

THORPEX-Pacific Asian Regional Campaign/Tropical Cyclone Structure-08 Experiments and Collaborative Efforts

Additional Targeting Component
at DLR and FZK, Germany

Extra observations and targeted
observations to improve
track prediction

U.S. (NOAA)
Winter
NOAA G-4 and
Air Force C-130s

EU, US,
Japan, Korea, Canada
[DLR Falcon, NRL P-3]

TIBET Exp

PROBEX

TH08
U.S.

WMO
WCRP/WWRP
Asian/Indian
Monsoon

SCS Exp

ONR/NSF
TCS-08

SoW Mex

DOTSTAR

DriftSonde

Typhoon
Landfall

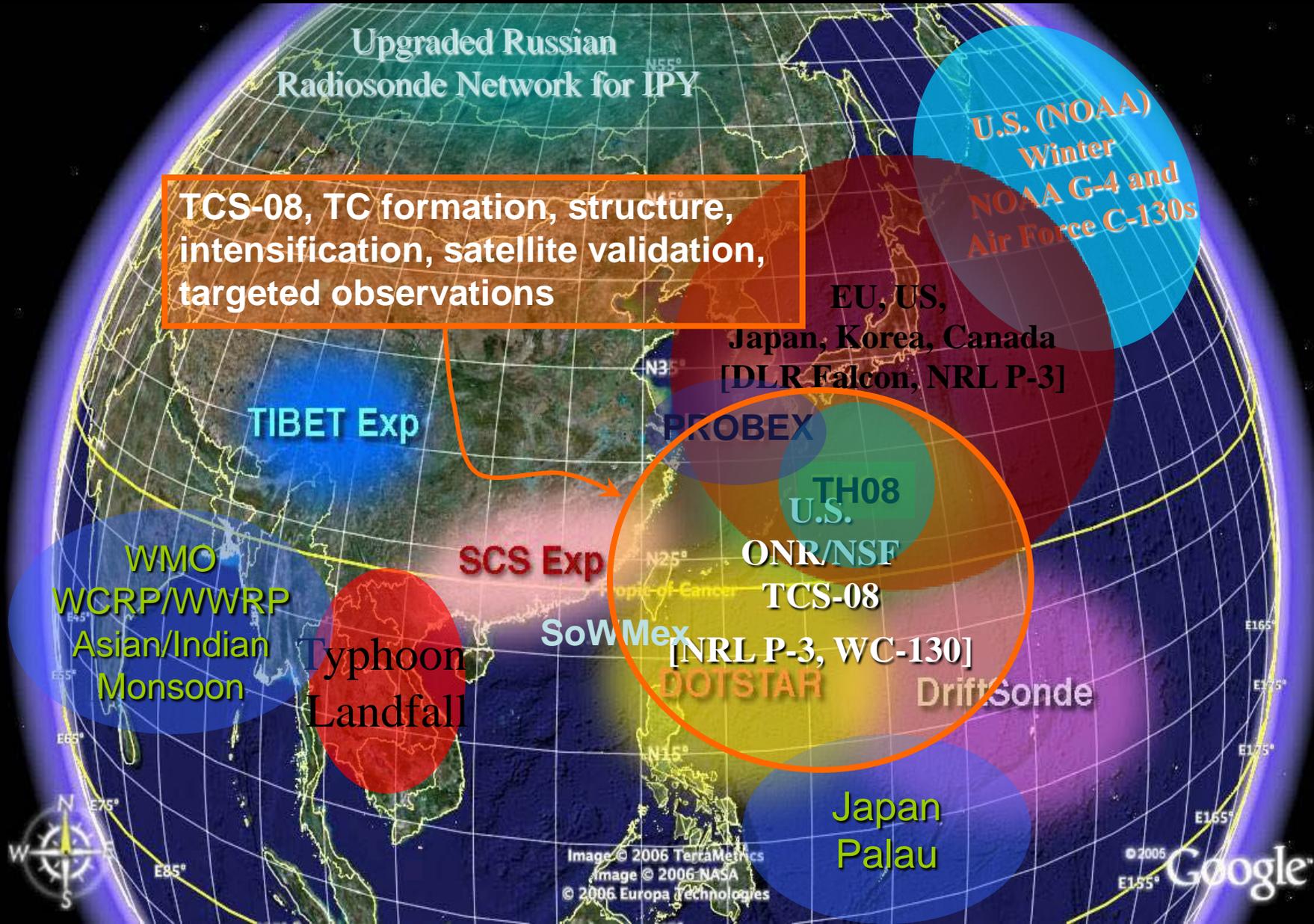
Japan
Palau

Image © 2006 TerraMetrics
Image © 2006 NASA
© 2006 Europa Technologies

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E155° Google

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THORPEX-Pacific Asian Regional Campaign/Tropical Cyclone Structure-08 Experiments and Collaborative Efforts



THORPEX-Pacific Asian Regional Campaign/Tropical Cyclone Structure-08 Experiments and Collaborative Efforts

Additional Extratropical Transition Components at DLR and FZK, Germany

Extratropical transition, downstream impacts, targeted observations

U.S. (NOAA)
Winter
NOAA G-4 and
Air Force C-130s

EU, US,
Japan, Korea, Canada
[DLR Falcon, NRL P-3]

TIBET Exp

PROBEX

TH08
U.S.

WMO
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Asian/Indian
Monsoon

SCS Exp

ONR/NSF

TCS-08

Typhoon
Landfall

SoWMex

DOTSTAR

[NRL P-3, WC-130]

DriftSonde

Japan
Palau

- **August-September 2008**
- **Asian societal impacts from heavy rainfall, typhoon and extratropical transition (ET) with research interests in:**
 - tropical cyclone formation
 - intensification
 - Motion/track
 - decay and/or ET
- **Downstream effects of Asian and Western Pacific high-impact weather on North America, Europe with research interests in**
 - tropical and midlatitude predictability
 - tropical cyclones
 - Recurvature
 - ET
 - intense extratropical cyclogenesis
- **International Collaborators: U.S. (NSF, ONR), Germany, Japan, China, South Korea, Canada, France, U.K., Taiwan, ECMWF**

Participants

- **Tropical Cyclone Formation**

- Steven Businger (U. Hawaii)
- Dave Raymond (New Mexico Tech)
- Jeff Hawkins (NRL) and Peter Black (NRL)
- Jim Doyle (NRL)
- Melinda Peng (NRL)
- Michael Montgomery (NPS) and Michael Bell (NCAR/NPS)
- Patrick Harr (NPS) and Russell Elsberry (NPS)
- Peter Black (NRL) and Peter Niiler (UCSD)
- Elizabeth Ritchie (U. Arizona)
- Ralph Foster (U. Washington)
- Dave Emmitt (SRA)
- K. Emanuel (MIT)

Participants

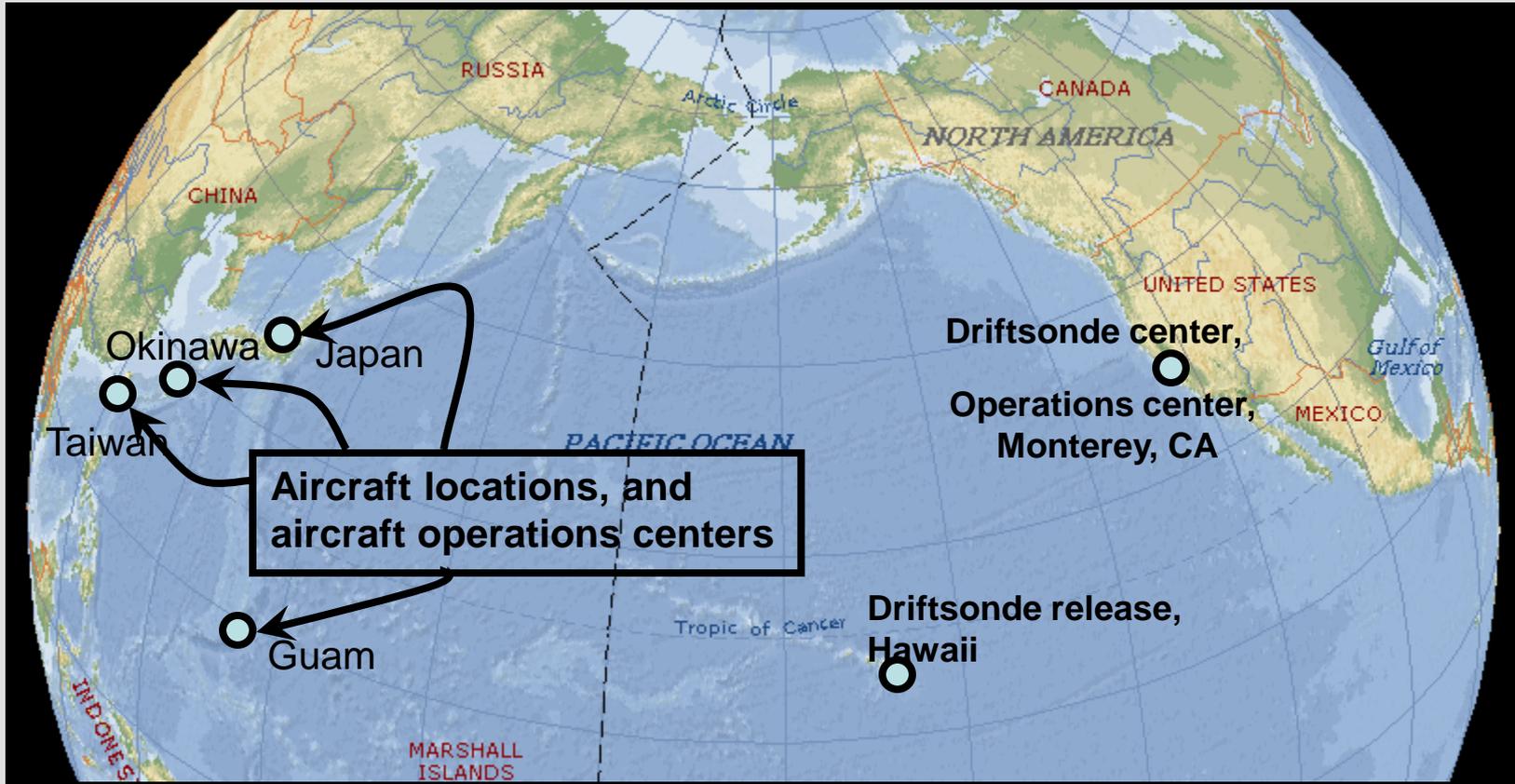
- **Targeted Data**
 - Carolyn Reynolds (NRL)
 - Rolf Langland (NRL), Chris Velden (U. Wisconsin)
 - Sharan Majumdar (U. Miami)
 - Greg Hakim (U. Washington)
 - Zhaoxia Pu (U. Utah)
 - C.-C. Wu (NTU)
 - M. Yamaguchi (JMA)
 - T. Nakazawa (MRI-JMA)
 - Martin Weissmann, George Craig (DLR)
 - Sarah Jones (U. Karlsruhe)
 - H. Kim (Yonsei U.)
 - H.-S. Lee (KMA)
 - Doris Anwender (U. Karlsruhe)

Participants

- **Extratropical Transition and Downstream Impacts**
 - Patrick Harr (NPS) and Russell Elsberry (NPS)
 - Chris Velden (U. Wisconsin)
 - Jenni Evans (Penn State U.) and Francesca Chiaromonte (Penn State U.)
 - Sarah Jones (U. Karlsruhe)
 - Chris Davis (NCAR)
- **Operational Weather Centers providing Special Products**
 - ECMWF
 - NCEP-EMC (USA)
 - FNMOC (USA)
 - UKMO (UK)
 - JMA (Japan)
 - CWB (Taiwan)
 - DWD (Germany)
 - CMC (Canada)
 - JTWC (USA)

Summary

T-PARC and collaborating projects constitute a GLOBAL OPERATION



Global Operations managed via: Elluminate Electronic Meeting Software

T-PARC-TCS-08 Elluminate Meetings

http://met.nps.edu/~tparc/meeting.html

BlackBerry Navy/NRL Tr...clone Page EOL/TPARC...OG - Home Microsoft O... Web Access Apple Yahoo! Google Maps YouTube Wikipedia News (433) Popular



T-PARC/TCS-08 Elluminate Live Meetings Link

T-PARC Daily Planning Session ----->	Click here to join T-PARC Daily Planning Meeting
T-PARC Forecaster Forum Session ----->	Click here to join T-PARC Forecaster Forum Meeting
T-PARC Operations Center Forum ----->	Click here to join T-PARC Operations Forum Meeting

After Elluminate starts enter your name (First and Last Name) at the login prompt.
Note that this meeting now requires a password to join.

