Air-Sea Interaction during active and suppressed phases of the MJO

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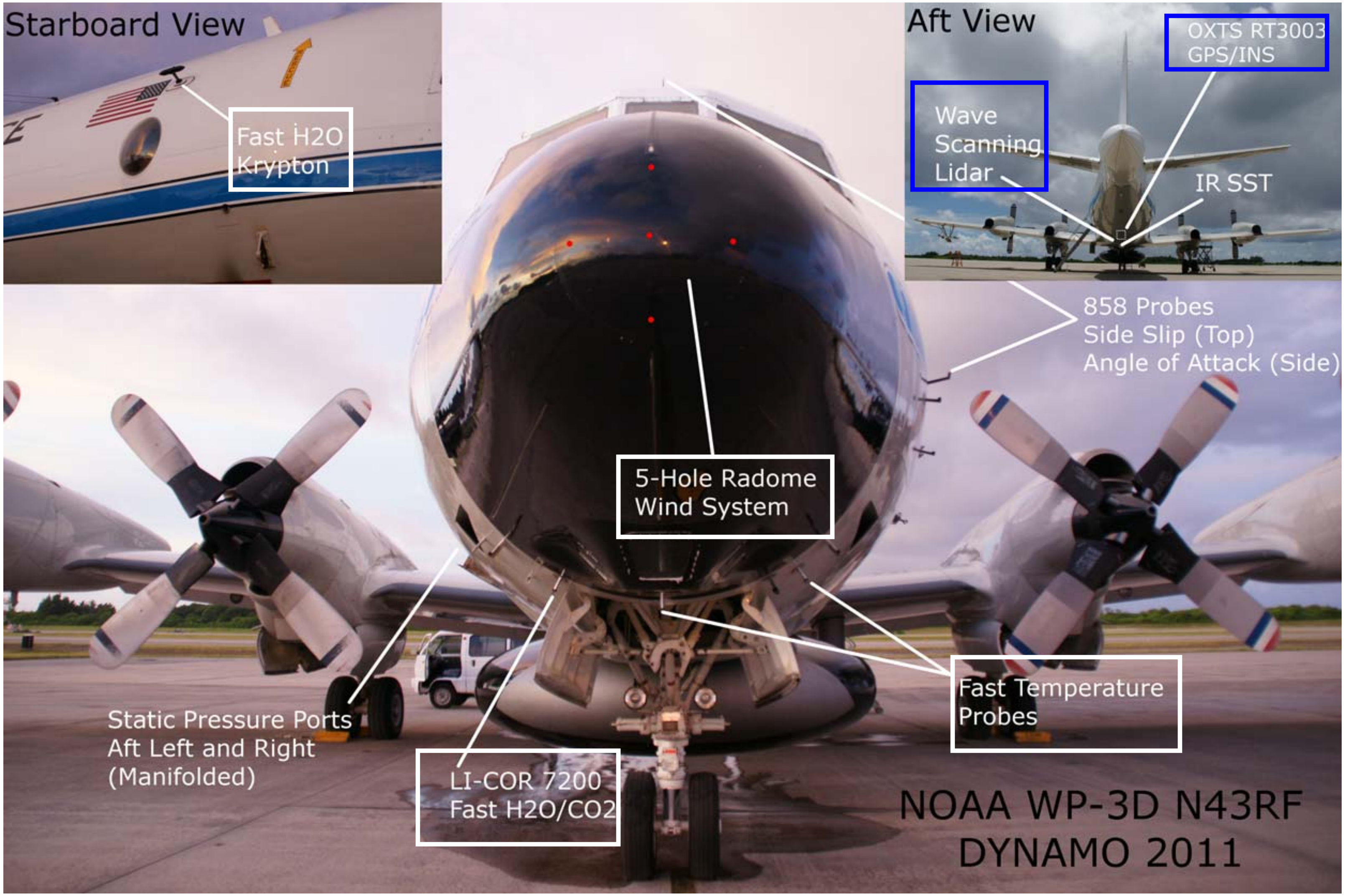
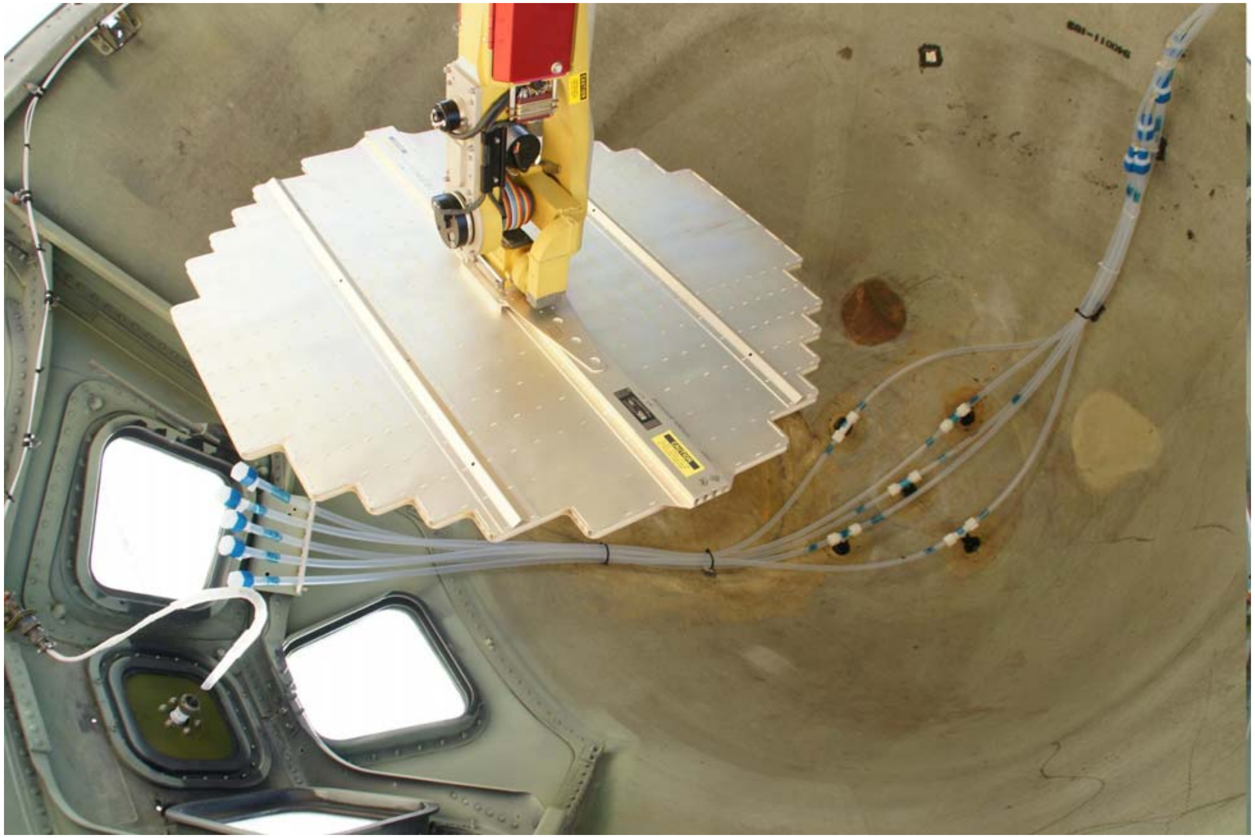
UCI Instruments for DYNAMO



