Status of P3 Doppler Wind Lidar (P3DWL) data processing and archiving

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TPAERC/TCS08 Data Management Workshop

Presented by
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NPS, Monterey

Data Collection Summary

- P3DWL in the field from August 4 to October 8, 2008
- Total data (ground and airborne) = 171 hours
- Flew 18 missions with TCs as target
  - 118 hours of data
- Additional flights:
  - Calibration of other instruments
  - Ferry flights between bases
  - Ferry flights USA – Guam - USA

General P3DWL instrument performance

- “Operated well when it was important” seems to describe the performance of the system
- Pre-deployment problems with nitrogen purge and GPS/INS were resolved with only a few exceptions.
- Scanner behavior below 10,000’ was acceptable; above 24,000’ it was not functioning properly but could be used for vertical velocity studies (waves and OLEs)

Data related activities

- Compilation of observer's notes complete (Carre', Riemer, Tang, Eleuterio and Emmitt)
- Have reviewed all P3DWL data and prioritized for advanced processing:
  - Wind profiles below and above flight level
  - Vertical stares used for OLE prospecting
  - Vertical stares used for wave spectra and ocean surface features (foam and sprays)

Data archiving

- Original data resides on the “Super Logic” and the P3DWL laptop.
- All data has been backed up on the following:
  - USB 500GB external drive 1
  - USB 500GB external drive 2
  - DVDs
- External drive 1 was sent to Ligon at Army Research Laboratory for use and the making of further copies.

Data Distribution

- Since TPARC/TCS08 P3DWL data has been provided to:
  - Zhaoxia Pu (University of Utah)
  - Ralph Foster (University of Washington)
  - Dave Ligon (Army Research Laboratory)
- Plan is to post a SWA hosted web site where all P3DWL data can be obtained along with operator's notes.

P3DWL Data Inventory

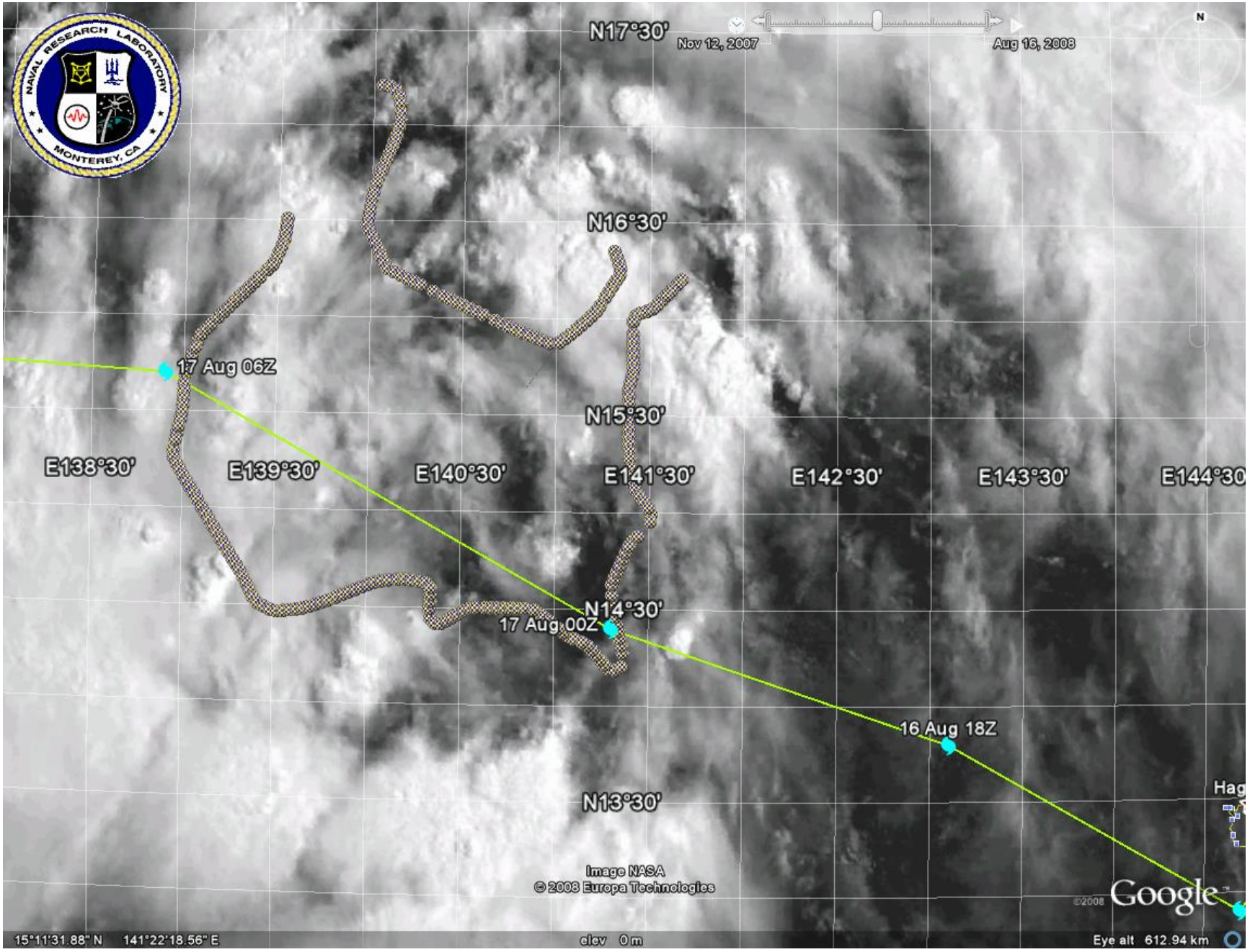
Date (UTC)	Times of Data (UTC)	Mission Goals	Comments
8/5/2008	0935 MDT - 1135 MDT	Ferry Flight from JeffCo, CO to Pt. McGu, CA	
8/5/2008 - 8/6/2008	2023 - 0218	Ferry Flight from Pt. McGu, CA to Kaneohe Bay, HI (Oahu)	Hesitation in Scanner (Ice?)
8/6/2008 - 8/7/2008	2040 - 0550	Ferry Flight from Kaneohe Bay, HI to Andersen AFB, Guam	Hesitation in Scanner (Ice?), Had to Reboot CMIGITS Several Times
8/9/2008	0431 - 0515		Testing CMIGITS on Ground
8/12/2008	0226 - ~ 0400	Calibration Flight between C130 and P3	Testing on Ground, Scanner Stuck, Had to Reboot RAS, Scanner, & Superlogic but Forgot to Set VME Time Again so 2 Hours of Data Was Not Saved
8/13/2008	0455 - ~ 0505	Testing on Ground	Stare Up and Up VAD
8/13/2008 - 8/14/2008	2355 - 0033	Testing/Training on Ground	Up VADs
8/15/2008 - 8/16/2008	2257 - 0414	Mission Flight 1 - Flight into Pre-TC Nuri	Dropsonde Support - Mostly Down VADs
8/16/2008 - 8/17/2008	2205 - 0346	Mission Flight 2 - Flight into Pre-TC Nuri	Dropsonde Support - Mostly Down VADs
8/17/2008 - 8/18/2008	2116 - 0527	Mission Flight 3 - Flight into TD14/TC Nuri	Dropsonde Support - Mostly Down VADs