Last Reviewed: 29 July 2008
[Privacy and Security](#)
[Copyright Information](#)

Example Elluminate Session: voice, chat, data, graphics

The screenshot displays the Elluminate interface with several key components:

- Participants Panel:** Lists 50 participants from various locations including N. America, Europe, and Asia.
- Application Sharing:** Shows a Google Earth window displaying a weather map with aircraft tracks. A blue track represents WC-130 operations, and a yellow track represents NRL P-3 operations. The map includes a grid with latitude (N11° to N17°) and longitude (E131° to E137°) markers. A callout box states: "Image being shared in the meeting: Current aircraft operations with WC-130 track in blue and NRL P-3 track in yellow".
- Chat Panel:** Shows a concurrent chat session with messages such as: "Derrick Herndon: boo, no not yet. waiting for mission to be completed.", "Tetsuo NAKAZAWA (Geneva): Grant-san, Oh! you do!", "Chun-Chieh Wu: Sharan, the current track makes the obs. at the 27th very likely.", "Chun-Chieh Wu: Sharan, it seems the major sensitivity is to the east and north. Good to have both DOTSTAR and Falcon for it.", "Sharan Majumdar: Yes, the storm is now predicted to move a bit faster than it was yesterday." A callout box states: "Chat session concurrent with voice meeting".
- System Tray:** Shows the taskbar with "Terminal" and "Elluminate Live! - T-PARC/TCS-08" windows.



TPARC/TCS-08 Field Catalog

2008 Field Season

- Catalog Home
- Daily Reports
- Operational Products
- Model/Forecast Products
- Research Products
- Missions
- Tools & Links

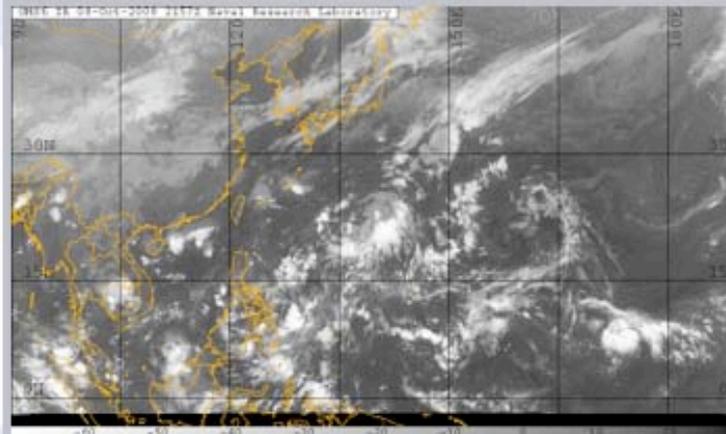
Links for display of real-time display of aircraft operations and satellite imagery in Google Earth and meetings in Elluminate

9, 2:54 Z	Guam: Thur, Oct 9, 12:54 PM	Tokyo: Thur, Oct 9, 11:54 AM
8, 8:54 PM	Monterey: Wed, Oct 8, 7:54 PM	Taipei: Thur, Oct 9, 10:54 AM
	Hawaii: Wed, Oct 8, 4:54 PM	

Quick Links:

- Facilities Status
- Operations Plan of the Day
- TPARC Weather Discussion
- Real-Time P3 Flight Track (kml)
- Real-Time C-130 Flight Track (kml)
- Real-Time MTSAT Vis/IR Imagery (kml)
- Real-Time Driftsonde Track (kml)
- (Download kmis first then open in GoogleEarth)
- NPS Weather Briefing Website
- Elluminate Meetings

Northwest Pacific Latest Infrared Image



Additional Satellite Imagery:

- Latest 4 hours Visible
- Latest 4 hours Water Vapor

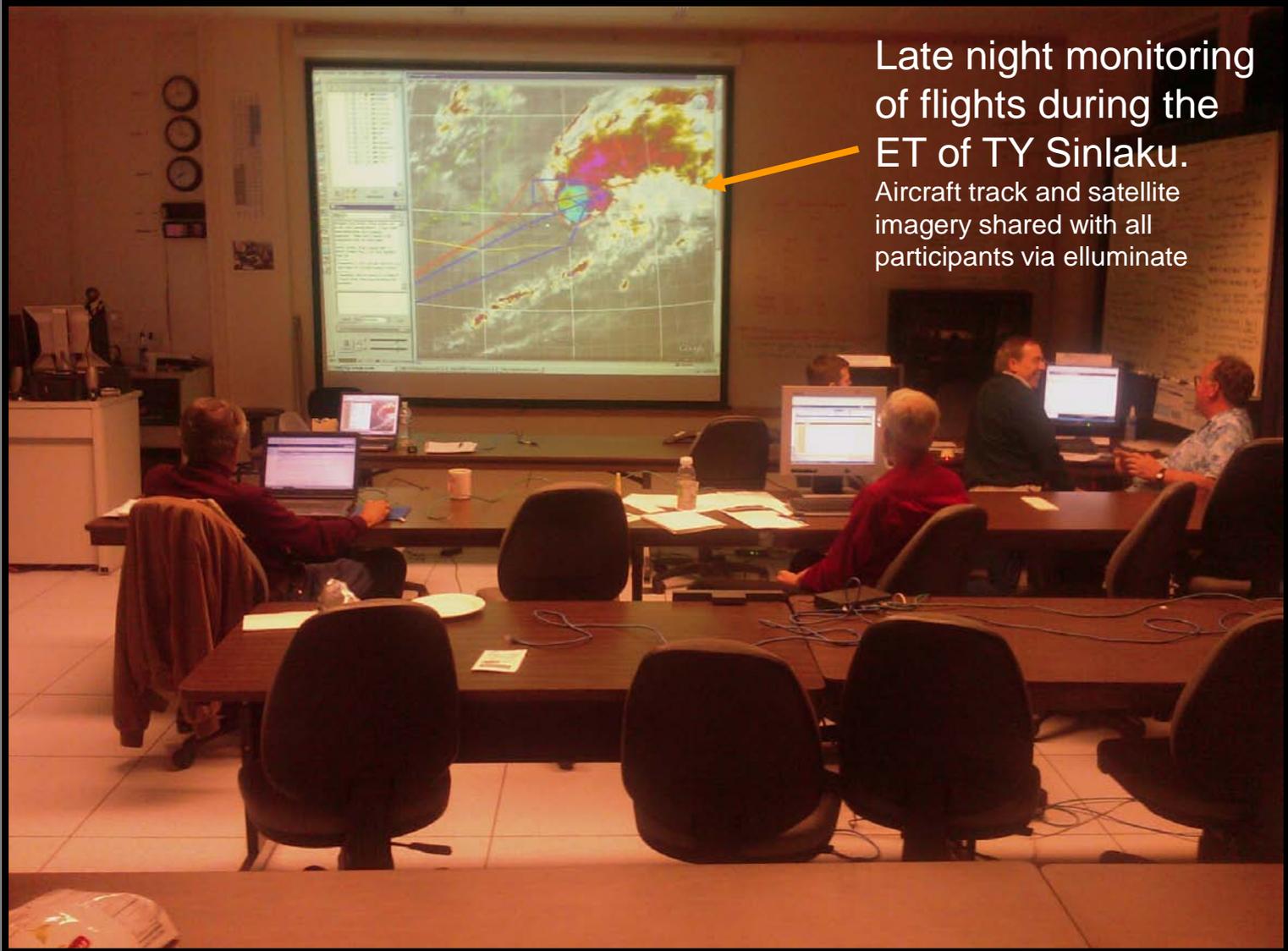
Information Links:

- JTWC Website
- Honolulu Weather
- Guam Weather
- Okinawa Weather
- Monterey Operations Center (831) 656-3569
- Guam Aircraft Coordination Center (671) 653-0235

[Comments](#)

Primary source of all products used during the field Campaign: observations (satellite, aircraft, etc.), NWP products

TPARC Operations Center in Monterey – 19/9/08



Operations: Aircraft

- NRL P-3 (10 August – 3 October)
 - 23 missions
 - 165 hours
- WC-130J (1 August – 30 September)
 - 24 missions
 - 215 hours
- DLR FALCON (25 August – 1 October)
 - 24 missions
 - 10 single mission days
 - 7 days in which two missions were flown
 - 85 hours
- DOTSTAR
 - 10 missions
 - 51.8 hours

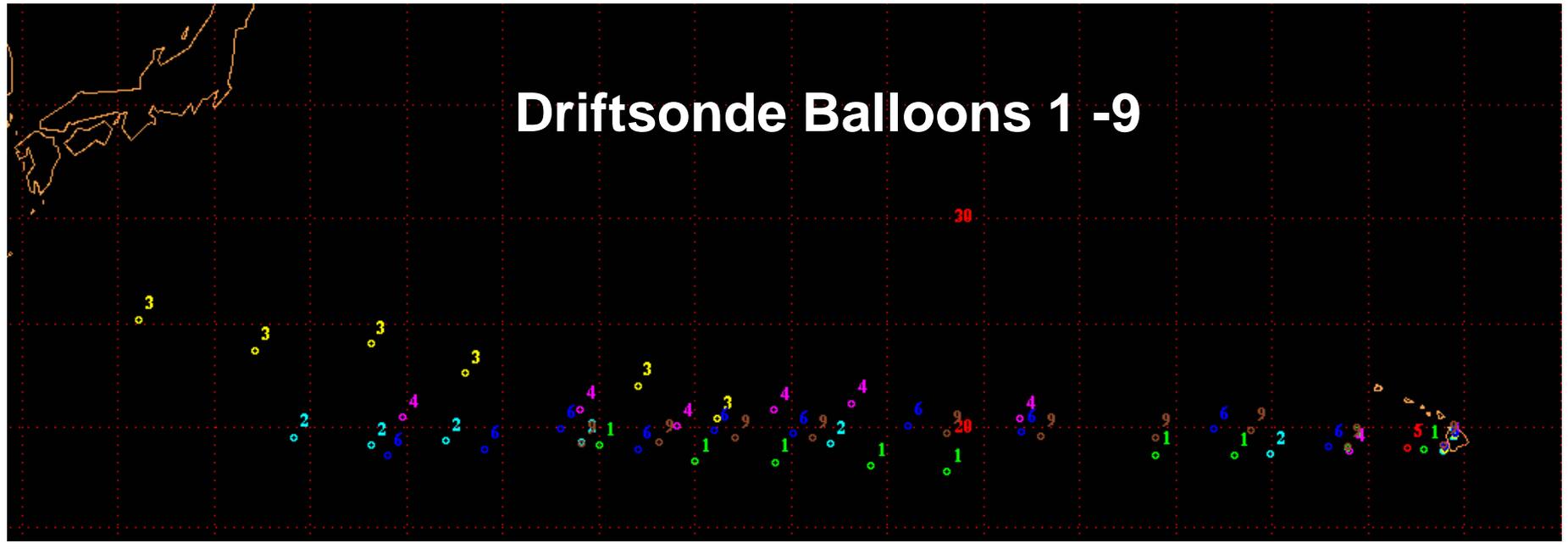
Operations: Aircraft

- Mission objectives
 - NRL P-3
 - TC formation, structure, intensification, TUTT structure, targeting for formation, extratropical transition
 - WC-130J
 - TC formation, structure, intensification, satellite validation, targeting for formation and track, extratropical transition
 - FALCON
 - Typhoon targeting, extratropical transition, targeting, ridge-building, tropical water vapor transport
 - DOTSTAR
 - Typhoon targeting