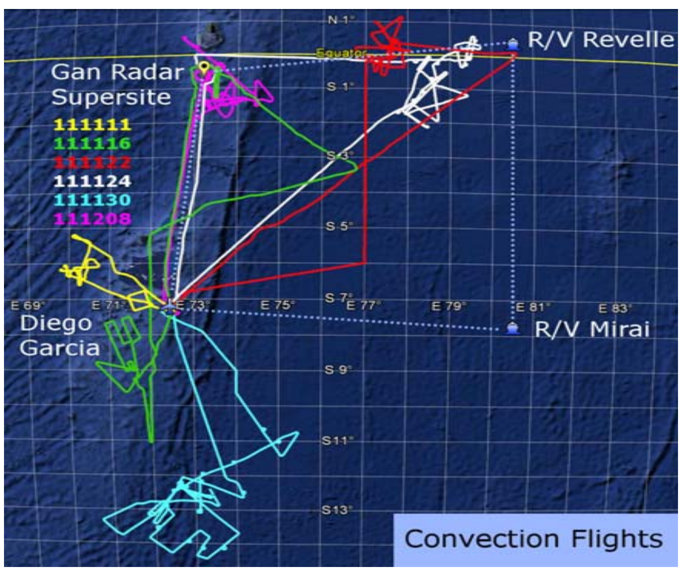
New radome plumbing, effectively traps clouds (or rain) liquid water preventing it from obstructing the pressure xducers lines. Zero water-related failure in DYNAMO.



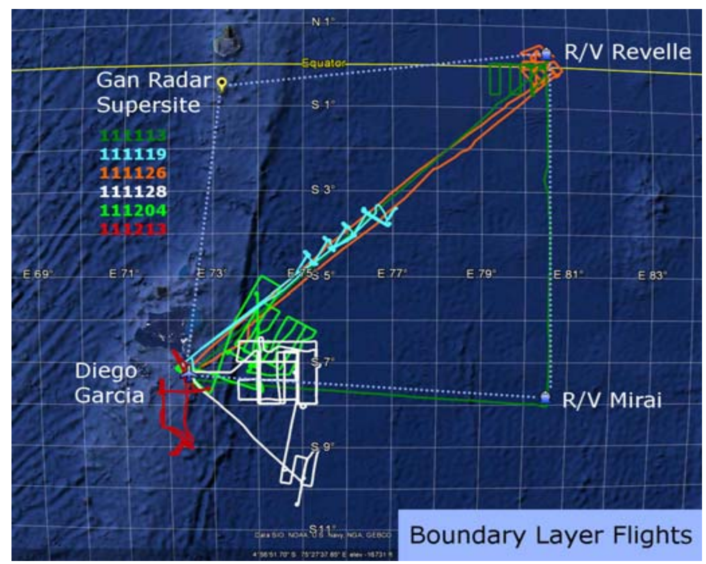
DYNAMO NOAA WP-3D N43RF	November 11 - December 13 2011								UTC Date			
	11/11	11/13	11/16	11/19	11/22	11/24	11/26	11/28	11/30	12/04	12/08	12/13
Instrument Flight	RF 01	RF 02 *	RF 03	RF 04	RF 05	RF 06	RF 07 *	RF 08	RF 09 *	RF 10	RF 11	RF 12
Total Temperature Thermistor												
Rosemount Temperature												
LI-COR 7200 CO2												
LI-COR 7200 Humidity												
Mod. Krypton Hygrometer												
Pitch Angle Rate Sensor												
Radome Gust System												
OXTS RT3003												
OXTS Base Station												
RIEGL LMS Q240i												
Heitronics IR SST												

Legend

UCI	Operational	Some data	No data	* NOAA DATA Gaps
NOAA AOC	Convection Mission		Boundary Layer Mission	