8/19/2008	0152 - 0220	Testing on CMIGITS Ground	Up VADs
8/26/2008	1803 - 2116	survey flight into TCS025 scheduled, but plane did not take off due to Radar issues	Up stares and VADs on ground, RASP ERROR 7 occurred
8/27/2008 - 8/28/2008	2320 - ~ 0900	Mission Flight 4 - Flight into TCS025	Dropsonde Support - Mostly Down VADs, LasCon power failed during waiting for take off, forgot to set VME time after restart, data available starting at 0059 (during ferry), scanner overotated and stuck on ferry home using dn_20_p3_nadir_05 scan routine
8/28/2008 - 8/29/2008	2110 - 0451	Mission Flight 5 - Flight into TCS025	Dropsonde Support - Mostly Down VADs
9/1/2008 - 9/2/2008	1924 - 0100	Mission Flight 6 - Flight into TCS030	Dropsonde Support - Mostly Down VADs with nadir dwells. Network timeout required reboot of RASP. Forgot to set VME time after reboot, but data times corrected post-flight. Scanner overrotated again.
9/8/2008	0100 - 0600	Mission Flight 7 - Flight into TCS037	Ferry in - Nadir dwells. Alternate between down VADs and nadir dwells at TCS037. 15 min of small nadir angle (scan mode 8) but may be limited by low clouds. Ferry out - Up VADs.
9/9/2008	0204 - 0645	Mission Flight 8 - Flight into TCS039 and TUTT	Alternate between down VADs and nadir dwells with limited excursions using small nadir angle and upward VADs.

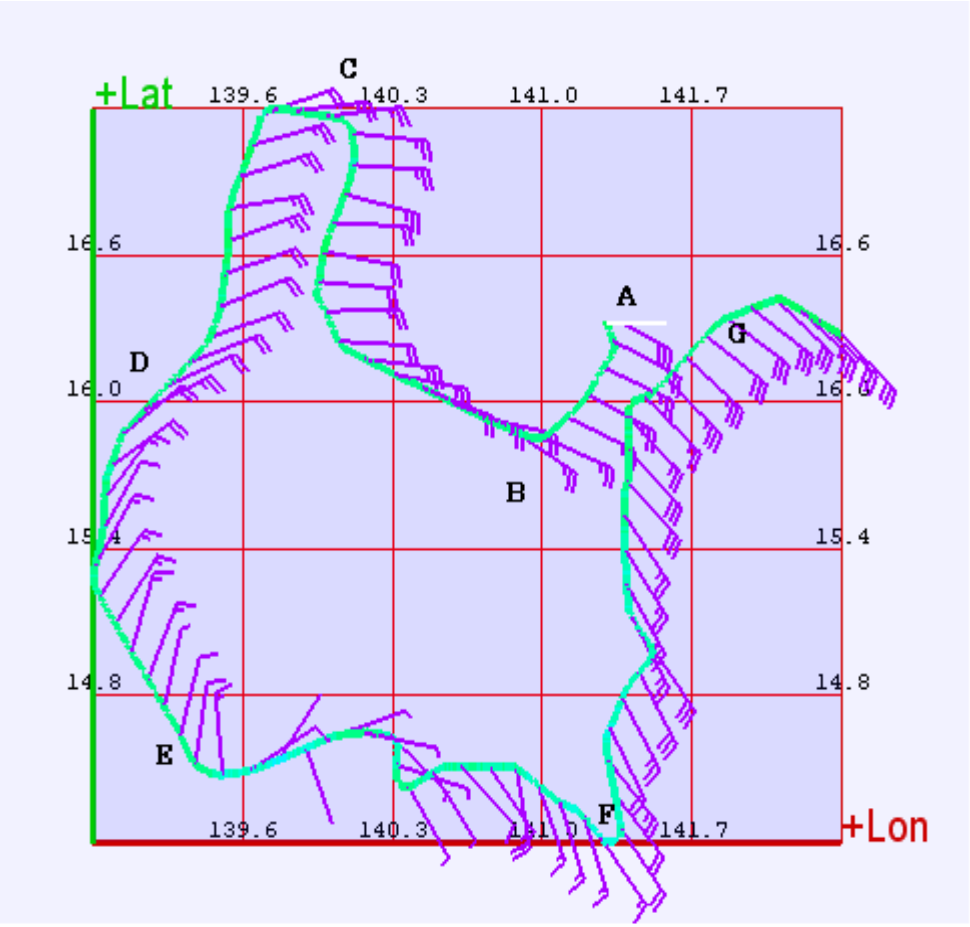
9/9/2008	0204 - 0645	Mission Flight 8 - Flight into TCS039 and TUTT	Alternate between down VADs and nadir dwells with limited excursions using small nadir angle and upward VADs.
9/10/2008 - 9/11/2008	2130 - 0130	Mission Flight 9 - Typhoon Sinlaku	BL Rolls Module - nadir dwells and forward raster. Dropsonde support - down VADs. ERROR 20 occurred but temporary. Scanner overrotation with down VAD (mode 2)
9/13/2008 - 9/14/2008	2050 - 0300	Mission Flight 10 - TSC043	Test decimation value of 3. Mostly nadir stares, downward VADs, and upward VADs. Scanner froze on two occasions. Tested raster elevation angle of -8.
9/16/08- 9/17/08	2045 - 0447	Mission Flight 11 - TCS043 N/NW of Guam and Typhoon Sinlaku	P-3 passed directly over the exposed surface circulation during Sinlaku ET!
9/17/2008 - 9/18/2008	2245 - 0600	Mission 12 - Typhoon Sinlaku	Good day
9/18/2008 - 9/19/2008	2300 - 0710	Mission 13 - Typhoon Sinlaku	All systems OK
9/20/2008	0230 - 0830	Mission 14 - Typhoon Sinlaku	System OK
9/21/2008 - 9/22/2008	2215 - 0553	Mission 15 -Typhoon Haugapit (TCS043)	System OK
9/23/2008 - 9/24/2008	0000 - 9612	Mission 16 - TCS047	System OK
9/24/2008 - 9/25/2008	2000 - 0130	Mission 17 - TS Jangmi (TCS047)	Some CMIGT problems, otherwise OK
9/25/2008 - 9/26/2008	2200 - 0140	Calibration Flight between C130 and P3	Training flight for replacement operator
9/26/2008 - 9/27/2008	2000 - 0500	Mission 18 - Typhoon Jangmi	