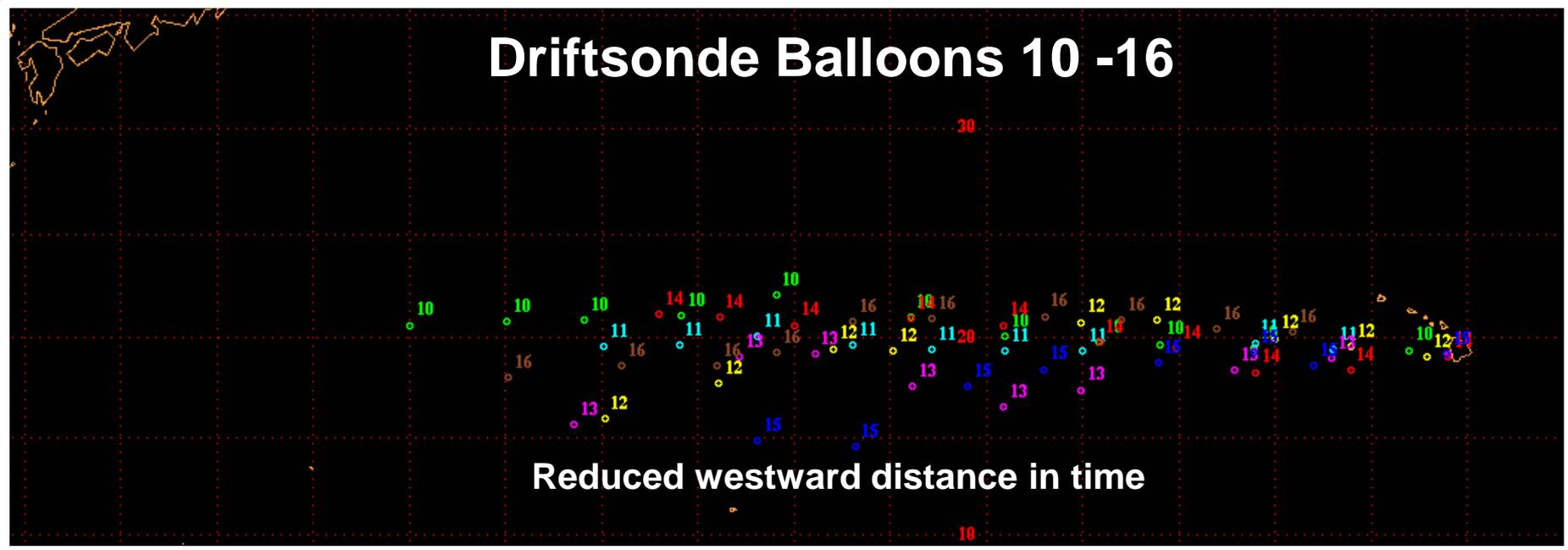
Operations: Driftsonde

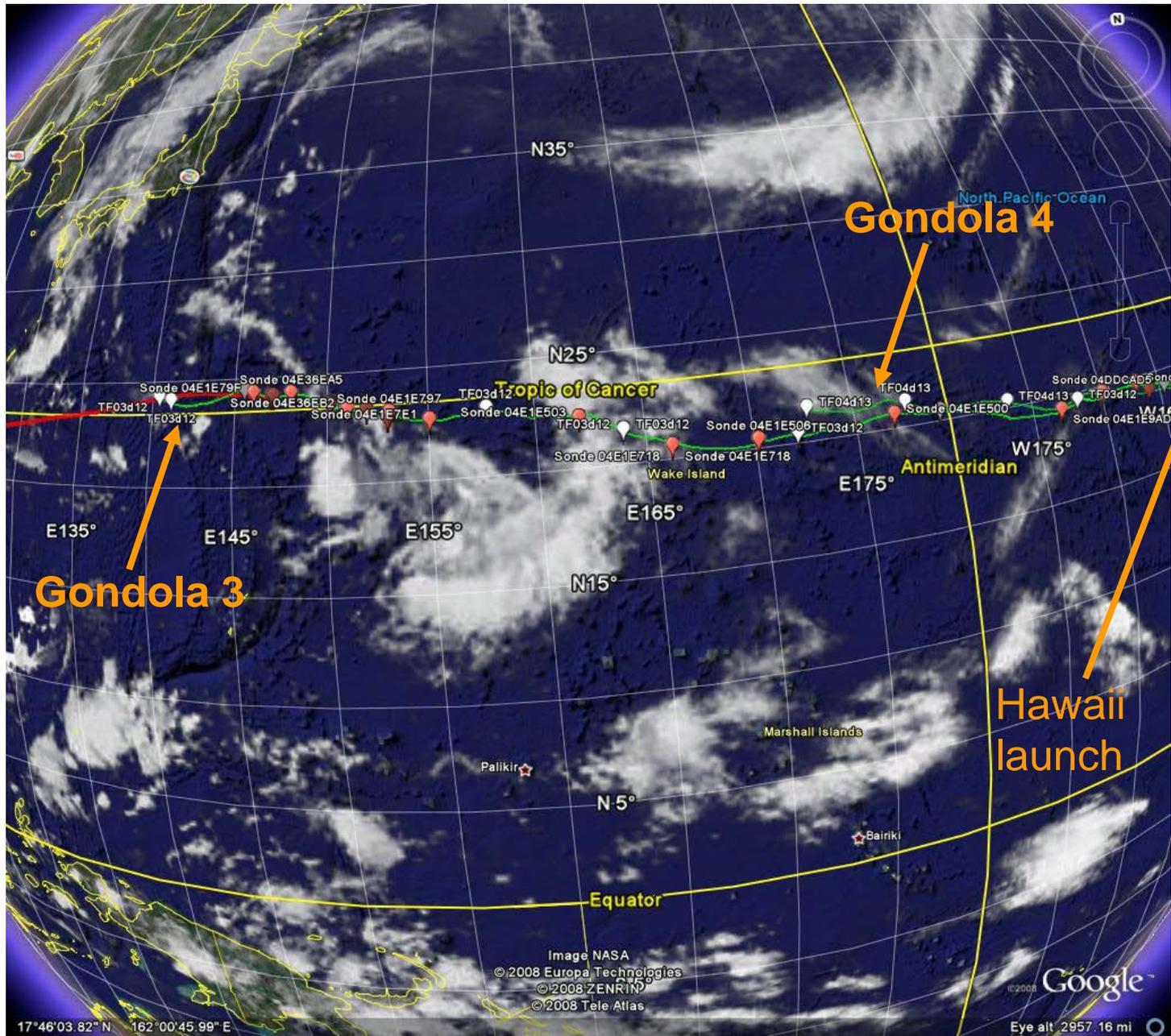
DRF	Flight	Up Days	Good Drops	Sent to GTS	Failed	Attempted Drops	Unused Drops	Last Lat	Last Lon
10 Aug 19	1	3.8	16	9	8	24	6 + 8	18.8	158.3
11 Aug 21	2	3.8	14	10	10	24	15	19.6	142.3
12 Aug 22	3	4.8	15	12	11	26	9+3	25.1	135.9
13 Aug 24	4	5.0	10	8	19	29	6+3	20.7	149.6
16 Aug 26	5 (x)	0.3	(1)	(1)	(2)	(3)	(35)	19.0	-158.6
17 Aug 28	6	4.9	18	17	20	38	0	18.6	149.0
14 Aug 30	7 (x)	4.5	(0)	(0)	(7)	(7)	(31)	21.1	171.9
18 Sep 01	8 (x)	0.0	(0)	(0)	(0)	(0)	(38)	19.1	-155.8
20 Sep 03	9	4.0	24	24	8	32	6	20.5	158.6
21 Sep 06	10	3.8	18	18	6	24	14	20.7	147.2
22 Sep 8	11	3.8	21	21	8	29	9	20.0	157.1
23 Sep 16	12	4.8	17	16	13	30	6+2	14.7	157.1
24 Sep 18	13	5.7	22	22	13	35	3	15.6	158.4
25 Sep 20	14	4.8	23	23	10	33	5	22.0	161.9
26 Sep 22	15	5.0	18	17	9	27	7+4	16.0	165.4
27 Sep 23	16	5.8	25	25	13	38	0	17.4	152.6
			242	223	157	399	56		

