR 2004 0903Z

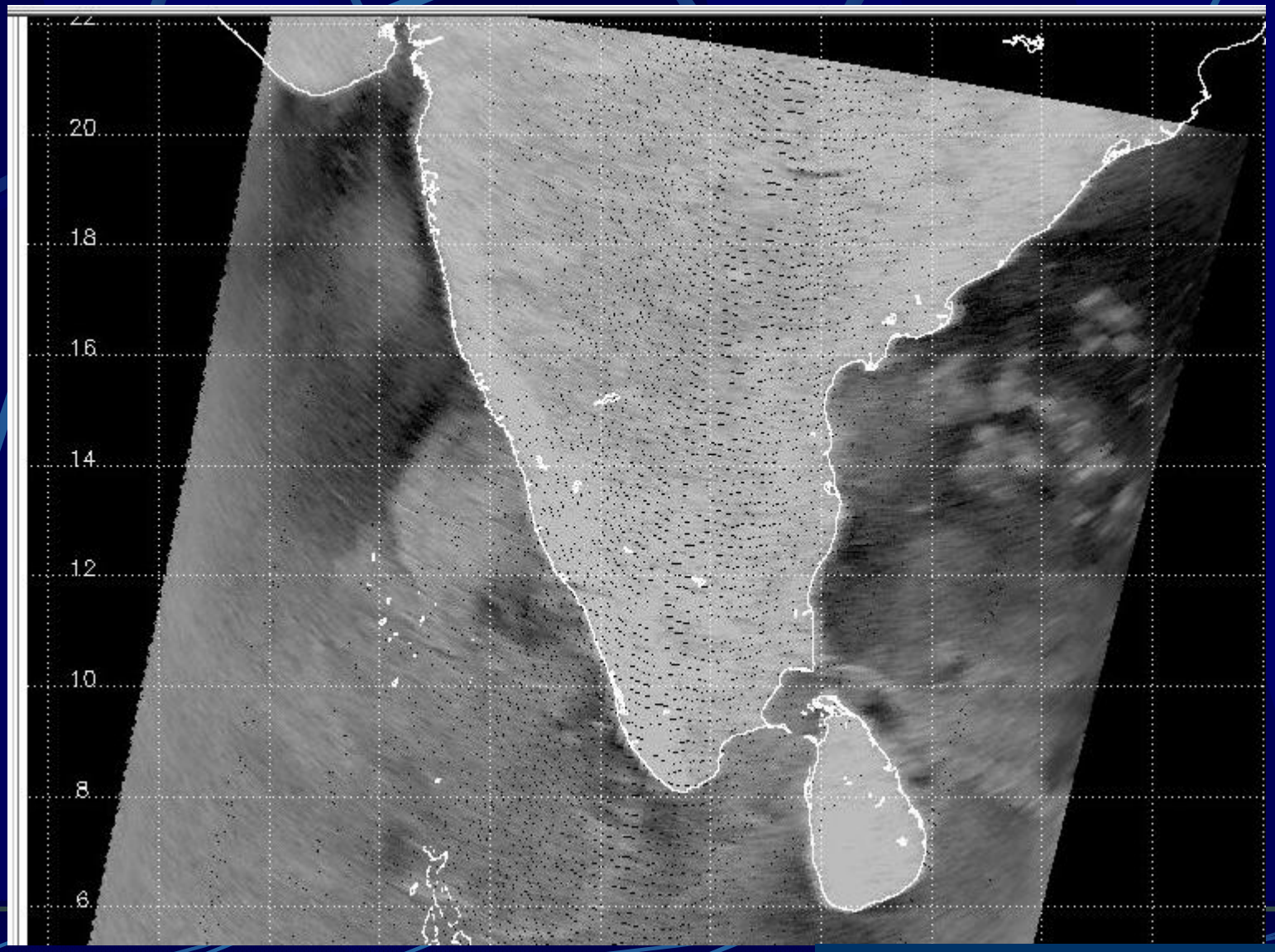
Previous | 20040412.0903.scat_FNMOC.wind.1397.03WSUDAL.115kts-927mb-157N-1308E.jpg | Next

Reduced quality (36 K), click image to get full-quality (1197 K).