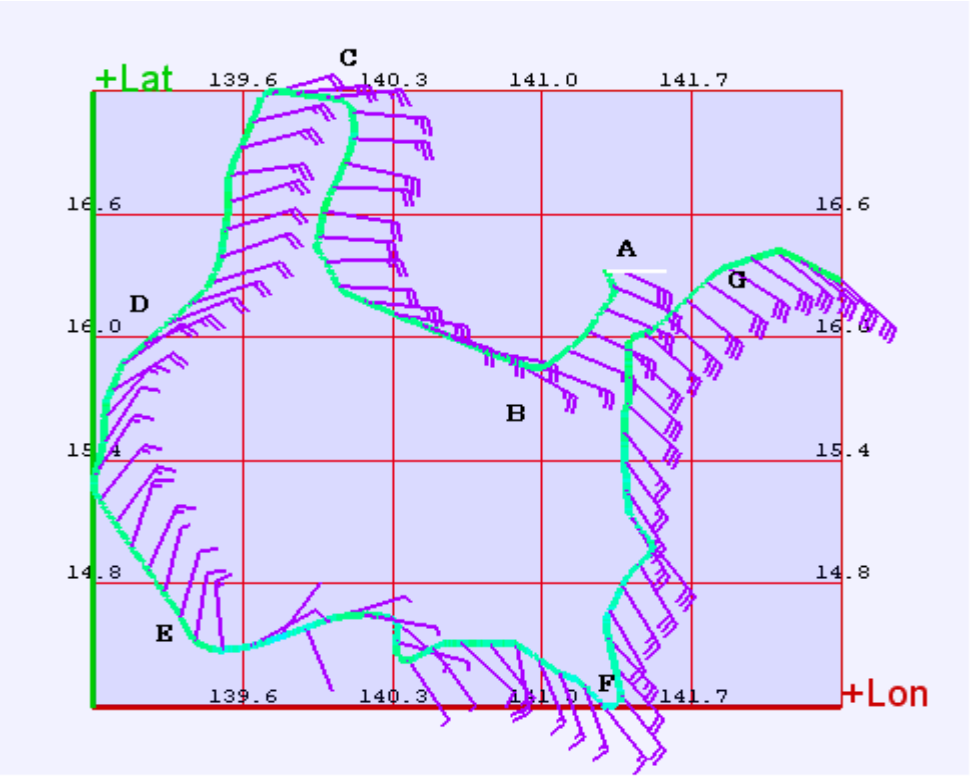
Example of P3DWL observations near Typhoon

- Tropical cyclone Nuri
- August 16 -17 , 2008 flight
- Flight level ~3000 meters
- Downward scanning for wind profiles


NAVAL RESEARCH LABORATORY
MONTEREY, CA
N17°30'
Nov 12, 2007
Aug 16, 2008
N16°30'
17 Aug 06Z
N15°30'
E138°30'
E139°30'
E140°30'
E141°30'
E142°30'
E143°30'
E144°30
N14°30'
17 Aug 00Z
16 Aug 18Z
N13°30'
Hag
Image NASA
© 2008 Europa Technologies
©2008 Google
15°11'31.88" N 141°22'18.56" E
elev 0 m
Eye alt 612.94 km

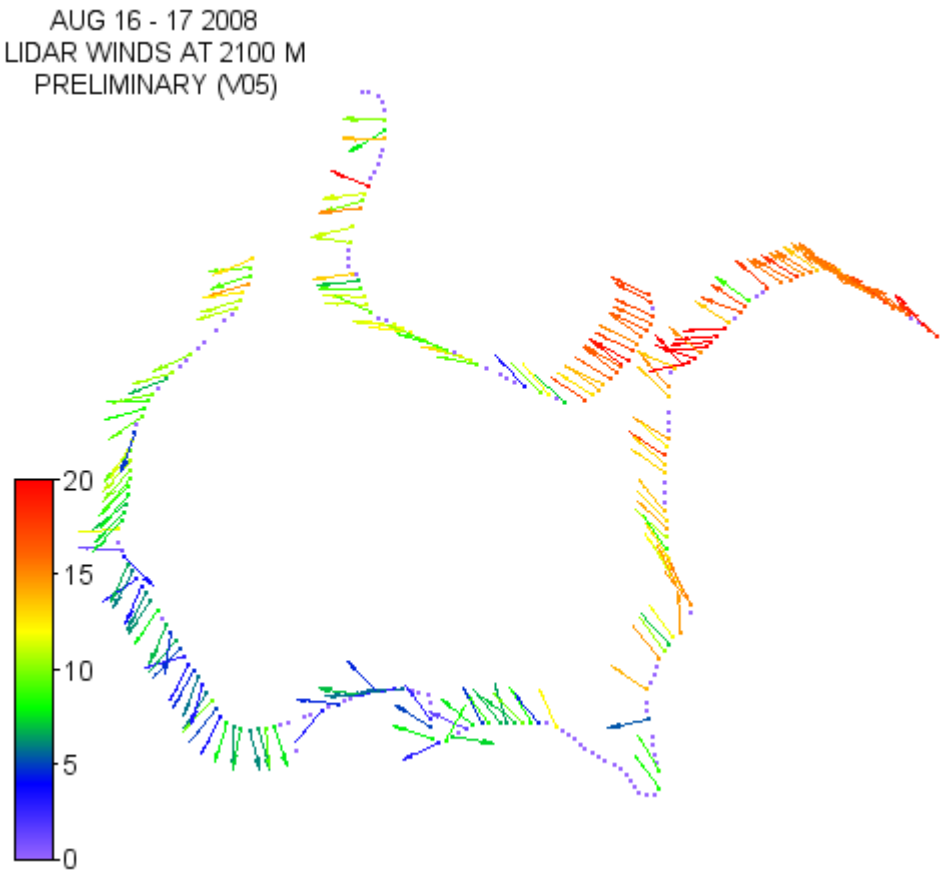
Flight level winds from P3



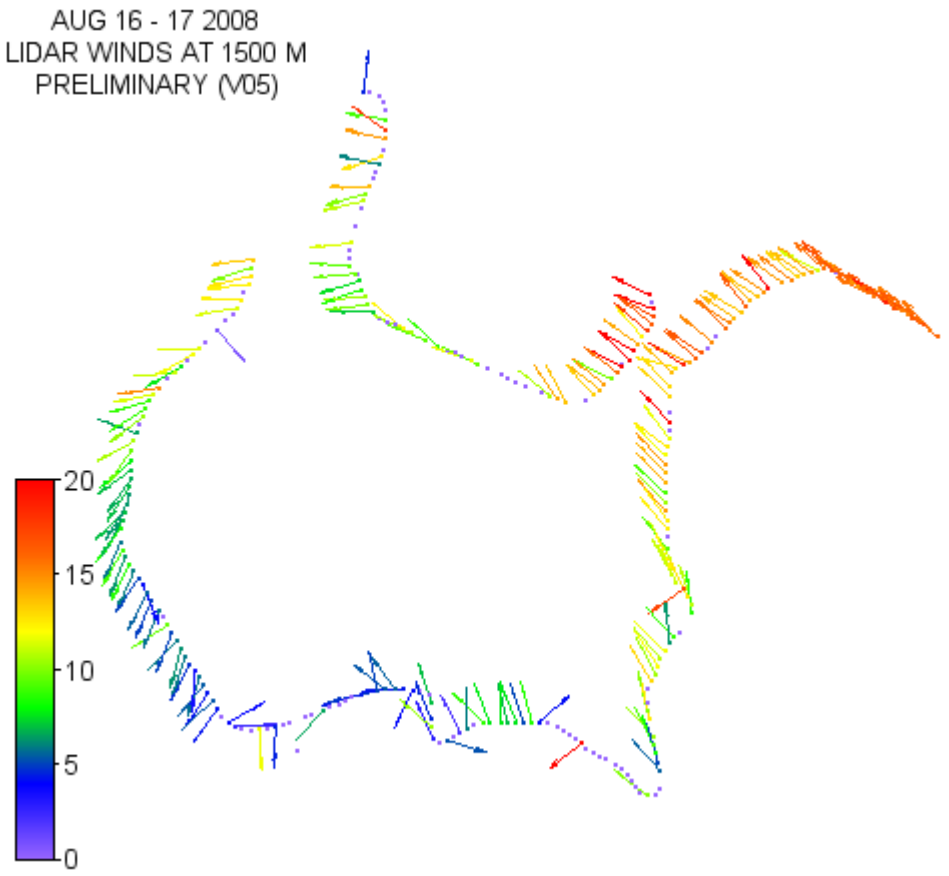


The above plot shows the flight track from 8/16 23:50 (point A) through 8/17 02:40 (end of track past point G). Points B – G represent the location every half hour, starting at 8/18 0000 UTC (B). The P3 crossed the center of circulation or trough axis between 0130 and 0200 UTC (points E and F), as can be seen from the wind shift (N on the west side, SE on the east side). It appears that a full wind barb represents 5 m/s and a half barb is 2.5 m/s. Thus, the strongest flight level winds of about 15 – 17.5 m/s occur very early in the flight segment (near point A) and then in the final segment from F through G, i.e. well away from the center. Flight level was about 2600 m MSL.