Driftsonde Balloons 1 -9



Driftsonde Balloons 10 -16





0000 UTC 27
August 2008

Gondola tracks
with markers at
locations
where
dropsondes
were launched

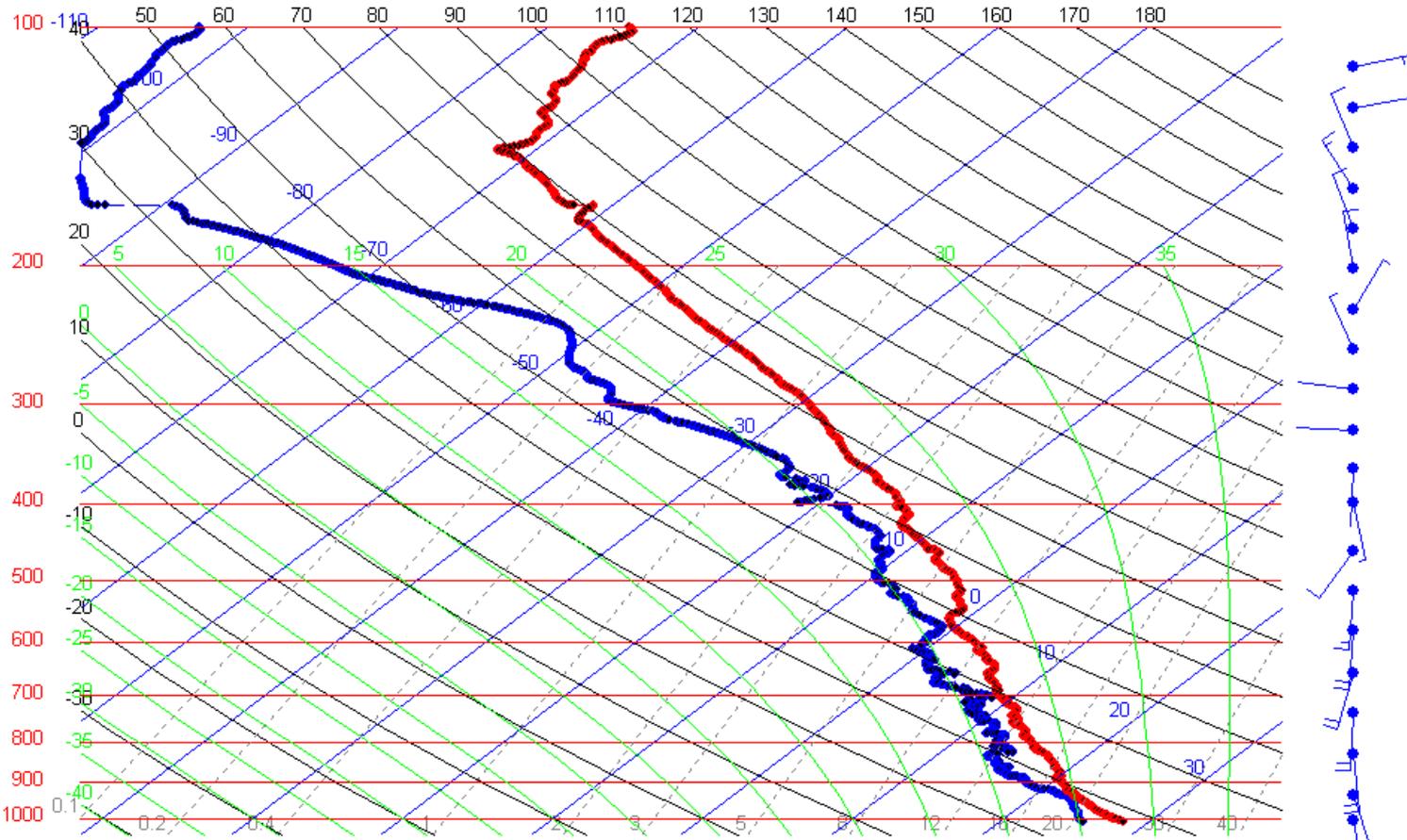
Gondola 3

Gondola 4

Hawaii
launch

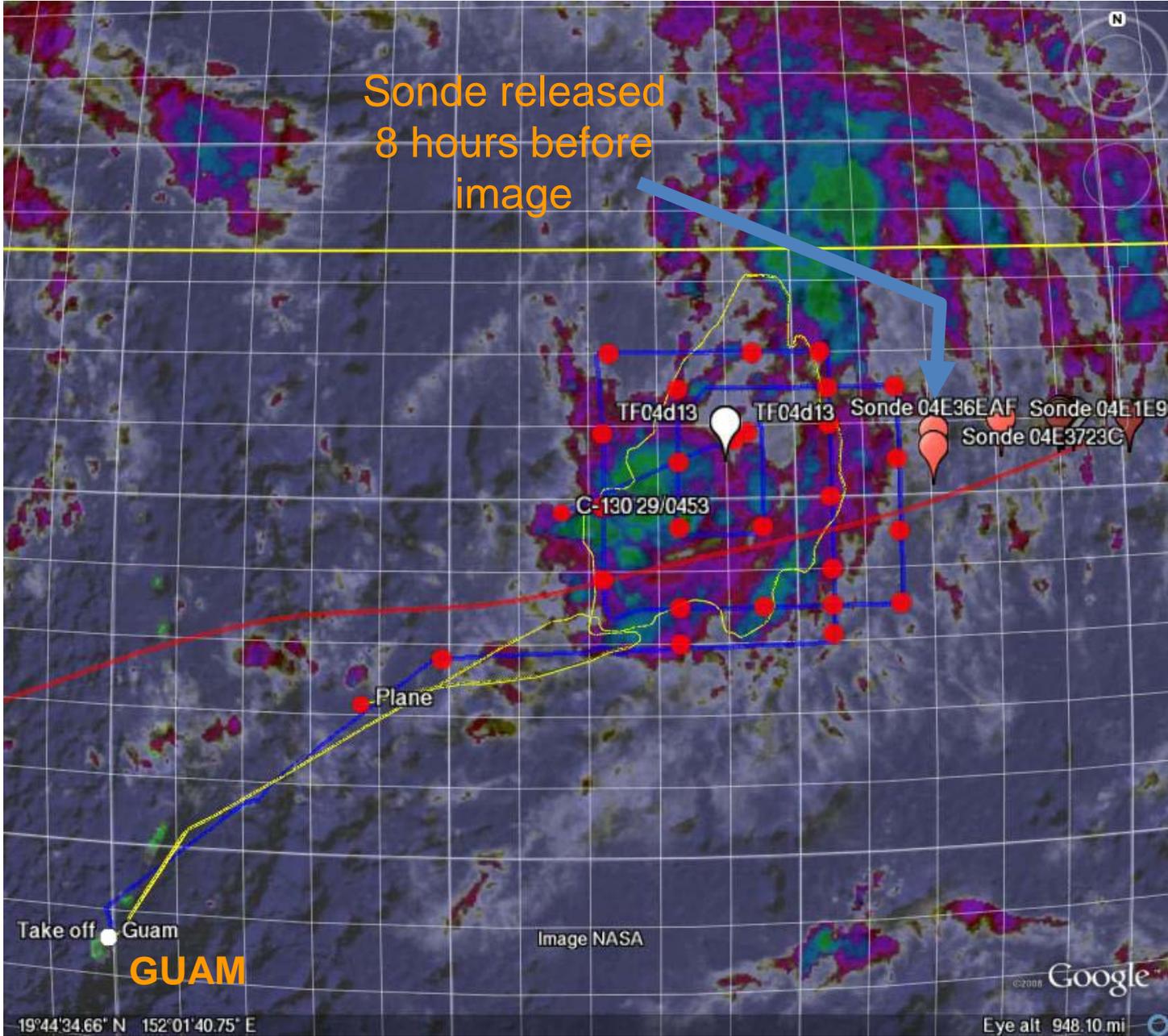
Driftsonde profile example

T-PARCDriftsonde_TF04d13_04E36EAF.dfile 082013871 T-PARC Driftsonde, drift13 DRIFTSONDE, drift13



Drop 08/28/08 21:04:39 UTC @ Lat 20.72N, Lon 157.06E

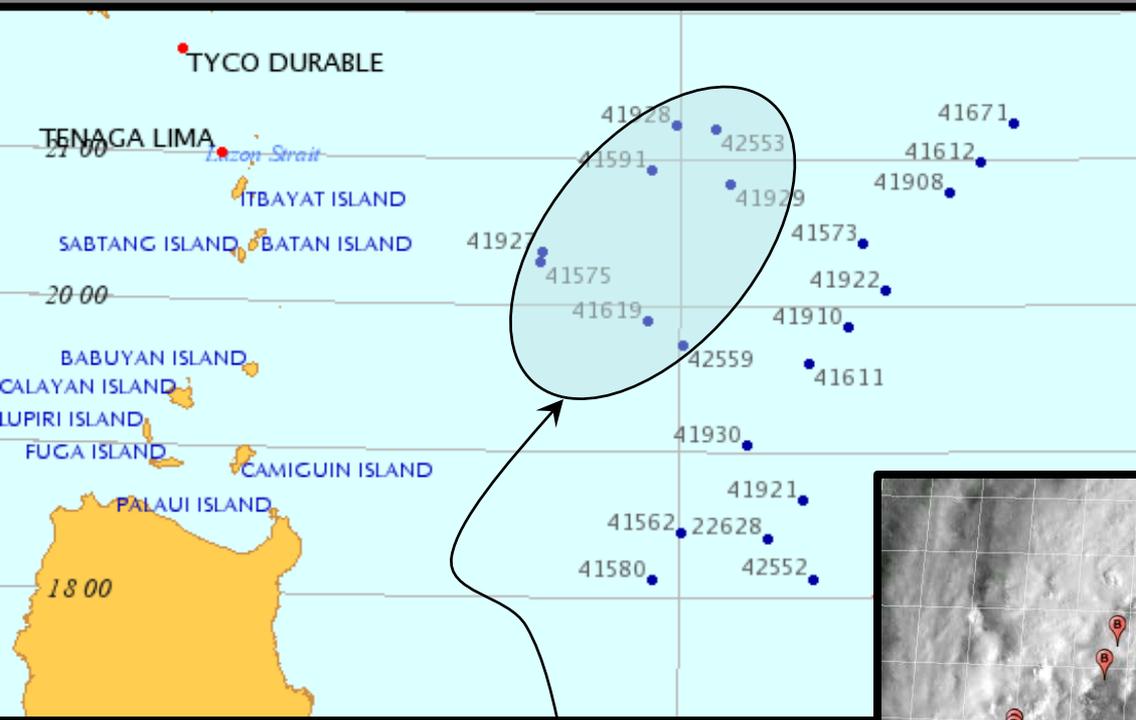
Sonde released
8 hours before
image



Combined
with aircraft
missions into
potential TC
genesis
event

- 0500 UTC 29 August 2008
- NRL P3 (yellow) and WC130 (blue) tracks
- Red circles mark locations of dropsonde releases from the WC-130
- Balloon markers define locations of driftsonde release from the gondola

Operations: Aircraft – buoy deployment

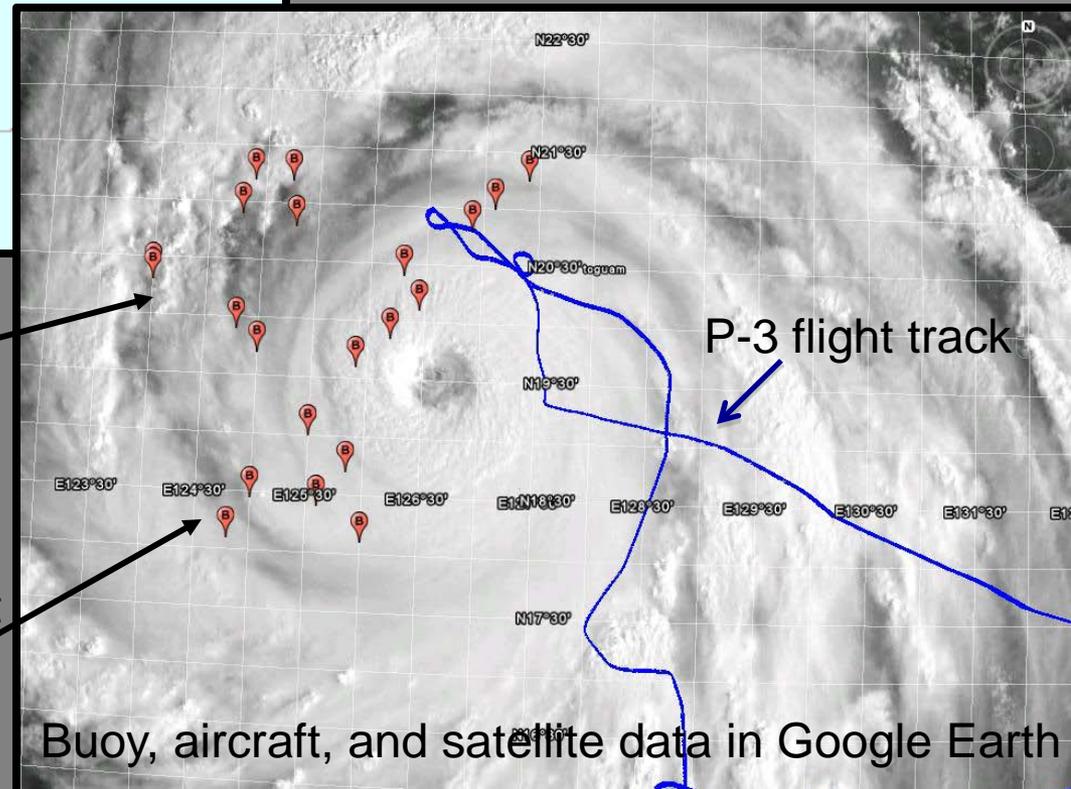


First occurrence of the deployment of drifting buoys ahead of a category 5 tropical cyclone (Jangmi). Chart at left and imagery below are from a few hours after the deployment of the buoys along the diagonal to the northwest of the TC