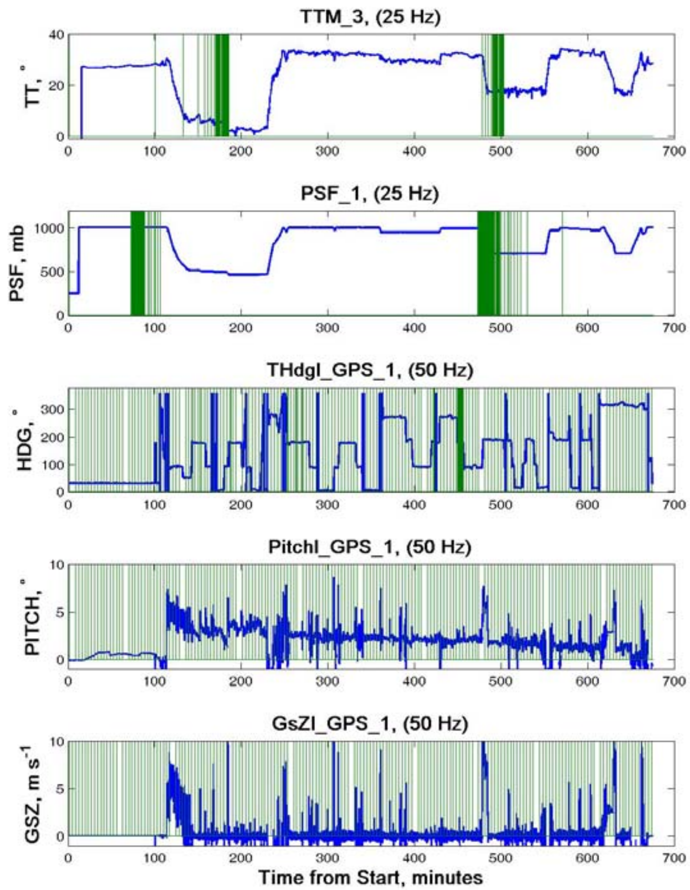
Convection Flights



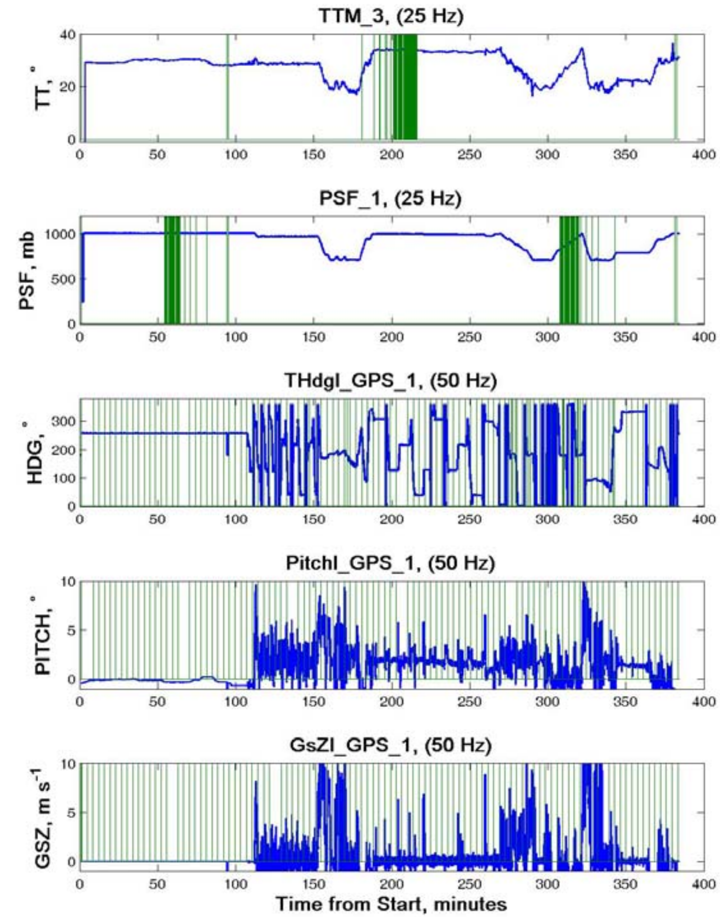
Boundary Layer Flights

High (Multi-rate) Data from NOAA/AOC New Data System
Not QCed and Not Processed by AOC

Nov 28, 2012



Dec 13, 2012



WINDS

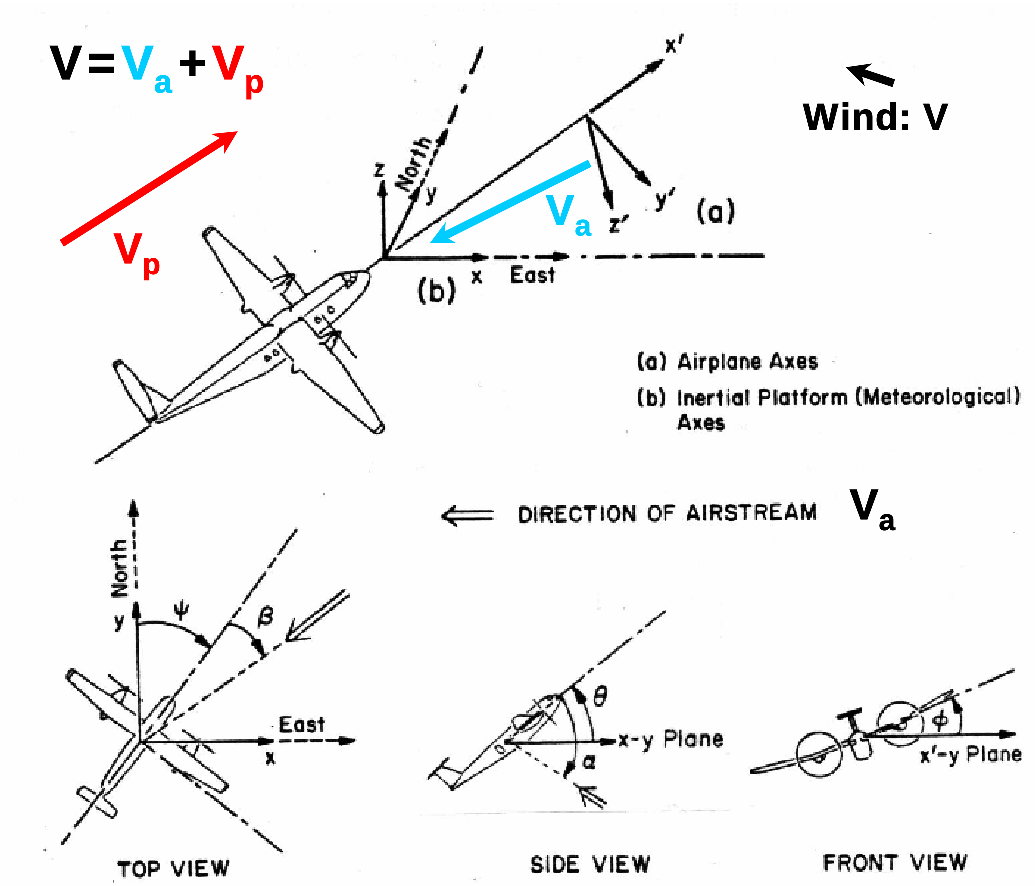


Figure adapted from D.H. Lenschow and P. Spyers-Duran, NCAR/RAF Bulletin 23

$$u = u_p - U_a D \times [\sin\psi \cos\theta + \tan\beta(\cos\psi \cos\phi + \sin\psi \sin\theta \sin\phi) + \tan\alpha(\sin\psi \sin\theta \cos\phi - \cos\psi \sin\phi)] - L(\dot{\theta} \sin\theta \sin\psi - \dot{\psi} \cos\psi \cos\theta)$$

$$v = v_p - U_a D \times [\cos\psi \cos\theta - \tan\beta(\sin\psi \cos\phi - \cos\psi \sin\theta \sin\phi) + \tan\alpha(\cos\psi \sin\theta \cos\phi + \sin\psi \sin\phi)] - L(\dot{\psi} \sin\psi \cos\theta + \dot{\theta} \cos\psi \sin\theta),$$