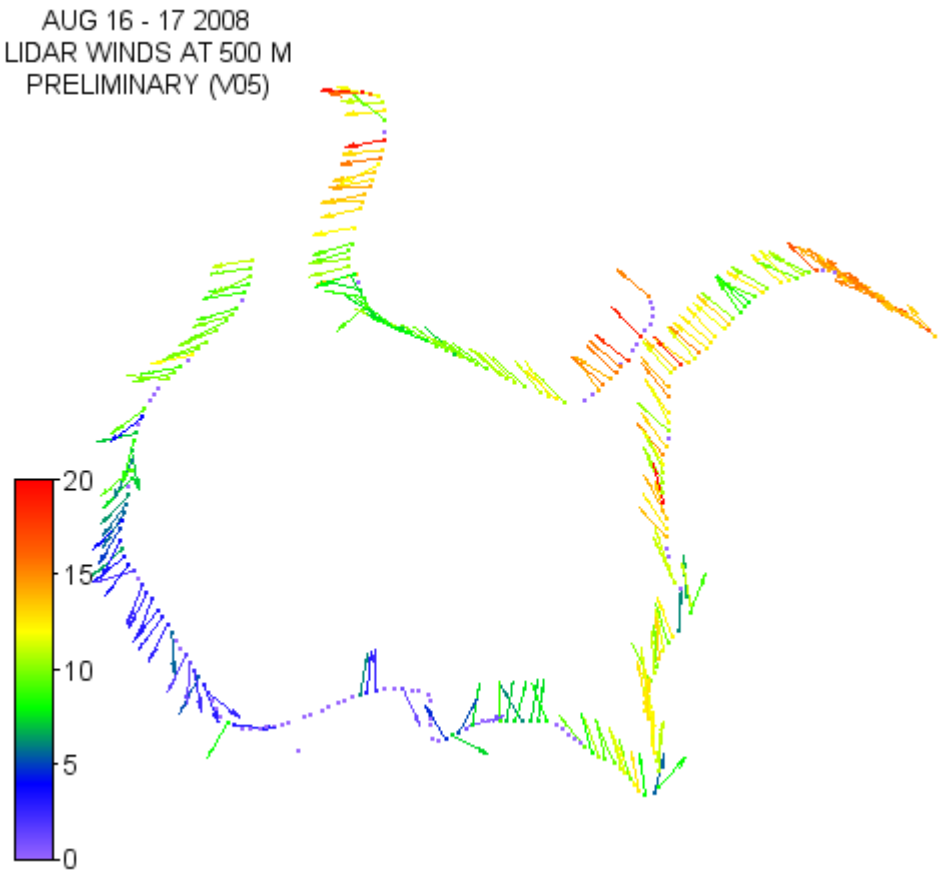
P3DWL winds at 2100 M



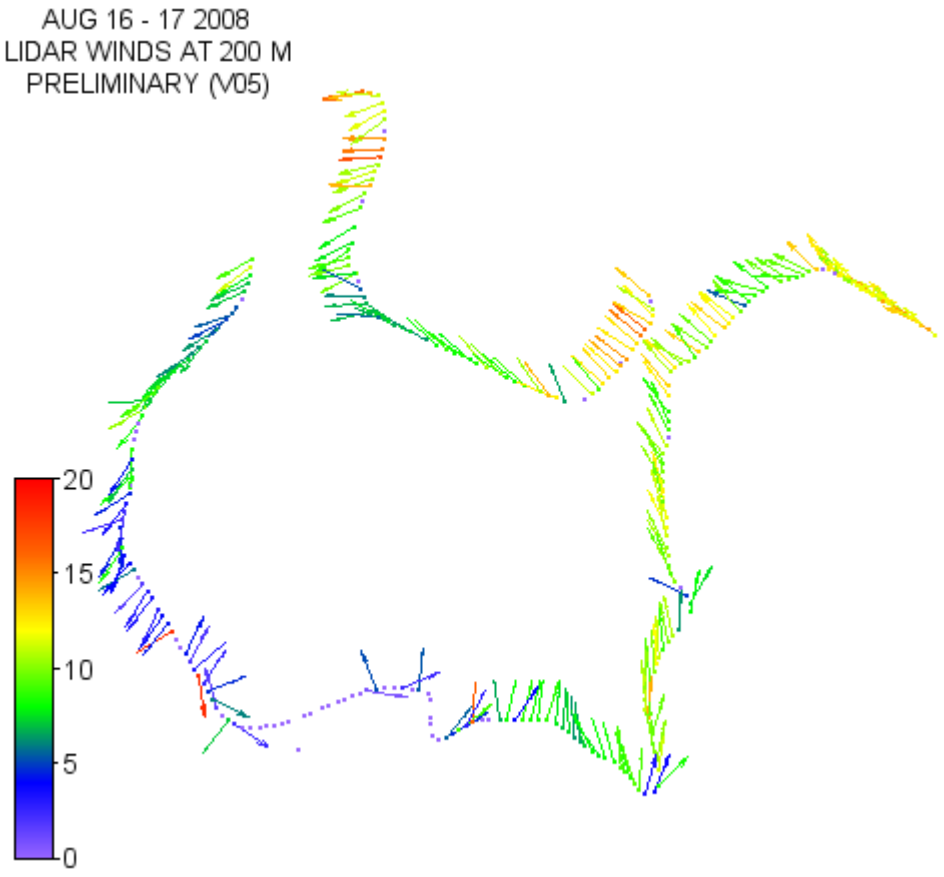
P3DWL winds at 1500 M



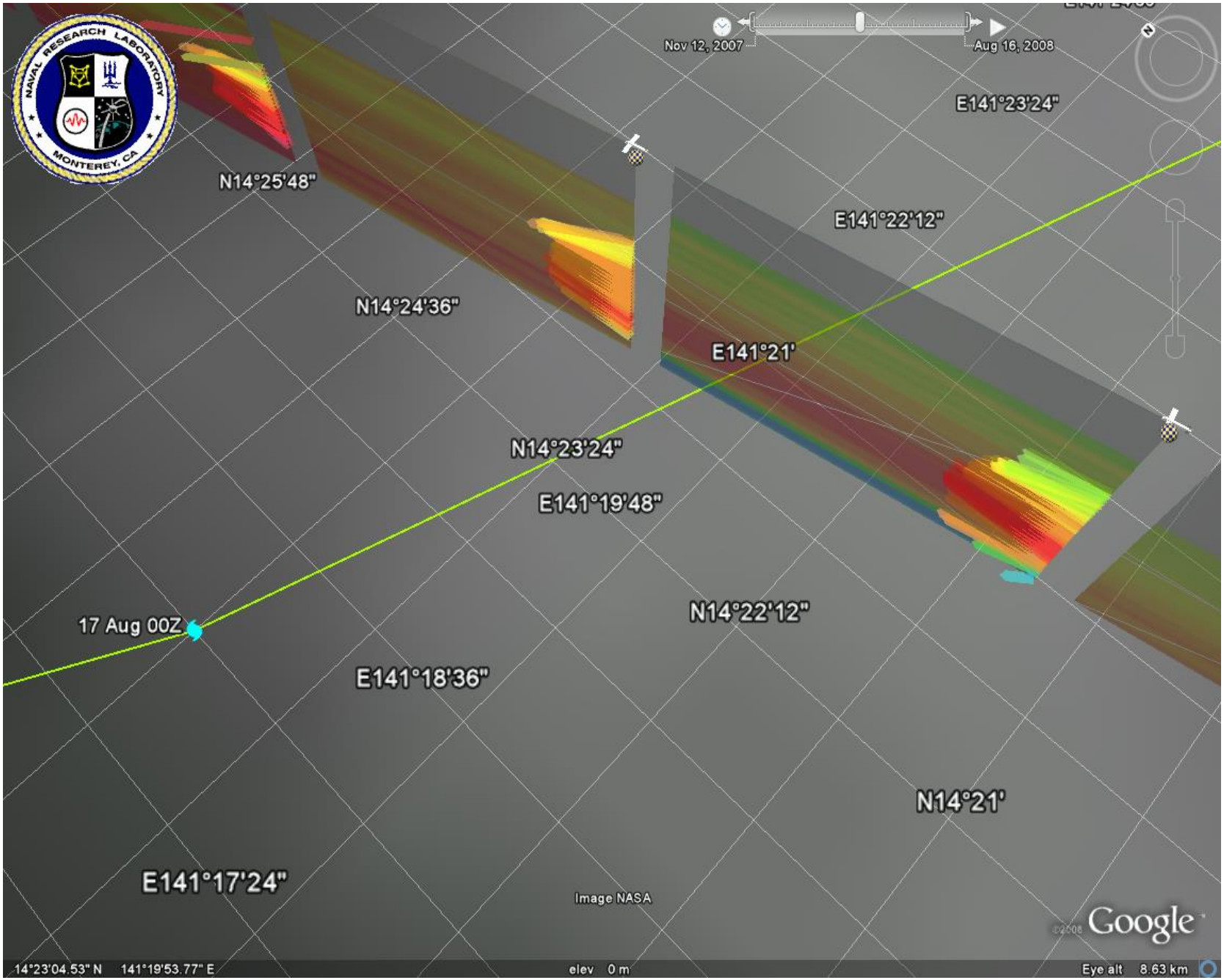
P3DWL winds at 500 M

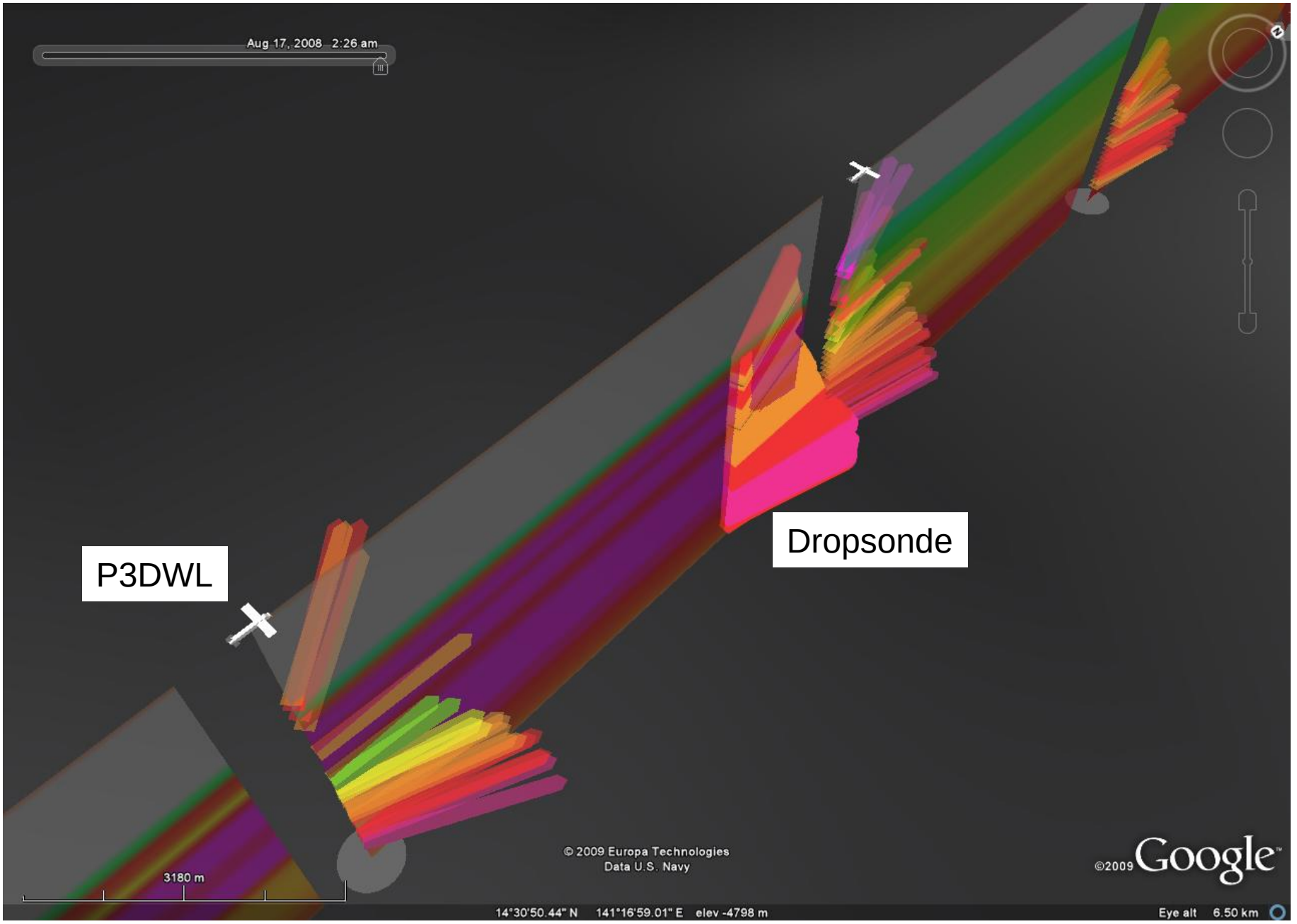


P3DWL winds at 200 M