Courtesy: FNMOC

QuikSCAT Data



Courtesy: Chang/NESDIS

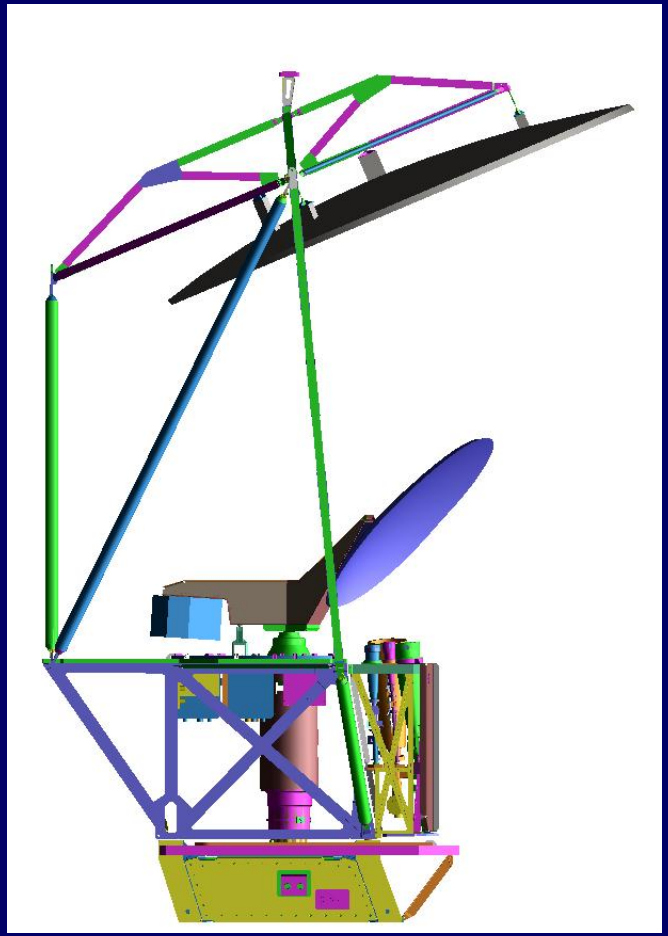
WINDSAT

Sensor: Passive Microwave Conical Scanner
Spacecraft: Coriolis
Launch: 2003 (January)
Heritage: SSM/I

Channels: 7, 11, 19, 24, 37, No 85 GHz
~55, 40, 20, 13, 11, km

Swath: 1025 km

Enhancements for TC Applications:
(1) Surface wind vectors, non-rain areas,
(2) Spatial resolution (37 GHz),
(2) Sea Surface Temperature,
(3) High winds closer to intense rain.



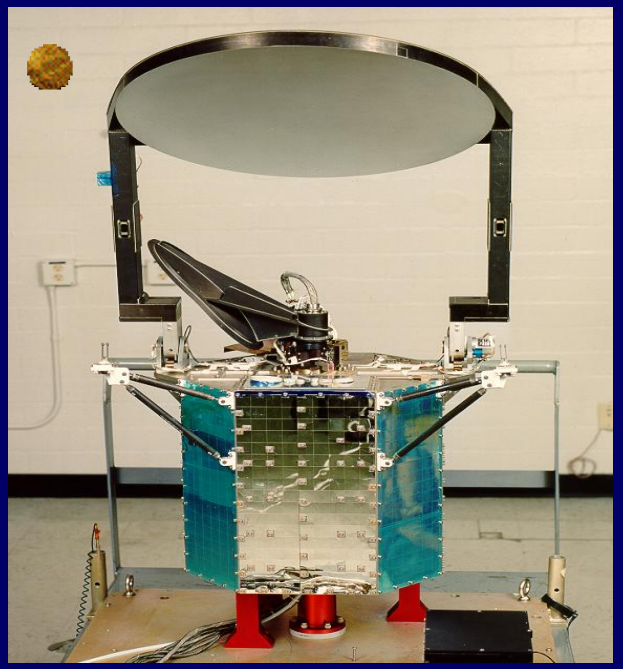
Web Links: http://www.pxi.com/windsat.main.html

Special Sensor Microwave Imager Sounder - SSMIS

Sensor: Passive Microwave Conical Scanner
Spacecraft: DMSP F-16, 17, 18, 19, 20
Launch: May 2003
Heritage: SSM/I, T1, T2

Channels: 19, 22, 37, 91 GHz
~55, 55, 35, 12 km

Swath: 1700 km



Enhancements for TC Applications:

(1) Collocated imager/sounder channels, improved retrievals,
(2) Longevity: 5 sensors [2003-2016],
(3) Large swath

Web Links: http://www.osdpd.noaa.gov/PSB/IMAGES/ssmisdoc.htm

NRL TC Web Page – Wed PM

http://www.nrlmry.navy.mil/tc_pages/tc_home.html

Disclaimer NRL Monterey Marine Meteorology Division (Code 7500) Tropical Cyclone Page (Ver: 3.7.3) Development Team

NOTE: this page is short lived (10 m). **DO NOT** bookmark it or save it to Favorites. Instead, bookmark http://www.nrlmry.navy.mil/tc_pages/tc_home.html

2004 Storms

All Active Year

Atlantic

East Pacific

Central Pacific

West Pacific

Indian Ocean

01A.NONAME

Southern Hemisphere

23S.NONAME

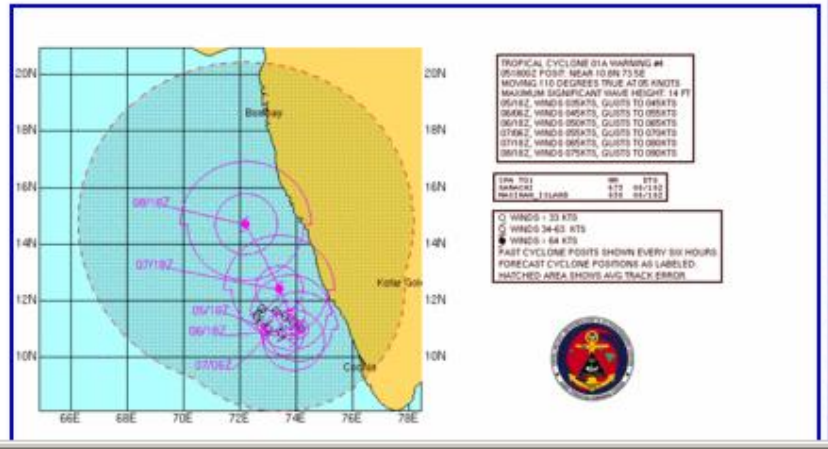
Display: Latest Pass_Mosaic | Warn: Text Track ATCF | 1_km: Track&Image VIS IR WV | Scatt AMSU/B | Info: General

	VIS	IR	IR-BD	Multi-Sensor	85GHz- H	85GHz- H weak	PCT	Color	Rain	Wind	Color 37	37GHz- V	37GHz- H	SSM/I Vapor
SSMI:		●	●	●	●	●	●	●	●	●	●	●	●	●
TMI:	●	●	●	●	●	●	●	●	●	●	●	●	●	
AMSR-E:	●	●	●	●	●	●	●	●			●	●	●	

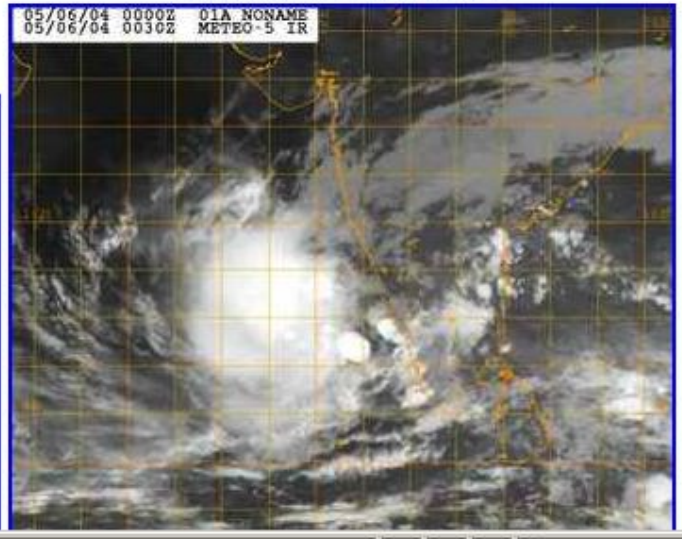
● <= 6 hrs. old, ● <= 12 hrs. old, ● > 12 hrs. old

01A.NONAME, TRACK_VIS, 06 MAY 2004 0030Z 02:19:14 UTC (Z)