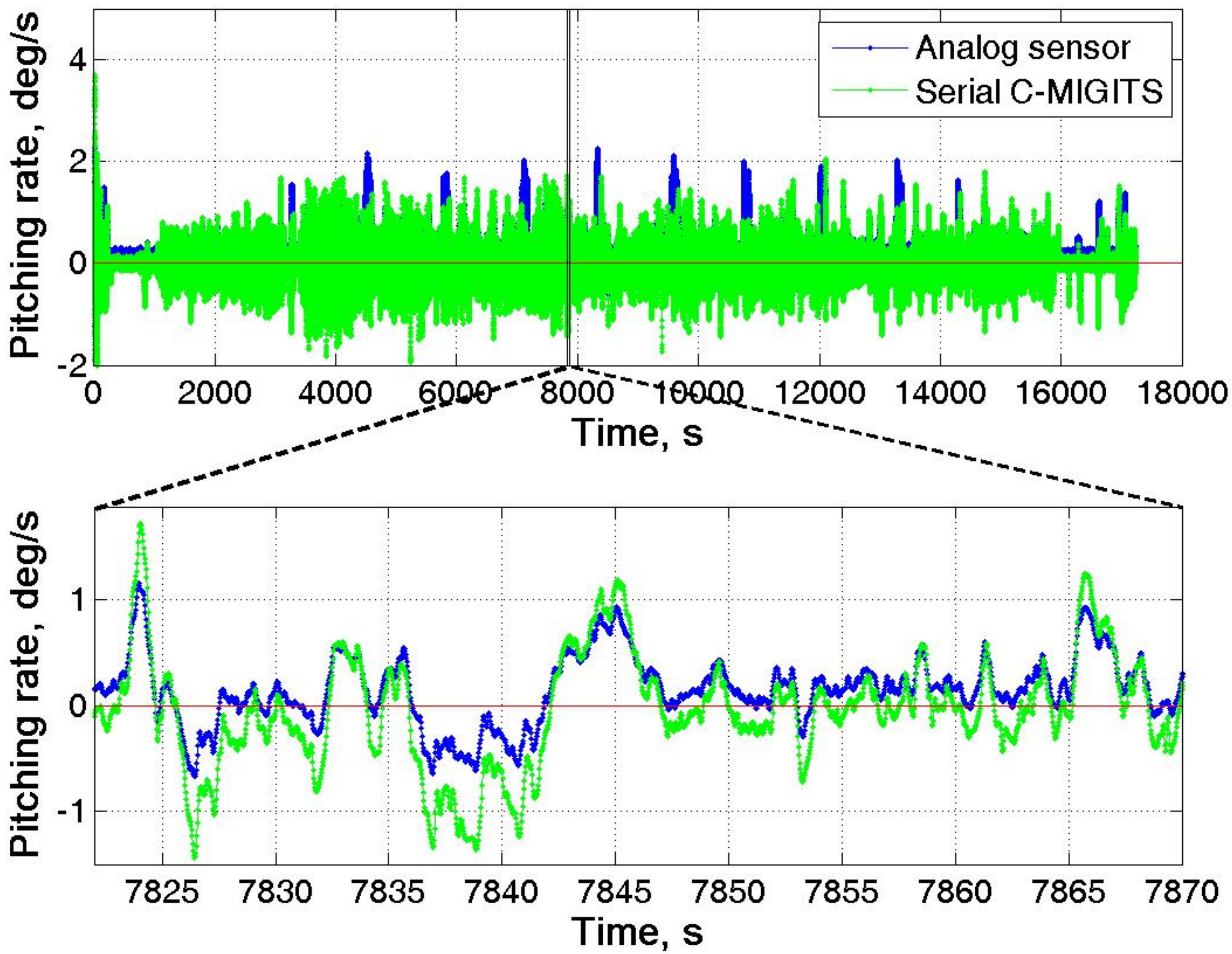
$$w = w_p - U_a D[\sin\theta - \tan\beta \cos\theta \sin\phi - \tan\alpha \cos\theta \cos\phi] + L\dot{\theta} \cos\theta$$

where u_p and v_p are the east and north aircraft velocity components, respectively; U_a is the true airspeed; α, β, θ, ϕ, and ψ are the aircraft attack, sideslip, pitch, roll, and true heading angles, respectively; L is the distance separating the INS and gust probe along the aircraft's center line; $D = (1 + \tan^2\alpha + \tan^2\beta)^{-1/2}$; and $\dot{\psi} = d\psi/dt$ and $\dot{\theta} = d\theta/dt$; w_p is the aircraft vertical velocity.

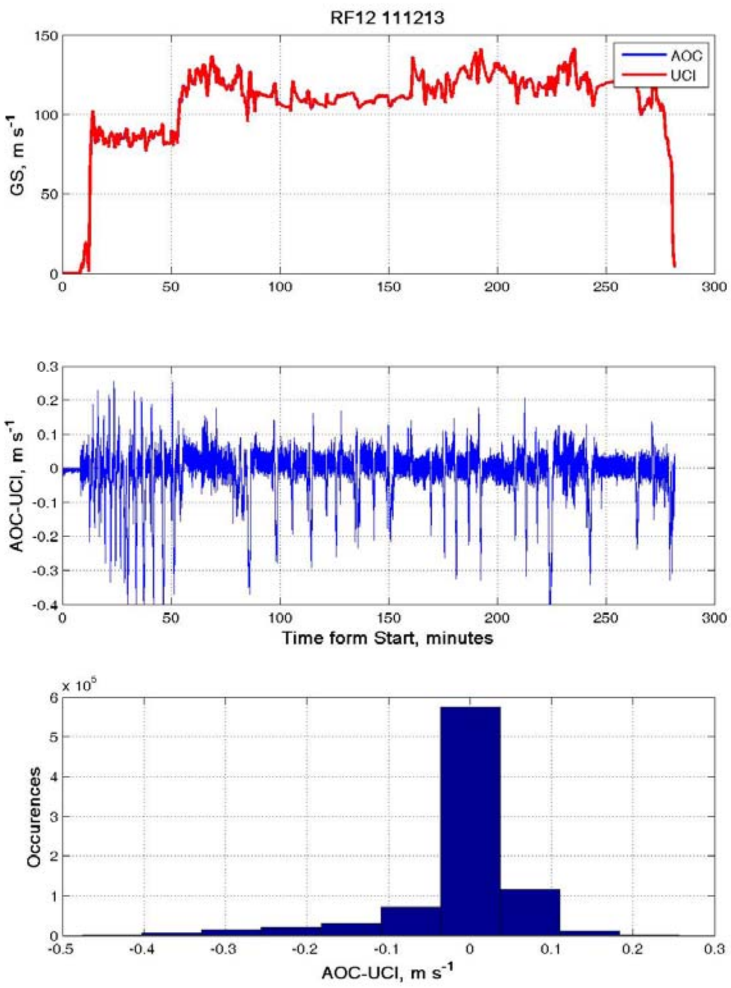
Serial data from INS/GPS C-MIGITS III unit.

Analog data (5-port radome gust system, P_s and T_r)