2313 UTC 26 September

First buoy deployment
in TY Hagupit
several days
earlier

Second deployment
in STY Jangmi

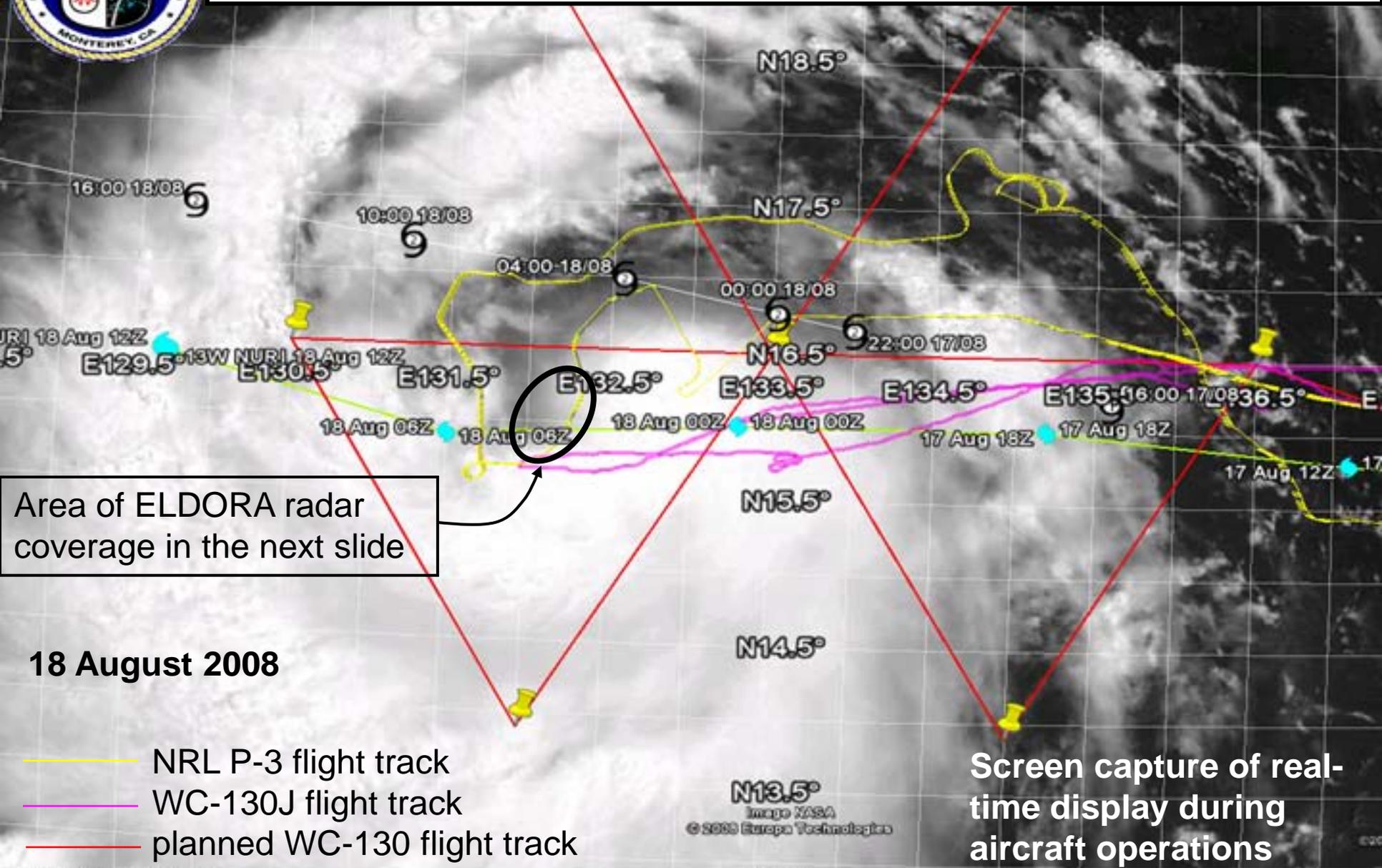


Buoy, aircraft, and satellite data in Google Earth



TCS-08

Third flight into the Pre-TY Nuri (13W) tropical disturbance



Area of ELDORA radar coverage in the next slide

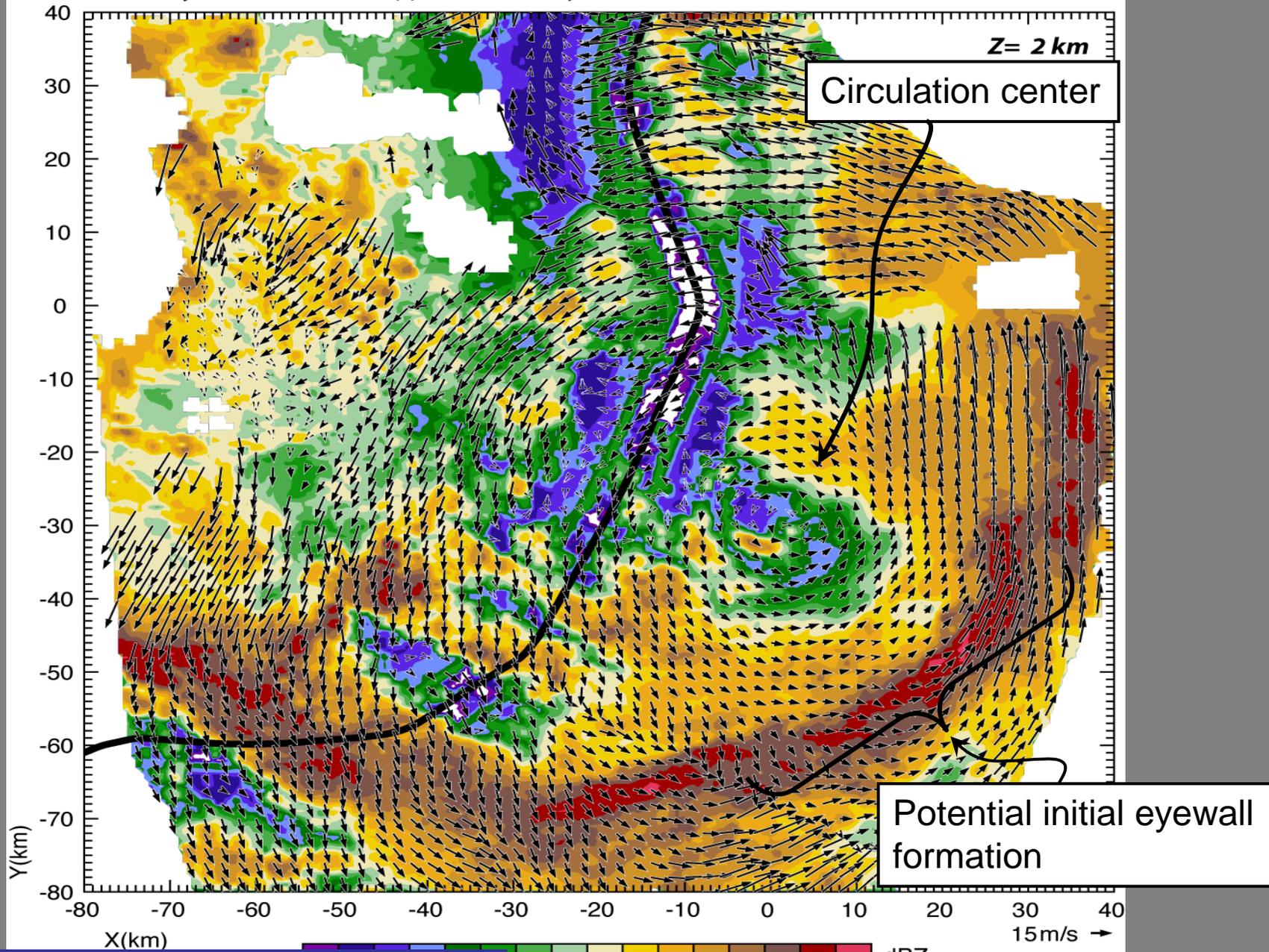
18 August 2008

- NRL P-3 flight track
- WC-130J flight track
- planned WC-130 flight track

Screen capture of real-time display during aircraft operations

Typhoon Nuri 18 August 2008 (0142 - 0205 UTC)

Preliminary ELDORA Dual-Doppler Reflectivity (color, dBZ), wind vectors, and track (thick black)



Typhoon Sinlaku

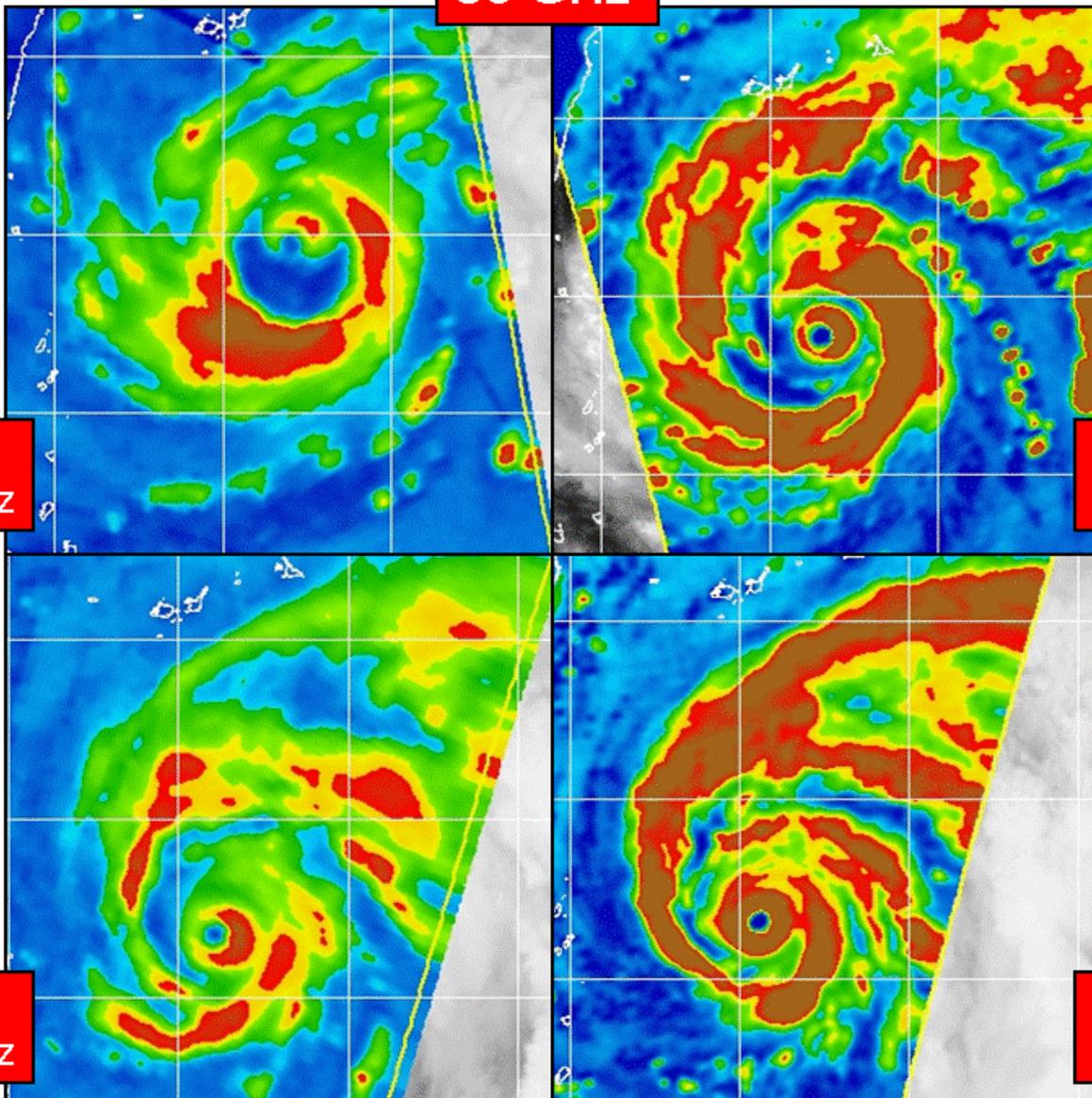
85 GHz

SSMIS
11/1135z

ASMRE
11/0445z

SSMIS
10/2145z

ASMRE
10/1750z



Typhoon Hagupit

09/22/08 0000Z 18W HAGUPIT
09/21/08 2252Z TRMM 85H
09/21/08 2230Z MTSAT VIS

09/22/08 0000Z 18W HAGUPIT
09/21/08 2342Z F-16 91H
09/21/08 2313Z MTSAT VIS

09/22/08 0000Z 18W HAGUPIT
09/22/08 0111Z NOAA-17 89
09/22/08 0057Z MTSAT VIS

0057 UTC

0357 UTC

Naval Research Lab www.nrlmry.navy.mil/sat_prod
<-- 85H Brightness Temp (Kelvin) -->

Naval Research Lab www.nrlmry.navy.mil/sat_products.html
<-- 91H Brightness Temp (Kelvin) -->

Naval Research Lab www.nrlmry.navy.mil/sat_products.html
<-- 89 Brightness Temp (Kelvin) -->