Overlay of P3DWL wind profiles on Google Earth maps

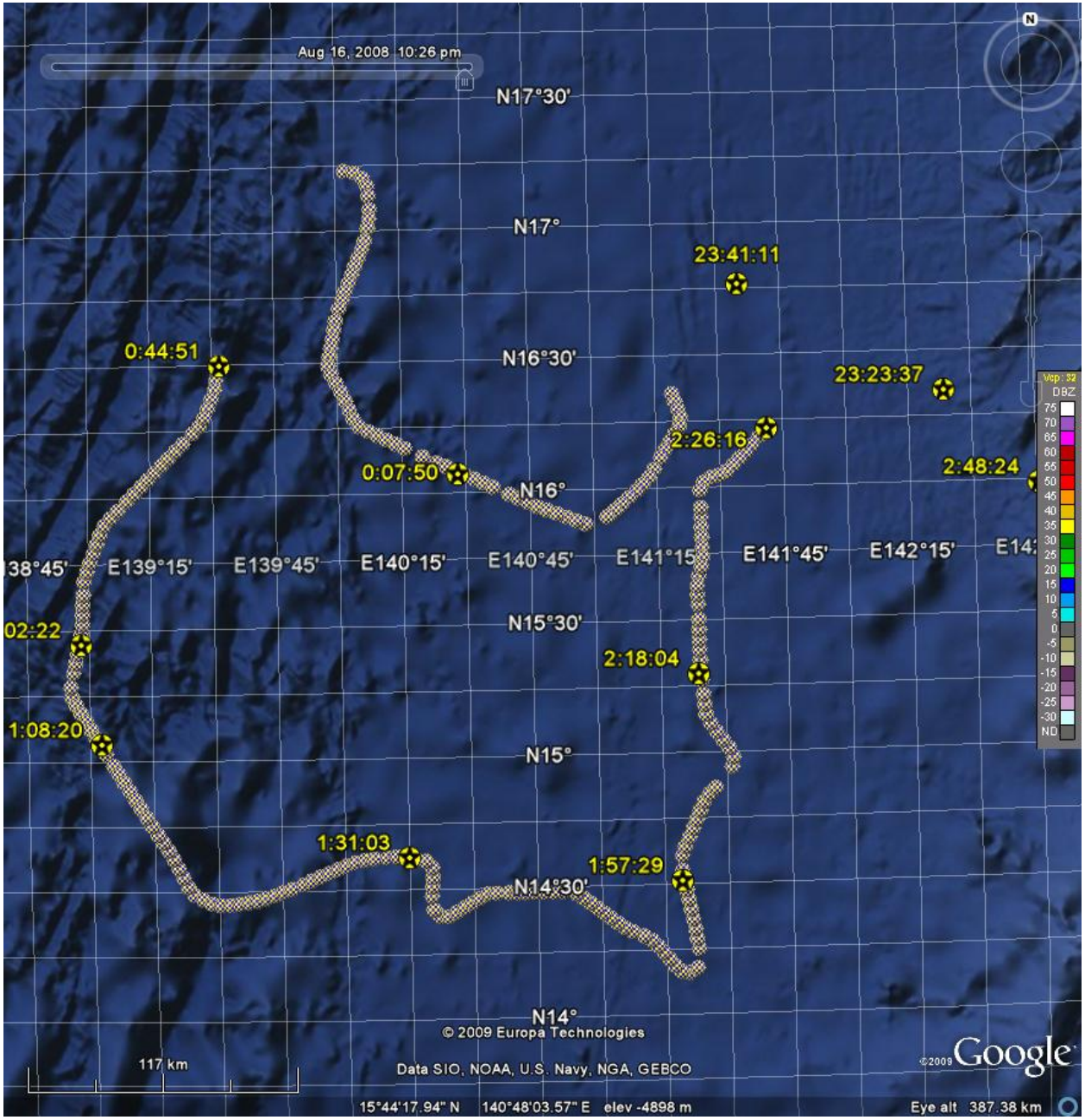

Nov 12, 2007
Aug 16, 2008
E141°23'24"
N14°25'48"
E141°22'12"
N14°24'36"
E141°21'
N14°23'24"
E141°19'48"
17 Aug 00Z
N14°22'12"
E141°18'36"
N14°21'
E141°17'24"
Image NASA