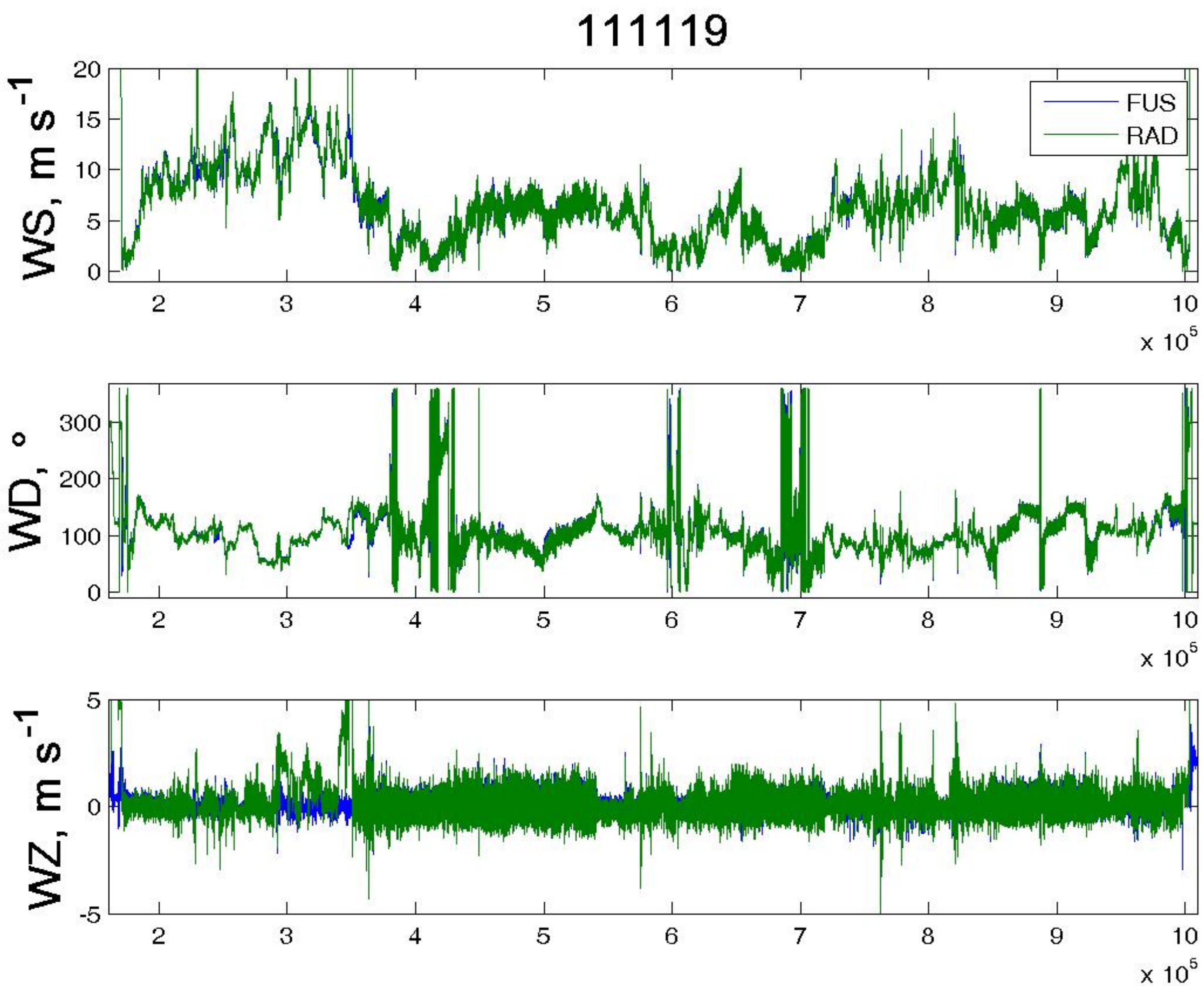
Analog-Serial Synchronization



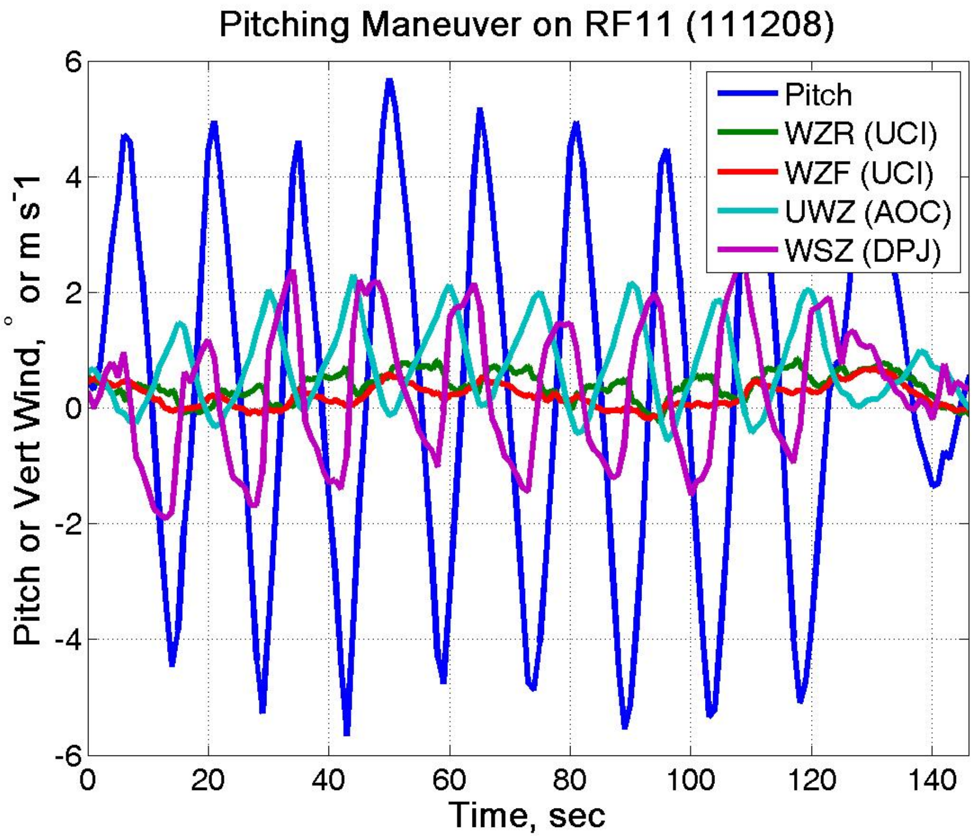
Ground Speed AOC vs. UCI



UCI Winds


111119
WS, m s-1
20
15
10
5
0
2
3
4
5
6
7
8
9
10
x 10^5
FUS
RAD
WD, °
300
200
100
0
WZ, m s-1
5
0
-5

Vertical Wind Critical Test



Rule of thumb: σ_w/σ_{Vz} <10% is acceptable

WSZ(DPJ): 18%; UWZ(AOC): 11%; WZR(UCI): 4%; WZF(UCI): 3%;

Air-Sea Fluxes

$$\boldsymbol{\tau} = -\rho(\overline{uw}\boldsymbol{i} + \overline{vw}\boldsymbol{j}) = \rho C_{d10} U_{10}^2$$

$$H_s = \rho C_p \overline{w\theta} = \rho C_p C_H U_{10}(\Theta_s - \Theta_{10})$$