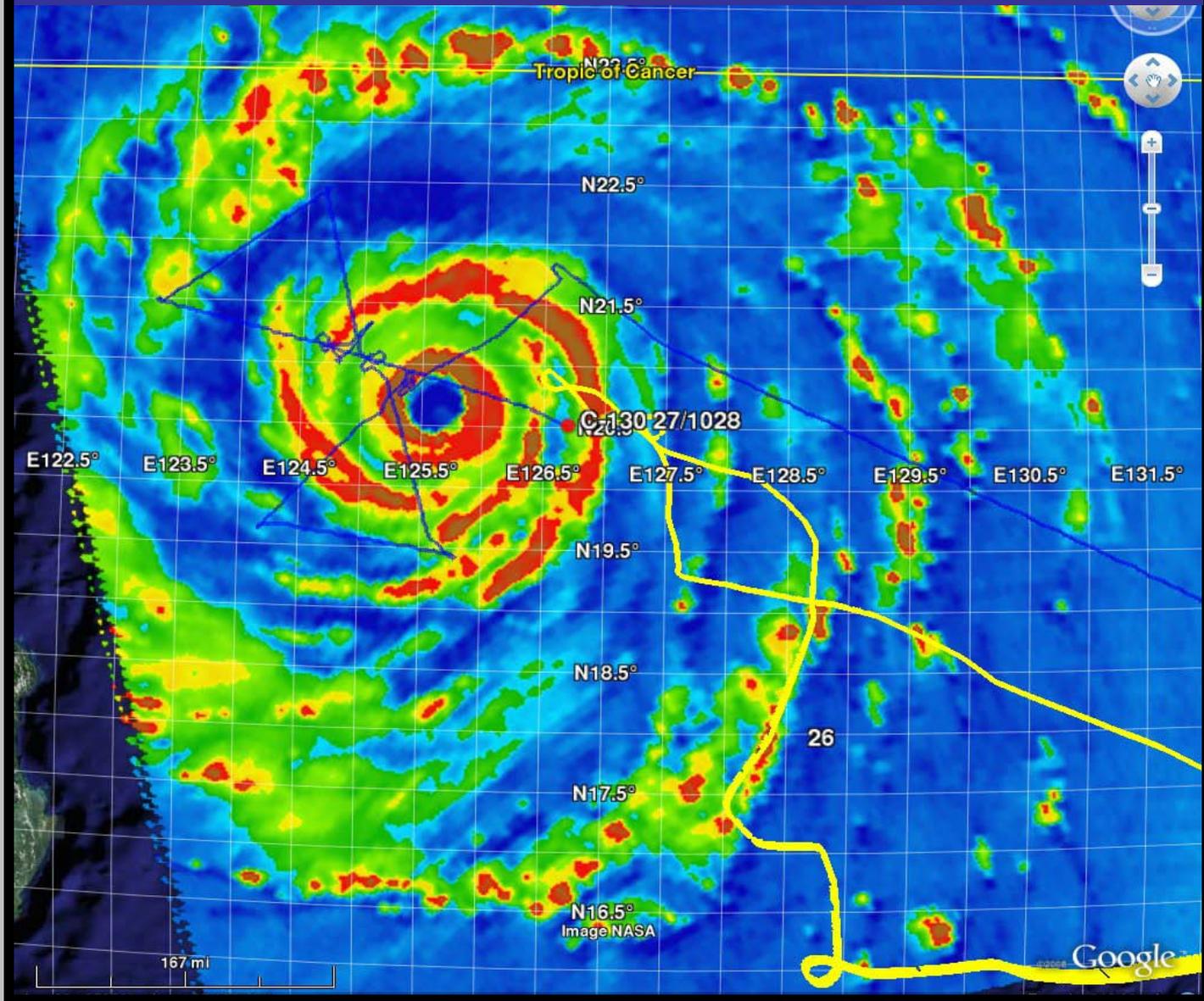
190 200 210 220 230 240 250

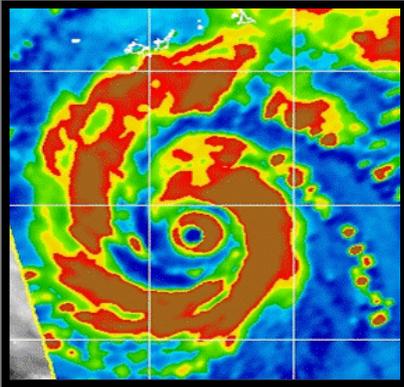
190 200 210 220 230 240 250 260

190 200 210 220 230 240 250 260 270

Super Typhoon Jangmi

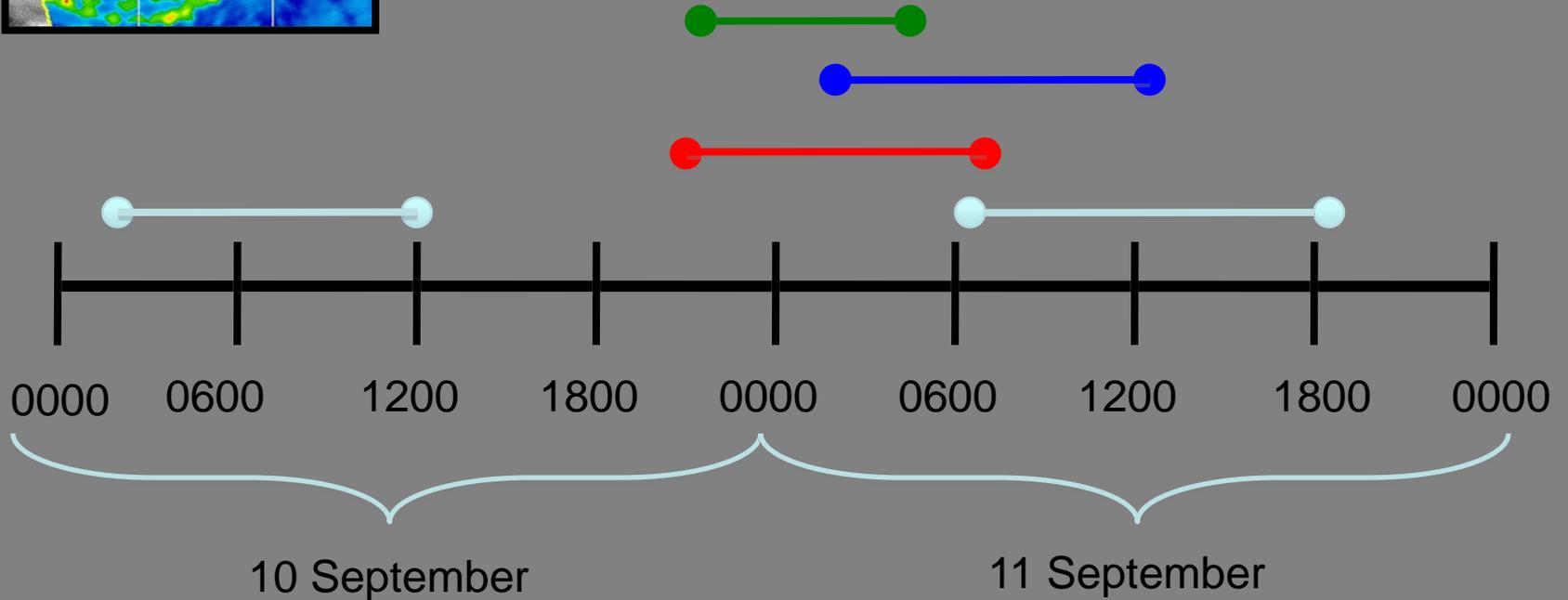
29 September 2008 WC-130 track (blue), NRL P-3 track (yellow)





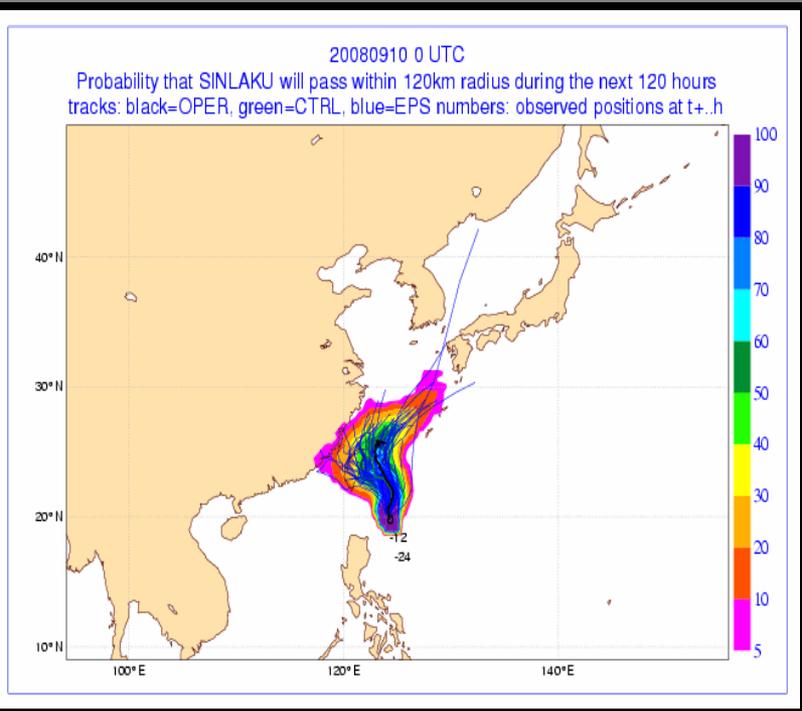
Typhoon Sinlaku

10-11 September: 4 Aircraft Missions

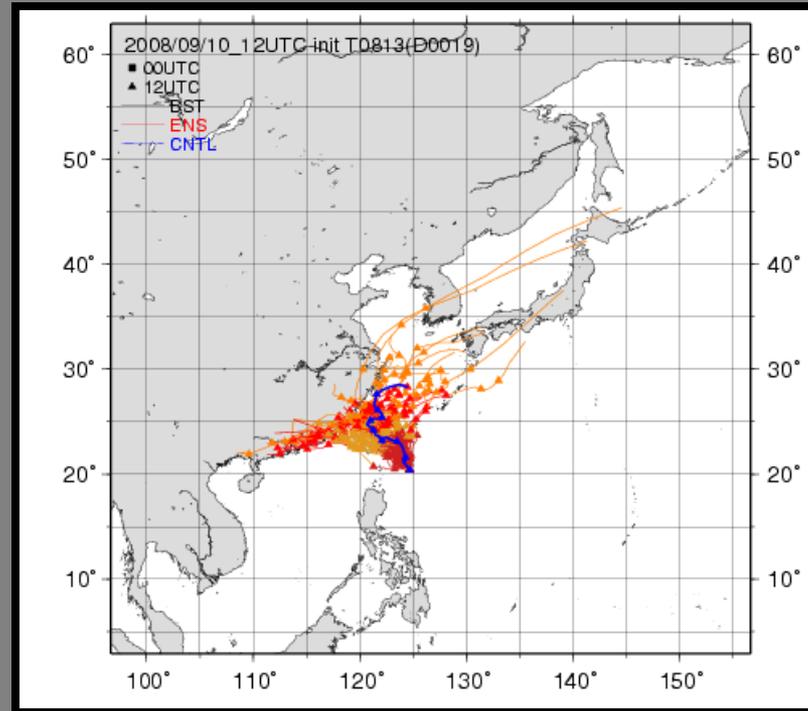


- WC-130: Center fixes, satellite validation, structure, intensity
- NRL P-3: Outer band structure
- FALCON: Typhoon Targeting
- DOTSTAR: Typhoon targeting

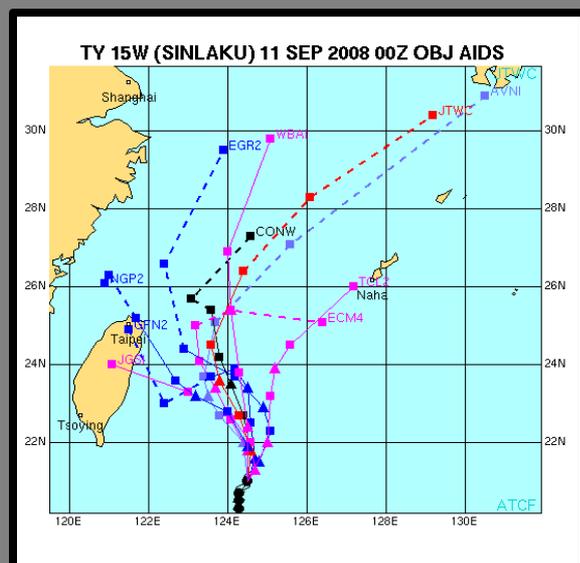
Targeting Motivation: Track Uncertainty 10 September