Google
14°23'04.53" N 141°19'53.77" E
elev 0 m
Eye alt 8.63 km

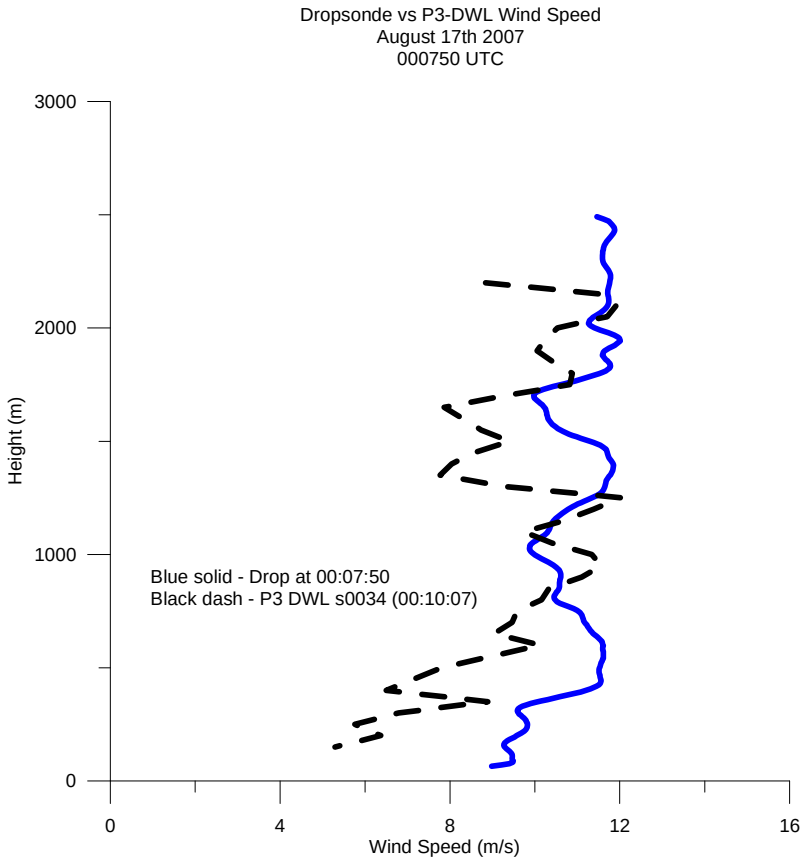

Aug 17, 2008 2:26 am
P3DWL
Dropsonde
3180 m
© 2009 Europa Technologies
Data U.S. Navy
©2009 Google
14°30'50.44" N 141°16'59.01" E elev -4798 m
Eye alt 6.50 km