$$E = \overline{w\rho_v} = C_E U_{10}(\rho_{vs} - \rho_{v10})$$

$$H_l = h_{fg} E$$

High-Rate Data Status

High-Rate Data: P PF PF P PF PF PF PF

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Legend

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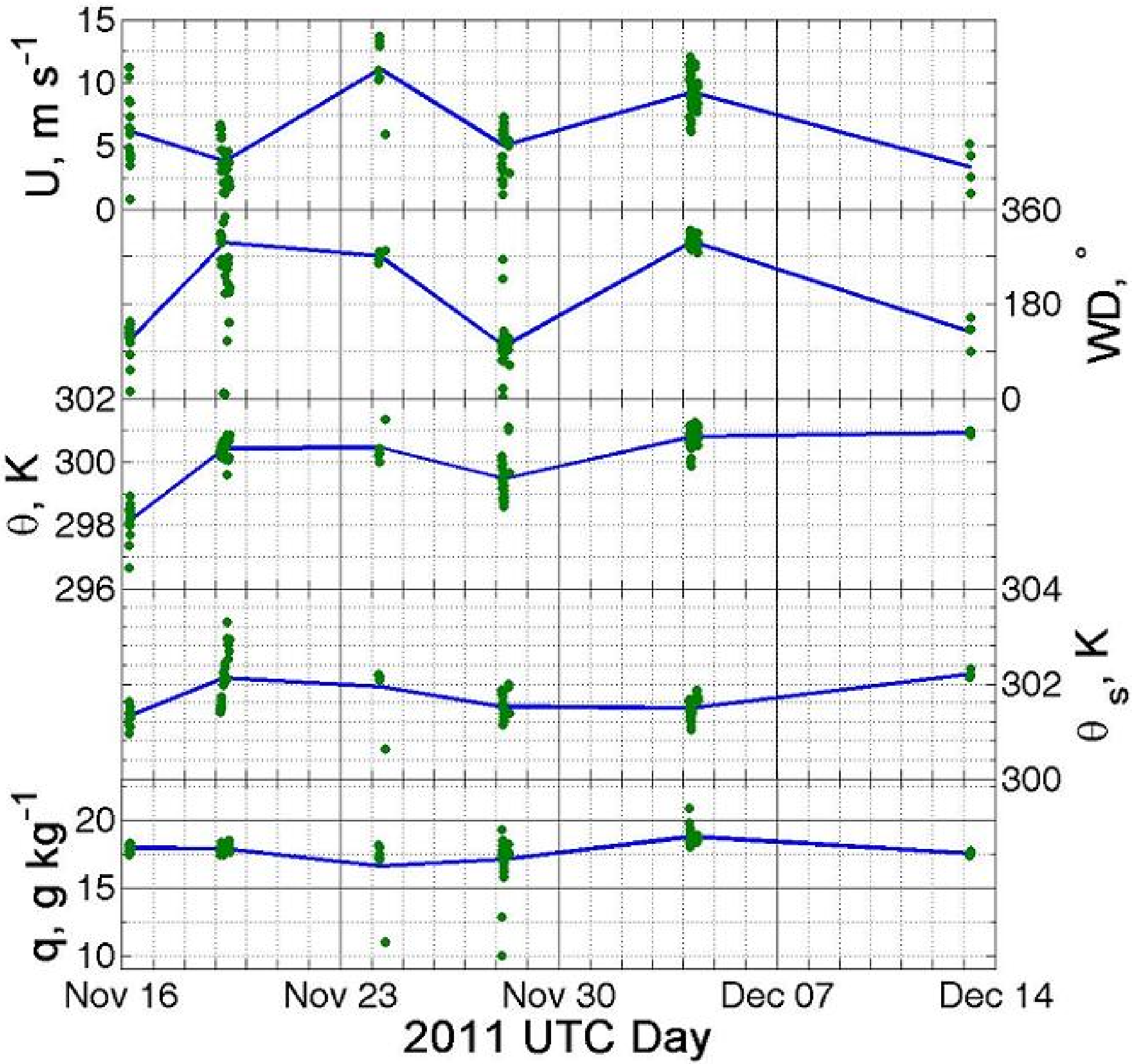
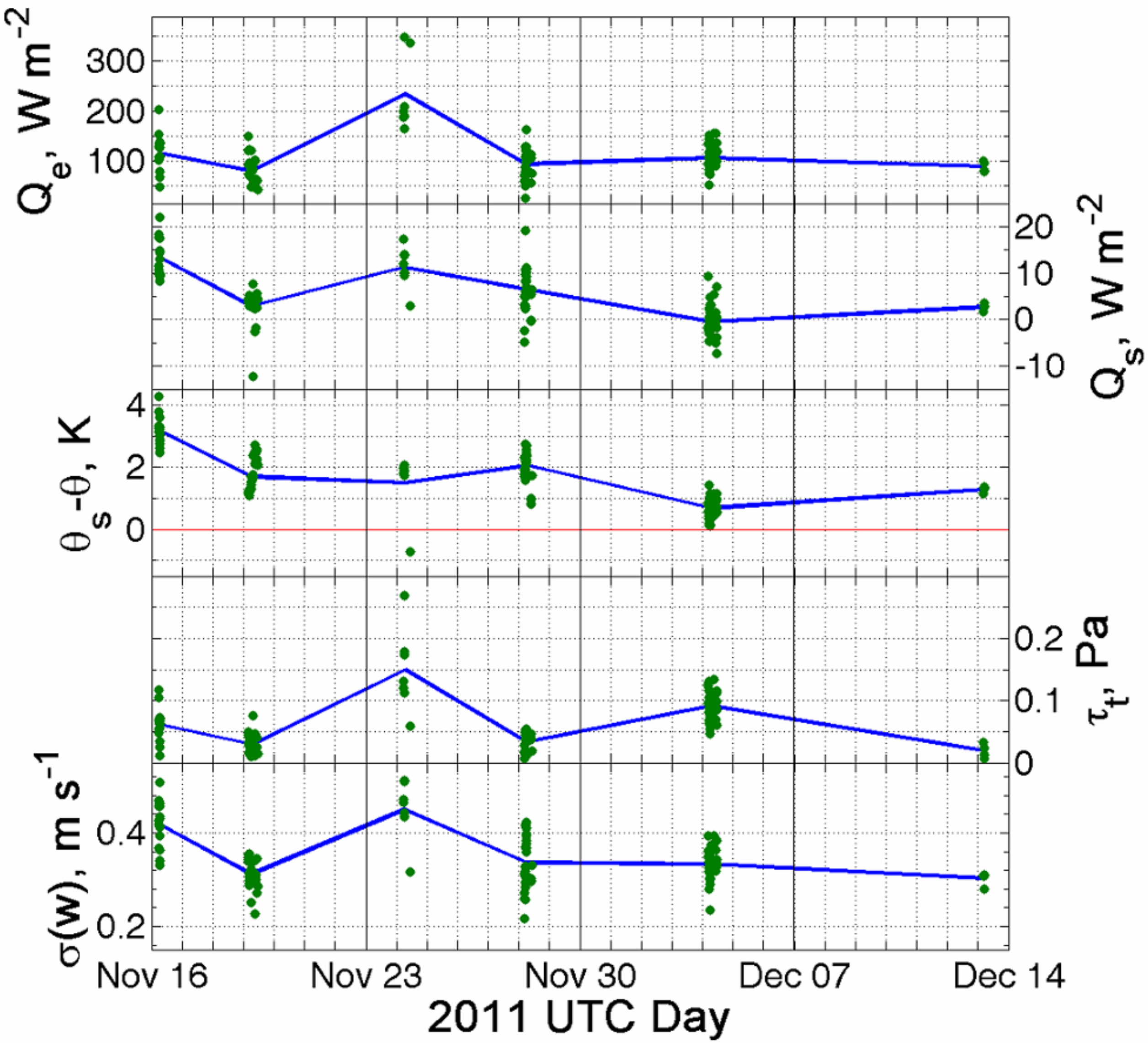
P: Processed