ECMWF Strike Probability



JMA Ensemble Members



Numerical model aids

ECMWF-SAP based on TE-5Vs (moist TL95) and Z500

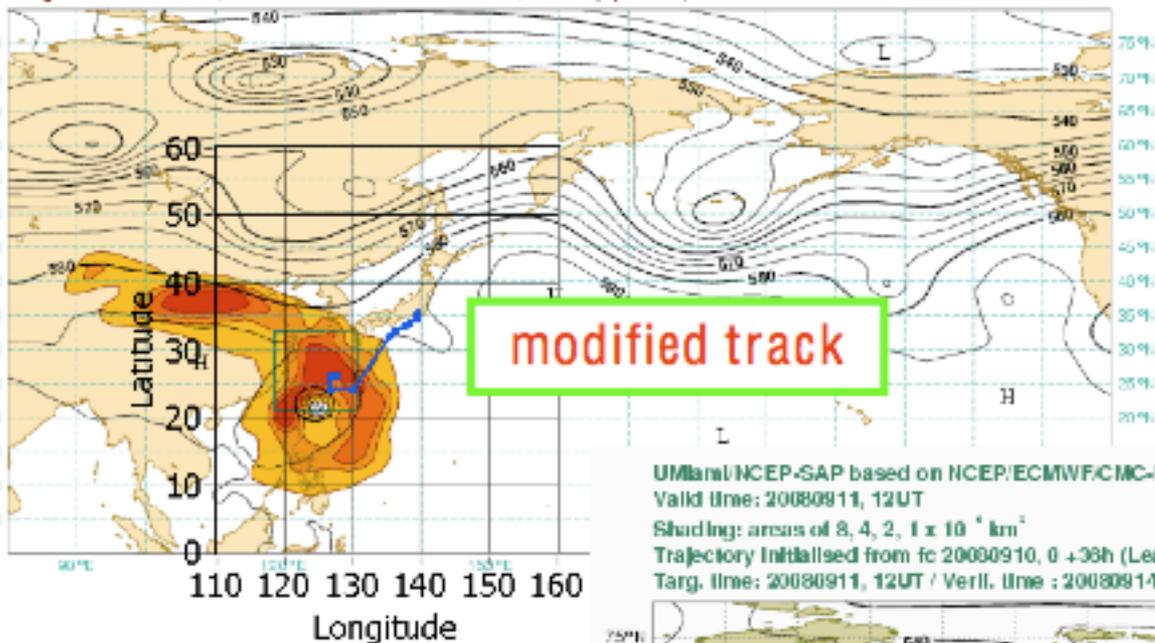
Valid time: 20080911, 12 UT (Targeting Time)

Shading: areas of 8, 4, 2, 1 x 10⁴ km²

trajectory initialized from fc 20080910, 00 UT +36 h

Targ. time: 20080911, 12 UT / Verif. time: 20080914, 00 UT (opt: 60h)

track 



**FALCON flight 2:
takeoff Atsugi
landing Okinawa**

UMbari/NCEP-SAP based on NCEP/ECMWF/CMC-Initialised ETKF summary map and Z500 (black solid contour)

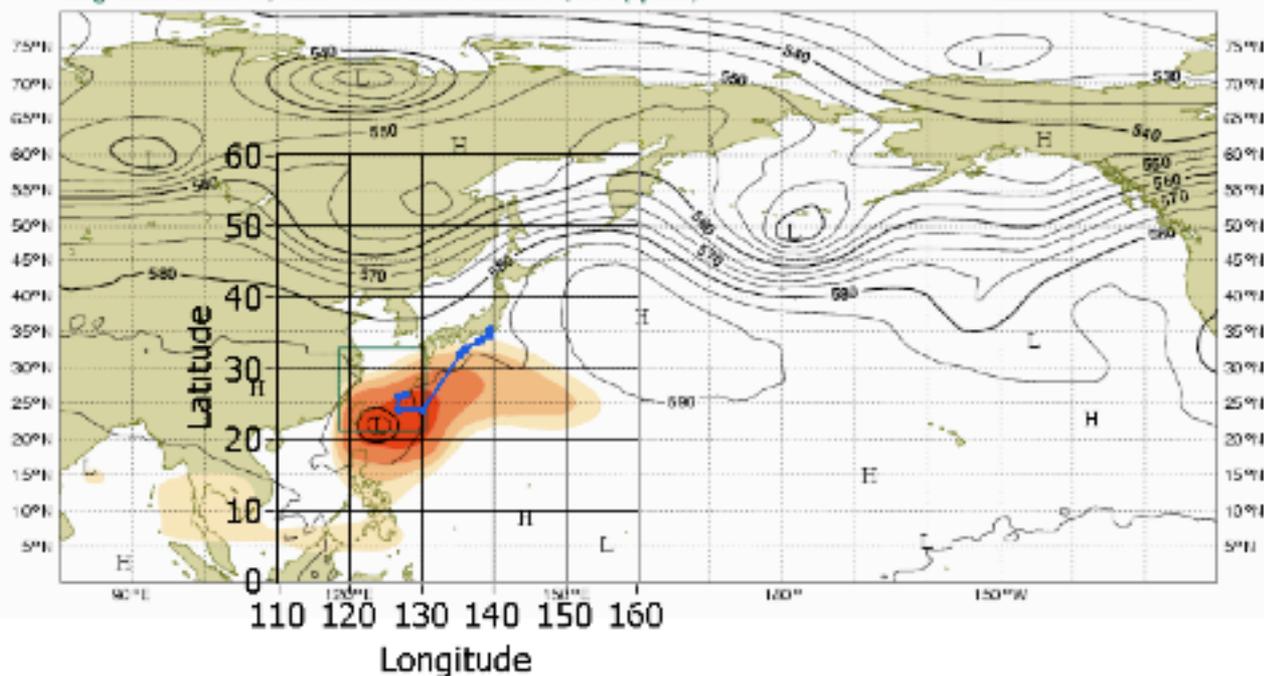
Valid time: 20080911, 12UT

Shading: areas of 8, 4, 2, 1 x 10⁴ km²

Trajectory initialized from fc 20080910, 0 +36h (Lead time)

Targ. time: 20080911, 12UT / Verif. time: 20080914, 00UT (opt: 60)

track 



calculations from
20080910 00 UTC

targeting on
20080911 12 UTC

Optimization Time Interval = 24h

Initial Time : 2008.09.10 00UTC

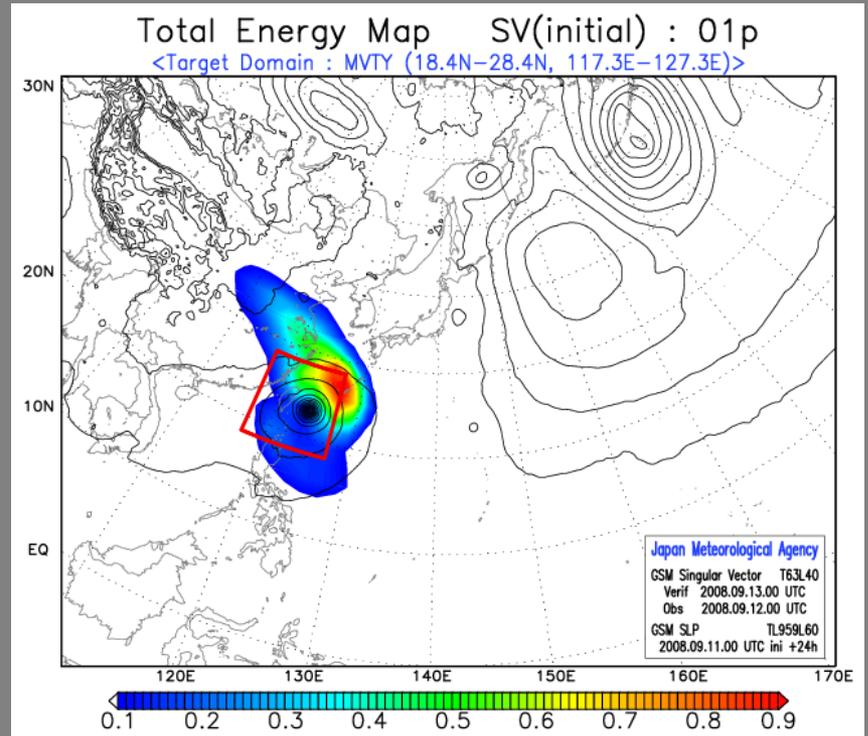
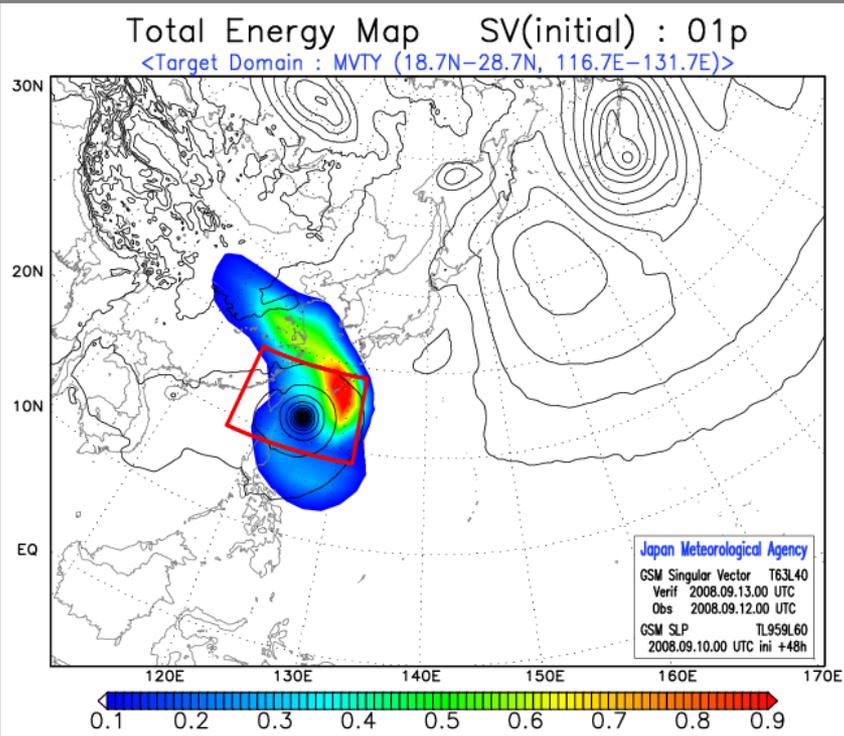
Observation Time : 2008.09.12 00UTC