Dropsondes vs. P3DWL wind profiles

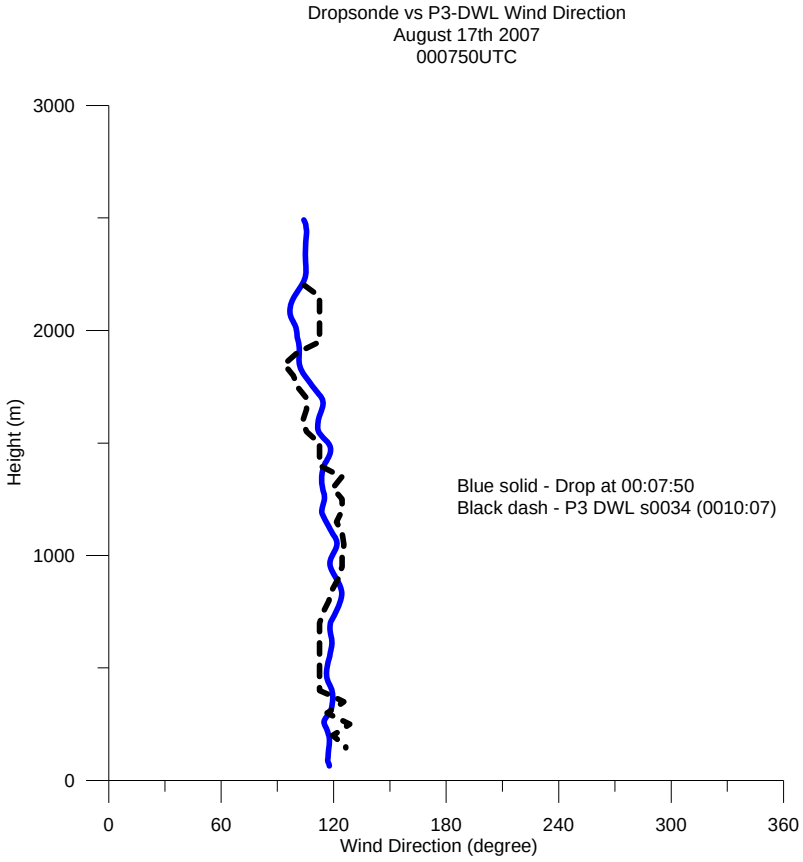
Dropsonde Comparisons

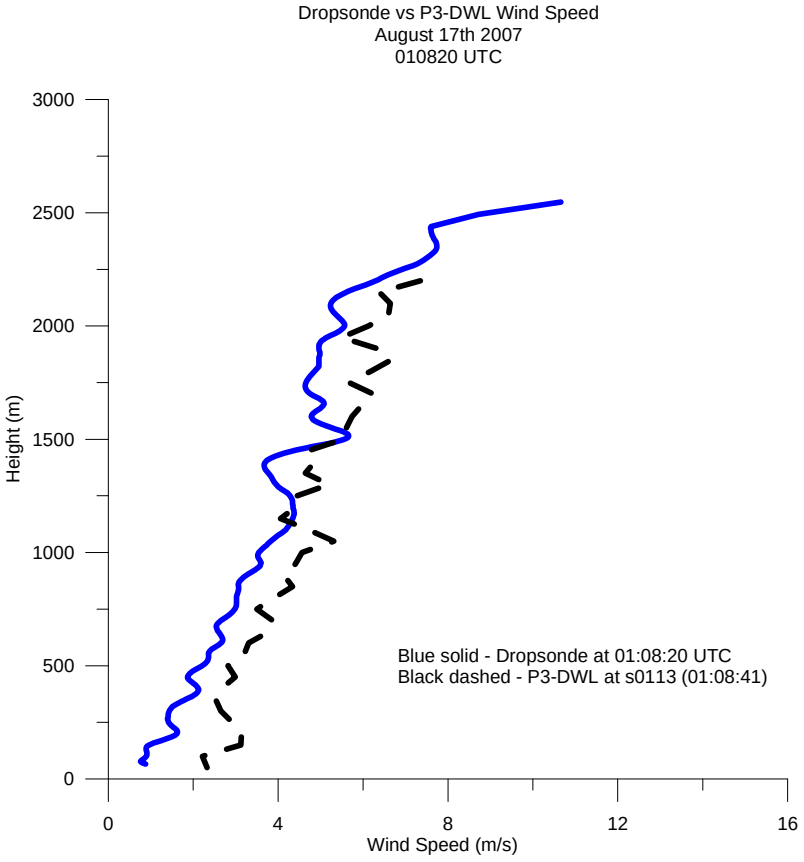
- Using NCAR data, we have begun a profile by profile comparison with the P3DWL profiles
  - Nearest neighbor used for “best” comparison
  - Plus/minus 10 P3DWL profiles for measure of representativeness of dropsondes
- Planning to compare all dropsondes taken during P3DWL operations.


Aug 16, 2008 10:26 pm
N17°30'
N17°
23:41:11
0:44:51
N16°30'
23:23:37
2:26:16
0:07:50
N16°
2:48:24
E139°15'
E139°45'
E140°15'
E140°45'
E141°15'
E141°45'
E142°15'
02:22
N15°30'
2:18:04
1:08:20
N15°
1:31:03
1:57:29
N14°30'
N14°
© 2009 Europa Technologies
117 km
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
©2009 Google
15°44'17.94" N 140°48'03.57" E elev -4898 m
Eye alt 387.38 km