PF: Processed and fluxes estimated

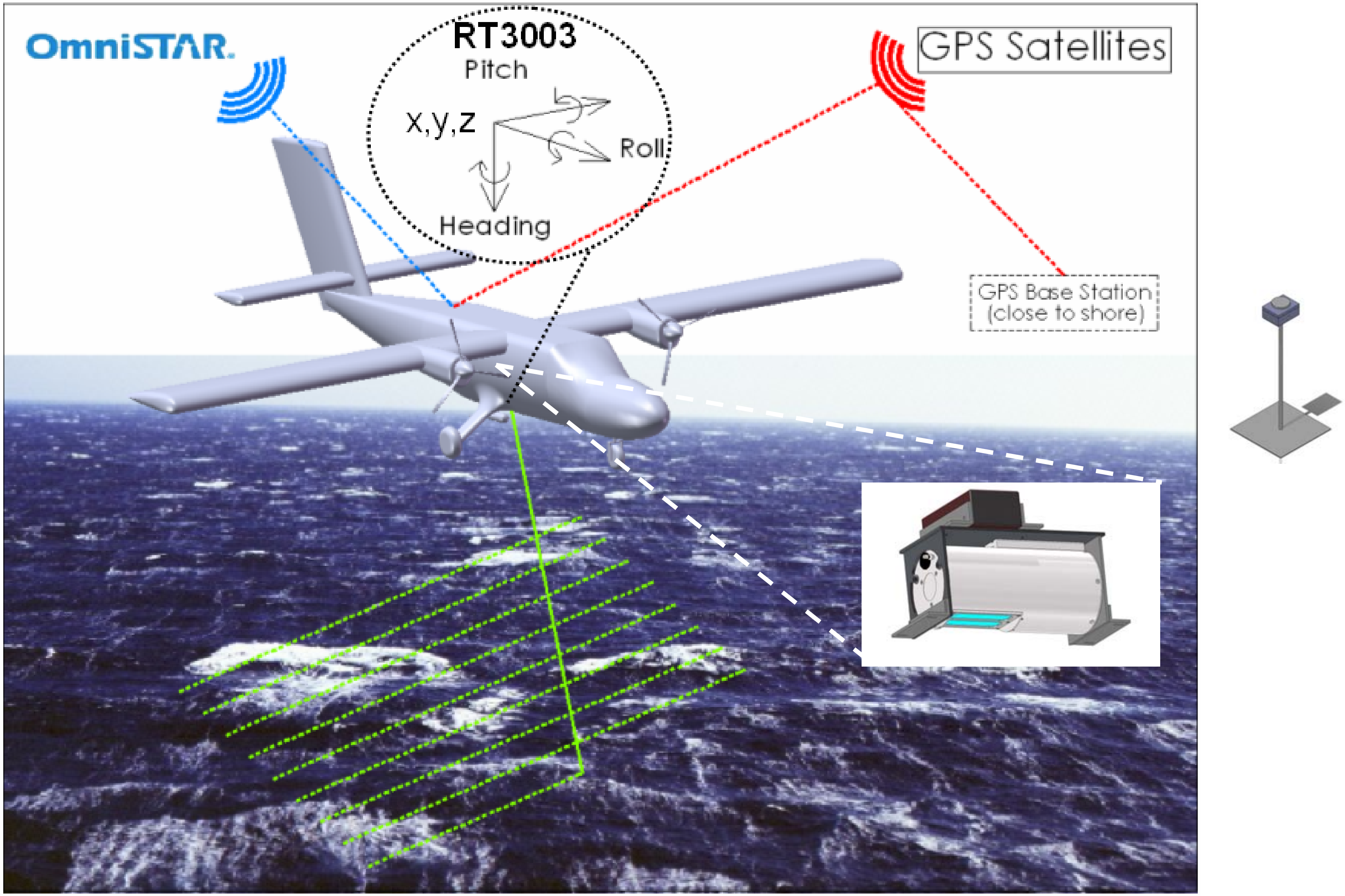
Means (z~60 m, Δt=180 s)



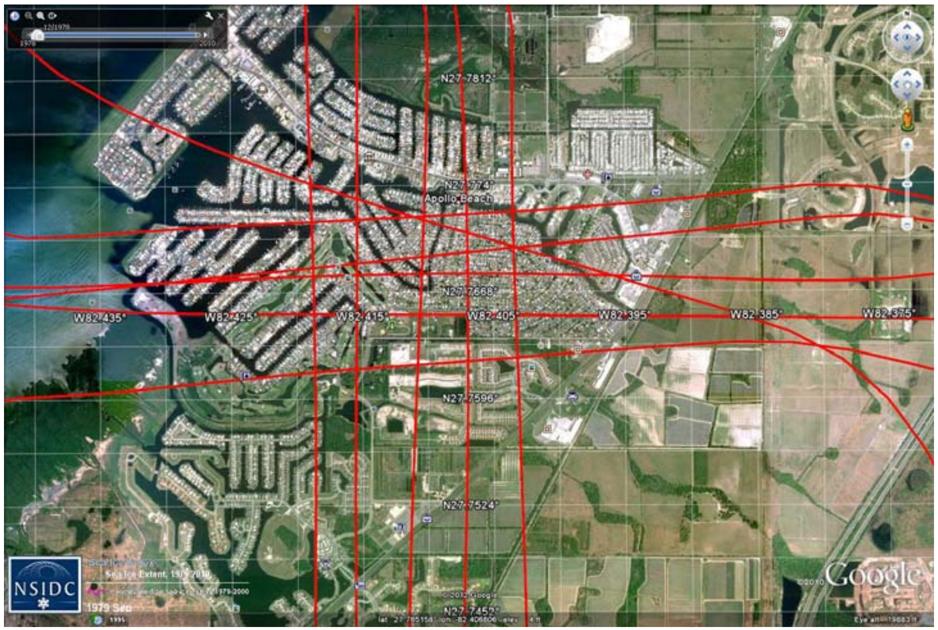
Turbulent Fluxes (z~60 m, Δt=180 s)