Forecast and Graphic by: Joint Typhoon Warning Center



20040506.0030 latest1km



FNMOC TC Web Page – Wed PM

http://152.80.49.216/tc_bin/tc_home.cgi

2004 Storms

All | Active | Year

Atlantic

East Pacific

Central Pacific

West Pacific

Indian Ocean

- 01A.NONAME

Southern Hemisphere

- 23S.NONAME

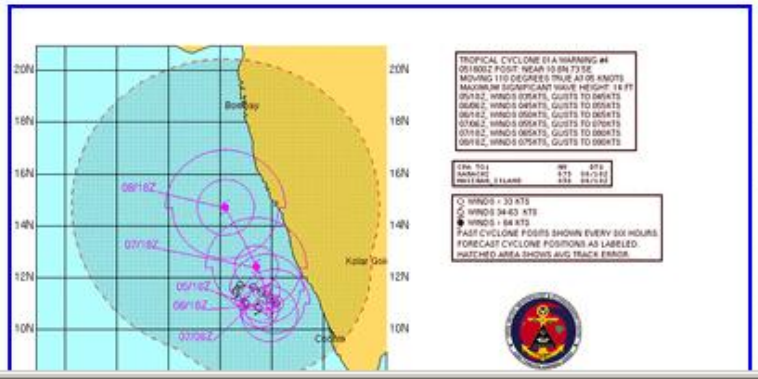
SSMI Sectors:	VIS	IR	IR-BD	Multi-Sensor	85GHz-H	85GHz-H weak	PCT 85	Color 85	Rain	Wind	37GHz-H	37GHz-V	Color 37	PCT 37	SSM/I Vapor
TMI Sectors:	VIS	IR	IR-BD	Multi-Sensor	85Ghz-H	85Ghz-V	PCT 85	Color 85	Rain	Wind	37GHz-H	37GHz-V	Color 37	PCT 37	Liquid Water
AMSU Sectors:					89Ghz			Color 89	Rain						
QuikScat Sectors:	NCEP Solution	No Model in Rain	Ambiguities												

Latest	Upcoming Passes (more)	Current Time
SSMI: 05/05 1631Z	05/06 02:21 F-14 585	02:24:10 GMT
TRMM: 05/05 2125Z	05/06 10:39 TRMM 686	
AMSU: 05/05 2210Z	05/06 05:38 N-17 56	
QScat: 05/05 0146Z	05/06 13:44 QUIK 923	

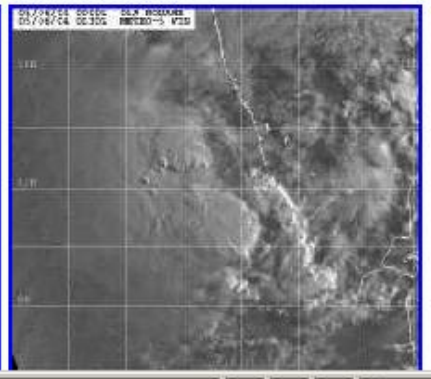
01A.NONAME

Forecast by Joint Typhoon Warning Center

Graphic by Joint Typhoon Warning Center



1KM



NRL Tropical Cyclone Web Page

Microwave Data Sets:

- 1) Special Sensor Microwave/Imager (SSM/I) 1997
- 2) TRMM Microwave Imager (TMI) 1998
- 3) Advanced Microwave Sounding Unit (AMSU-B) 2001
- 4) QuikSCAT surface wind vectors 2001
- 5) Advanced Microwave Scanning Radiometer 2003
- 6) QuikSCAT NRCS (Chang) 2004

Visible, Infrared, and Water Vapor Data Sets:

- 1) GOES-EAST/WEST, GMS-5/GOES-9, Meteosat-5/7
- 2) NOAA AVHRR GAC/LAC

Future: WindSat, SSMIS, MODIS, OLS 2004

NRL TC Web Page Upgrades

Points of Contact

Jeff Hawkins	hawkins@nrlmry.navy.mil
Tom Lee	lee@nrlmry.navy.mil
Joe Turk	turk@nrlmry.navy.mil
Kim Richardson	kim@nrlmry.navy.mil
Charles Sampson	sampson@nrlmry.navy.mil
John Kent	kent@nrlmry.navy.mil

Sponsors: Oceanographer of the Navy, via ONR and PEO C4I PMW-150 projects

Thanks: NHC-JTWC for "driving" the web page!!!

http://www.nrlmry.navy.mil/tc_pages/tc_home.html

http://152.80.49.216/tc_bin/tc_home.cgi