Verif. Time : 2008.09.13 00UTC

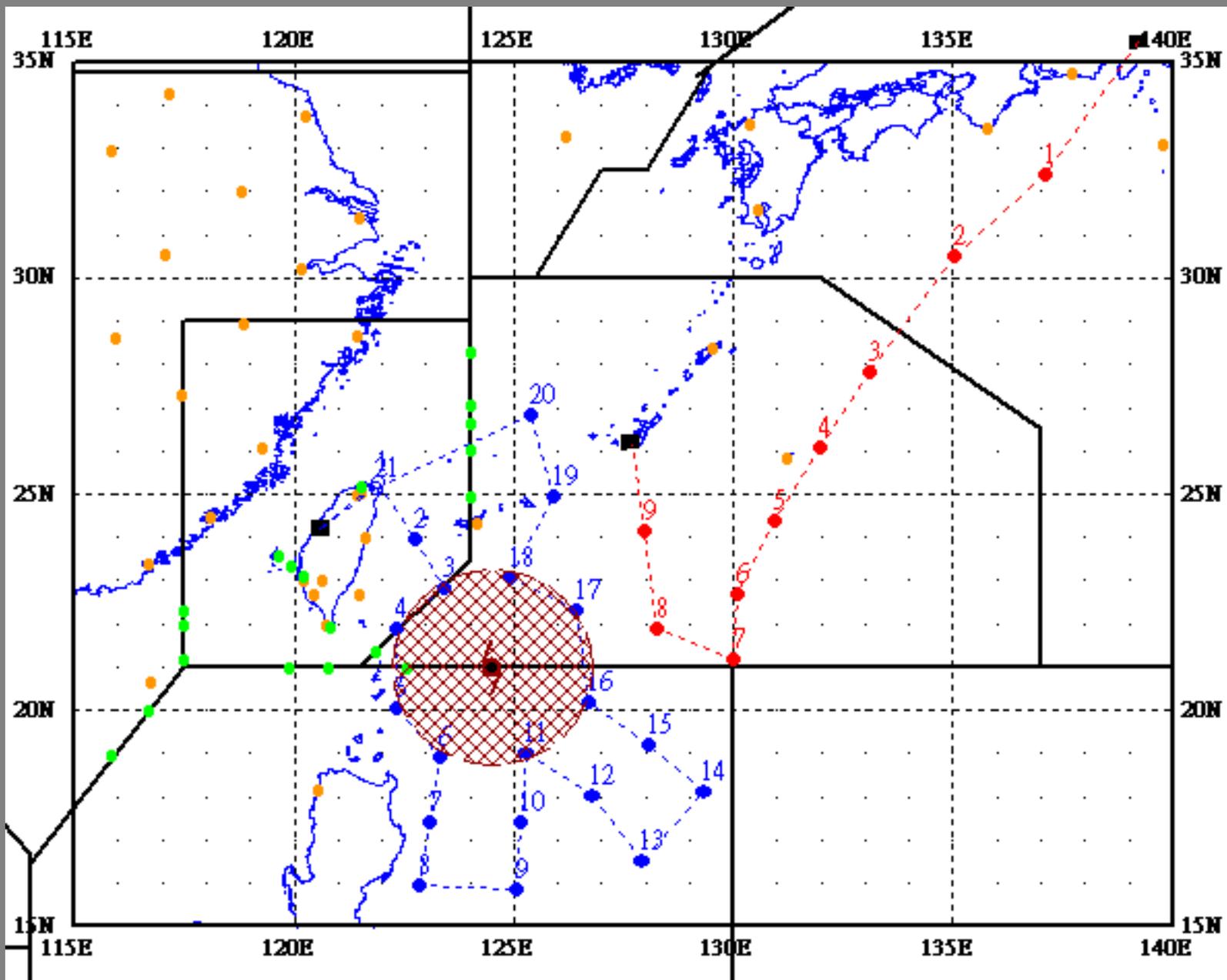
Initial Time : 2008.09.11 00UTC

Observation Time : 2008.09.12 00UTC

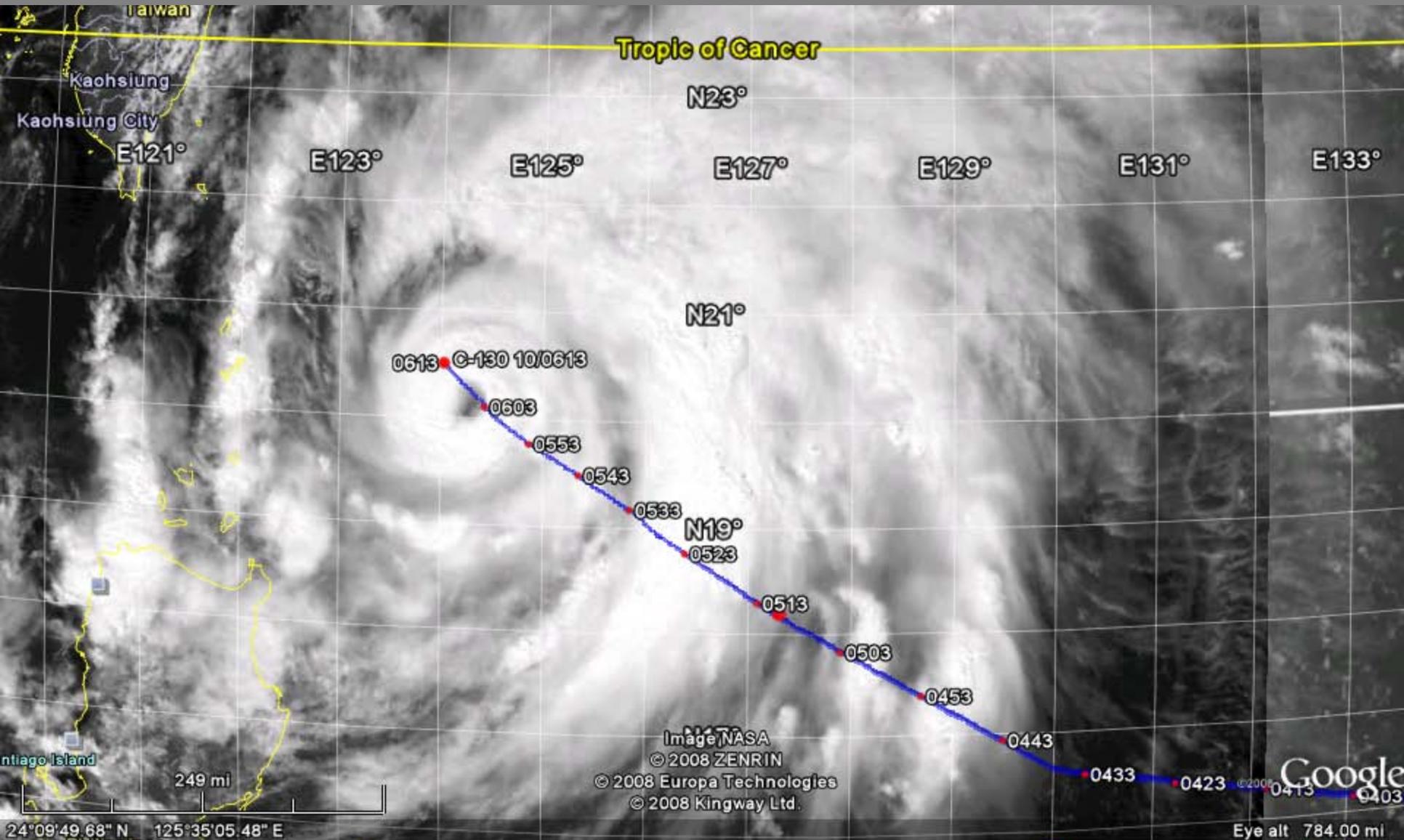
Verif. Time : 2008.09.13 00UTC



DOTSTAR Flight Plan (BLUE) and FALCON Flight Plan (1) (Red) 10-11 September 2008



WC-130 Flight Plan: 10-11 September 2008

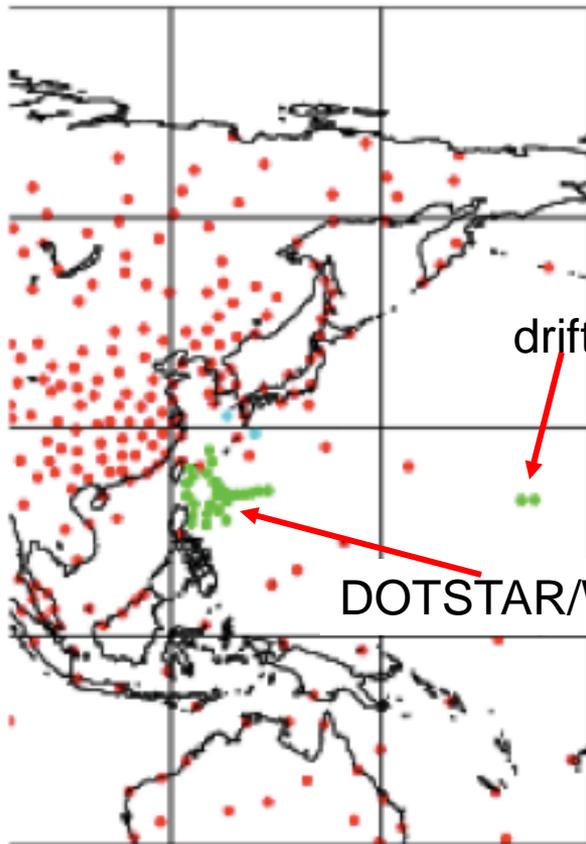


ECMWF Data Coverage

Data from all aircraft and driftsonde transmitted to operational weather centers

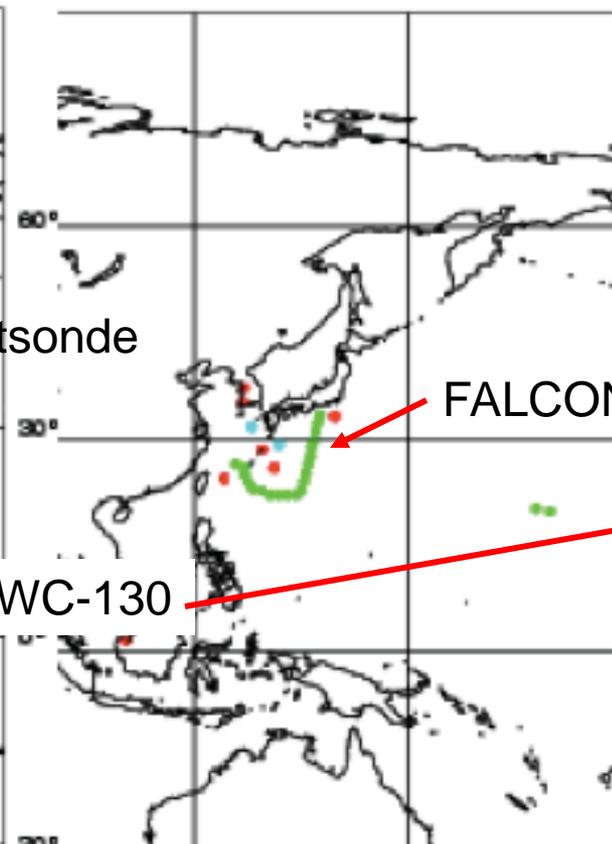
11 Sept 00 UTC

120°E 150°E



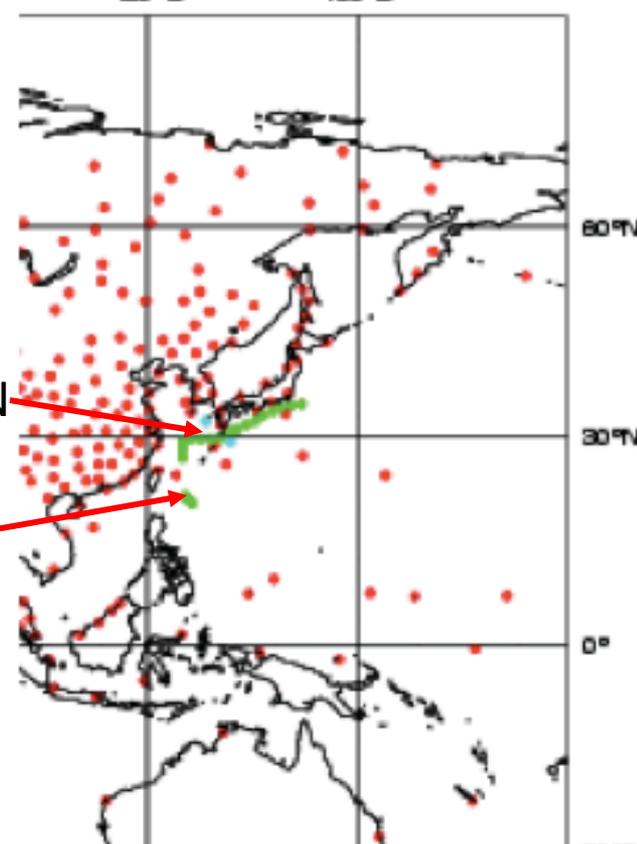
11 Sept 06 UTC

120°E 150°E



11 Sept 12 UTC

120°E 150°E



driftsonde

FALCON

DOTSTAR/WC-130

Summary

- **Anomalous weather conditions to start**
 - Non-existent monsoon trough
 - Anomalous low-level easterlies
 - Weak wave activity and strong upper-level cold lows (TUTT) dominated throughout August
 - 1 typhoon
 - However, many aircraft missions conducted for TC formation, wave structure, TUTT structure, subtropical cyclone development
- **Active September**
 - 3 typhoons (1 super typhoon, i.e. cat 5)
 - 2 recurvature tracks
- **Successfully addressed all science objectives in field phase**

Firsts

- **Operation of WC-130Js at 31,000 ft altitude except when penetrating a mature TC**
 - Dropped sondes and AXBTs from high altitude
 - Timed with passage of polar-orbiting satellites for satellite intensity validation
- **Systematic targeting operation in the WPAC**
 - Comparison of several methods from a variety of operational and research organizations
 - Multiple aircraft
 - ECMWF/UKMO Data Targeting System
- **First four plane operation in a WPAC TC**
- **First buoy drop in front of a WPAC TC**
 - Two TCs
 - First time a category 5 TC passed over buoys dropped in its path
- **First systematic observations of full extratropical transition process**
 - Multiple aircraft and land-based radar
 - Timed with satellite overpass