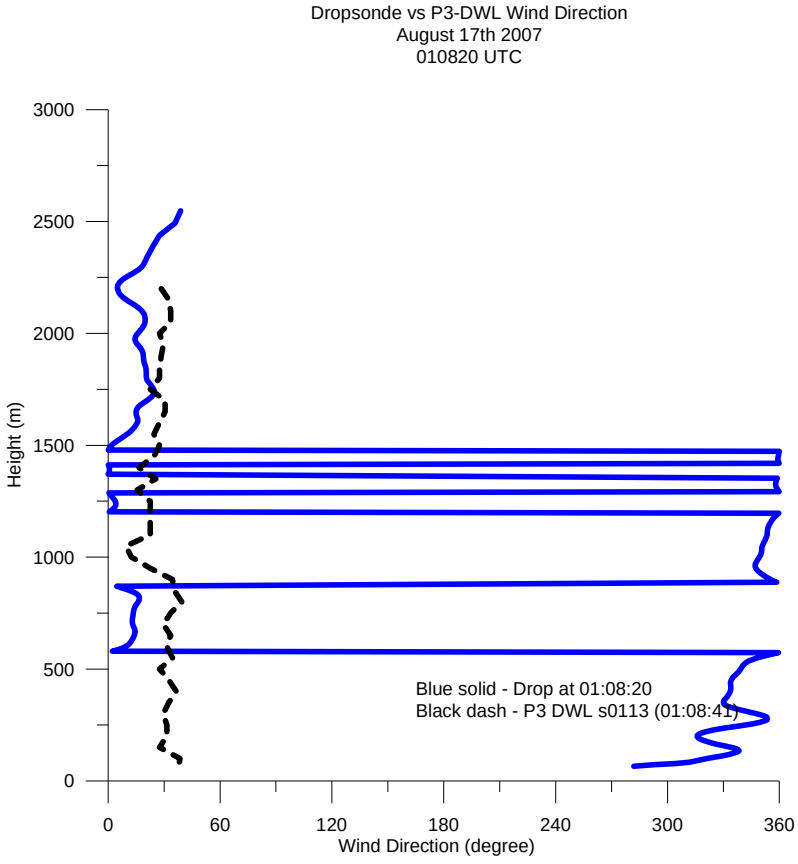


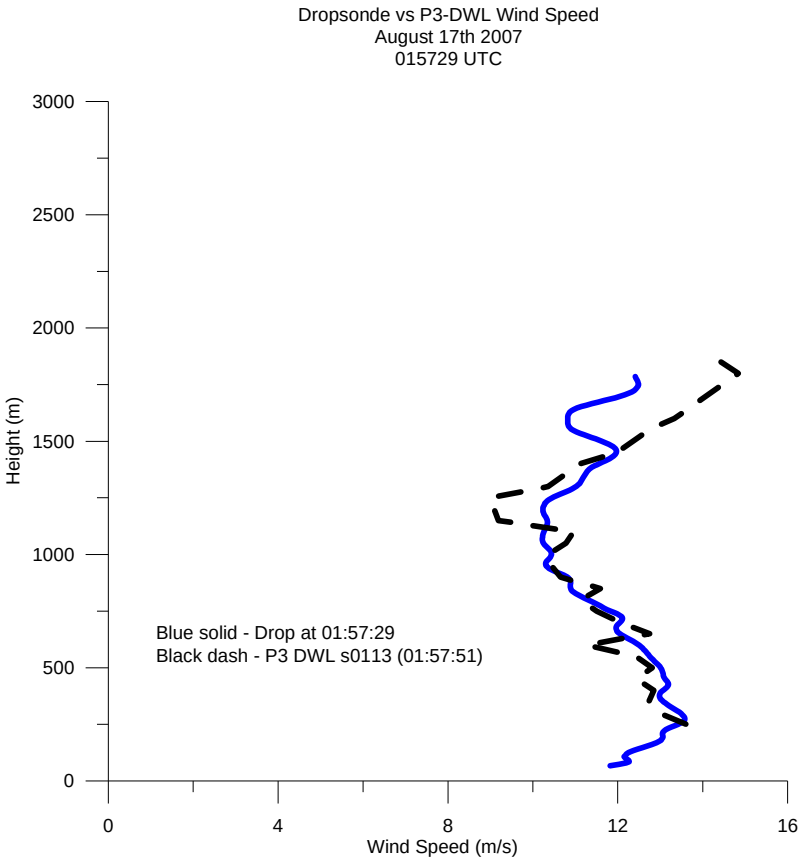
Drop@ 00:07:50
P3DWL@ 00:10:07



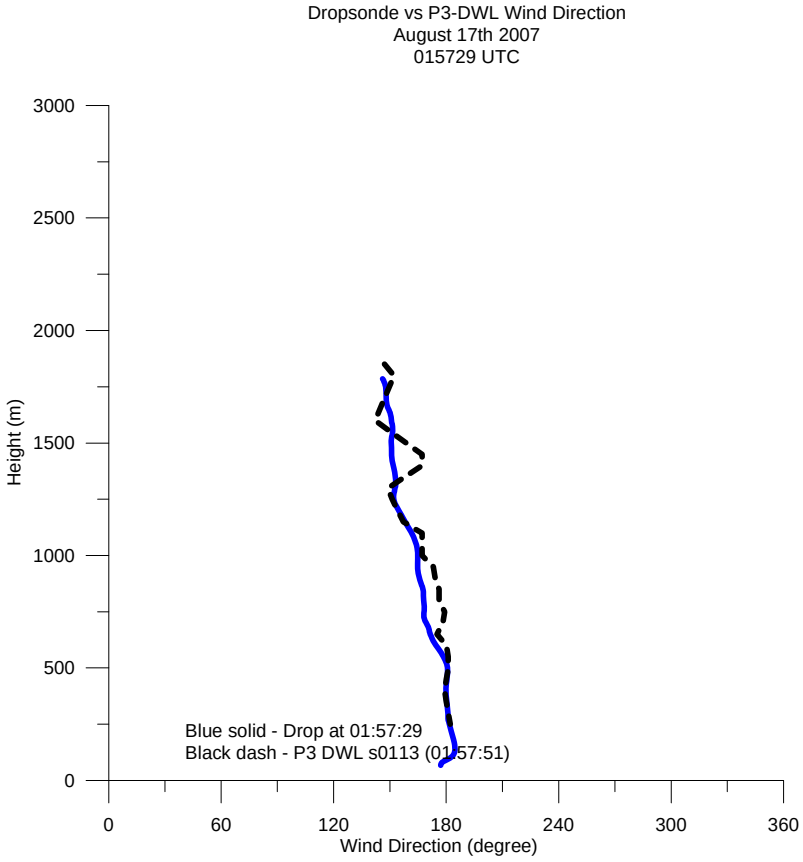


Drop @ 01:08:20
P3DWL@ 01:08:41





Drop@ 01:57:29
P3DWL@ 01:57:51



Preliminary P3DWL impact study using the WRF model and 3DVAR

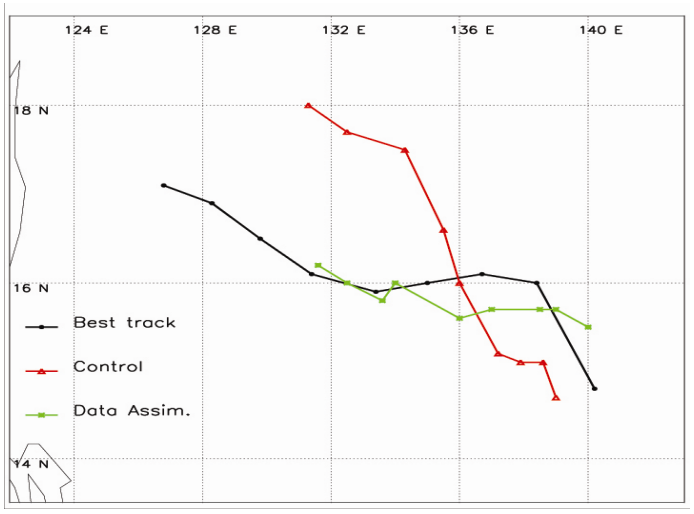
- First look P3DWL data provided to Zhaoxia Pu January, 2009
  - ~ 300 profiles from one circuit around Nuri
- Used 3DVAR to assimilate into WRF
- Found significant impact on track and intensity forecasts

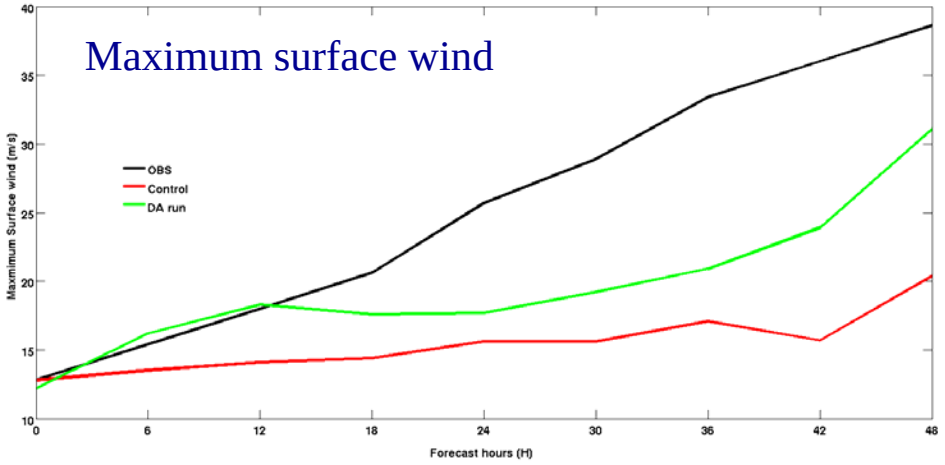
Impact of Doppler Wind Lidar Profiles on Numerical Simulation of Typhoon Nuri's Early intensification: Preliminary Results

Zhaoxia Pu, ***Department of Atmospheric Sciences, University of Utah***

Model: Mesoscale community Weather Research and Forecasting (WRF) model
Data: Doppler wind Lidar (DWL) profiles during 0000UTC –0200 UTC 17 August 2008
(DWL data provided by Dr. G. David Emmitt, Simpson Weather Associates, Inc)
Data Assimilation System: WRF 3DVAR
Forecast Period: 48-h forecast; 0000UTC 17 August 2008 --- 0000UTC 19 August 2008

Data impact: Control vs. Data assimilation (DA run)





- **Assimilation of DWL profiles eliminated the northern bias of the simulated storm track although the storm moves slowly.**

- **Assimilation of DWL profiles resulted in a stronger storm that is more close to the actual intensity of the storm.**