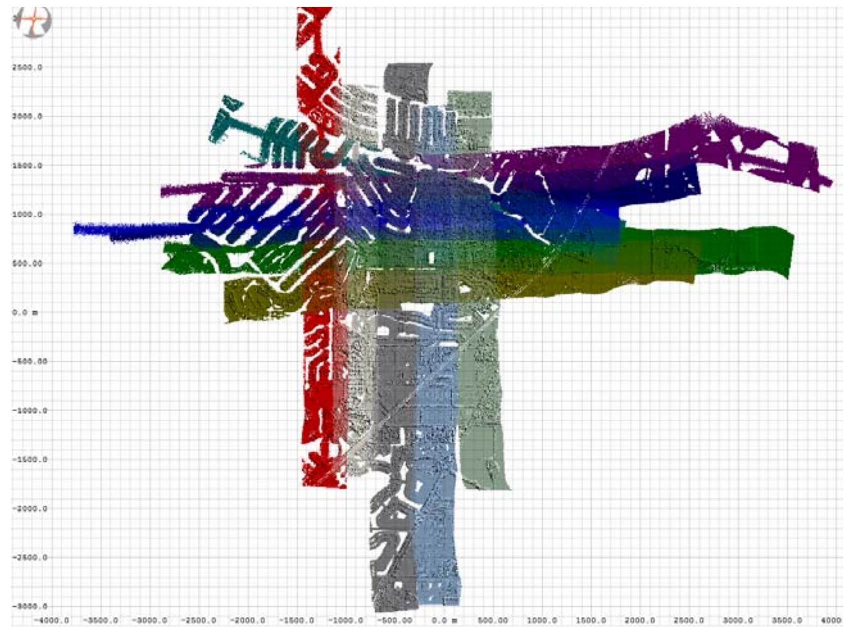


Airborne Scanning LiDAR for wave mapping

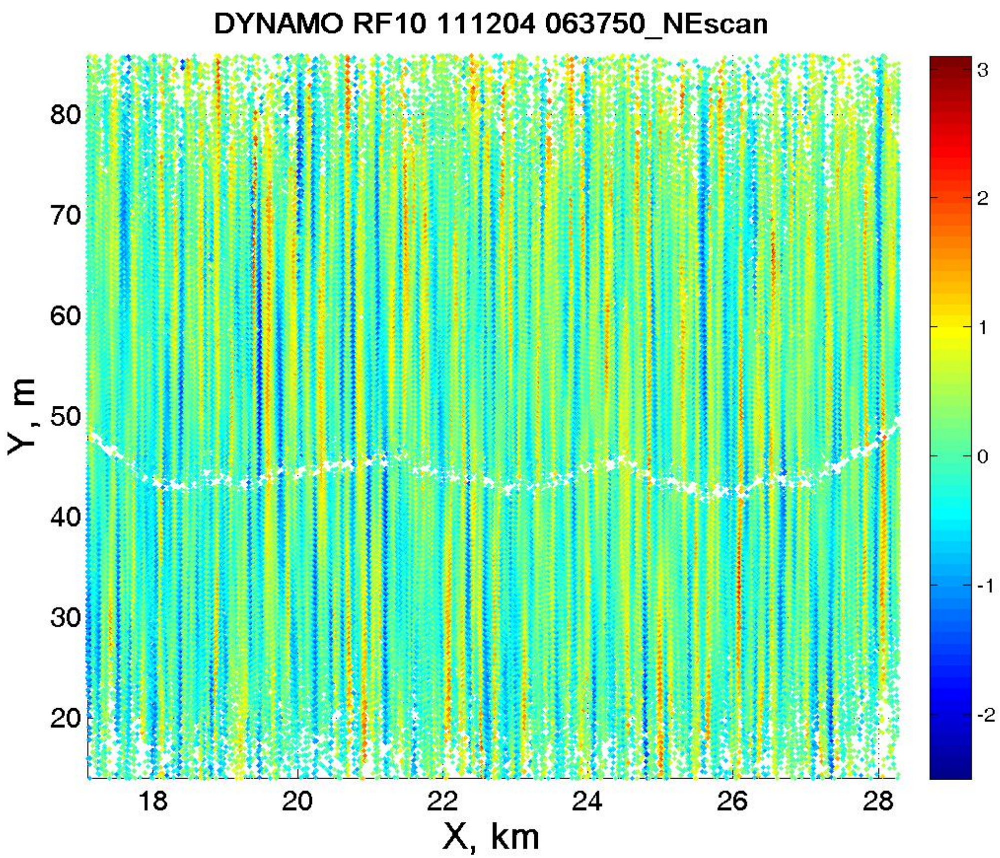


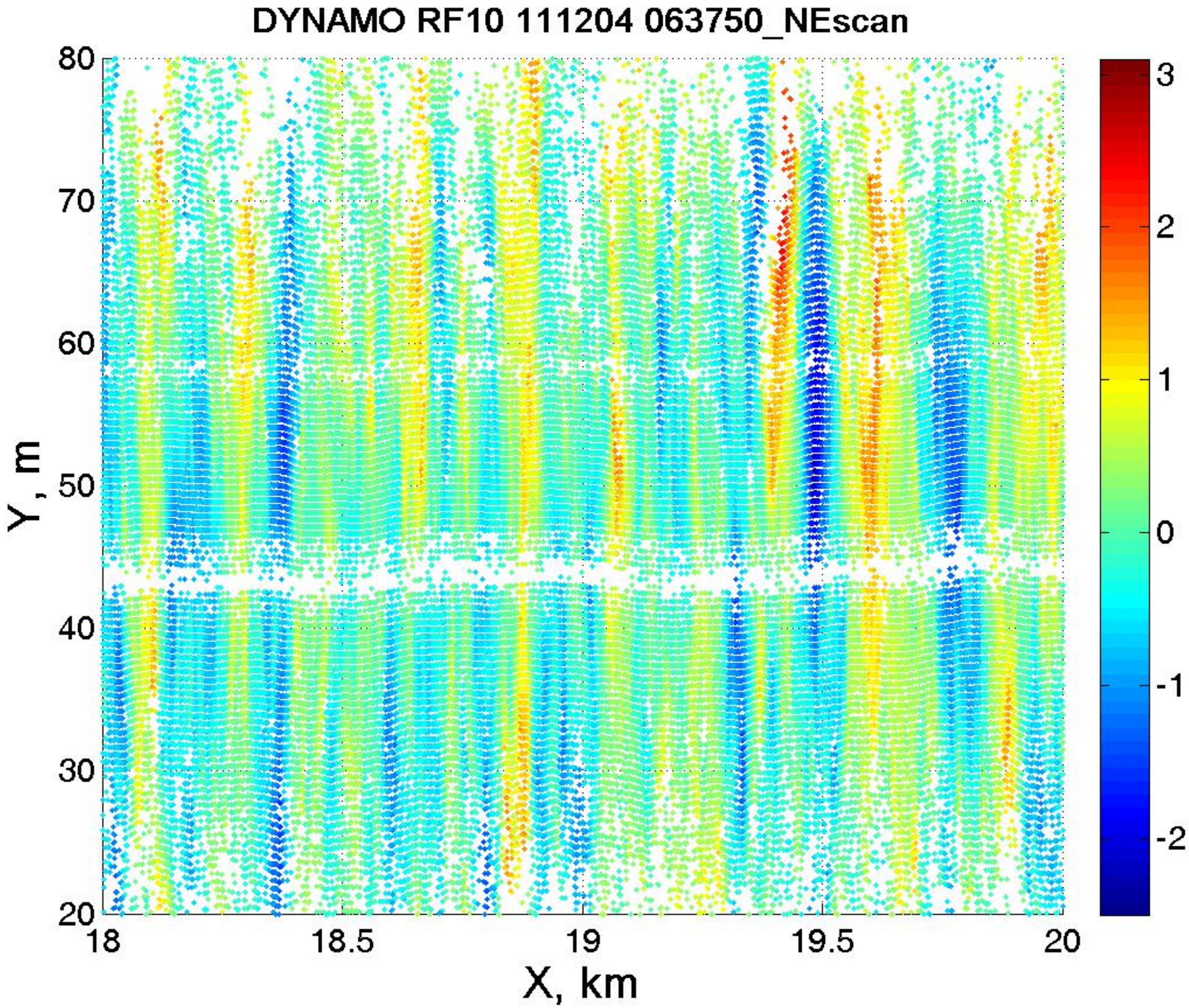
Post-Experiment Riegl Boresighting and Wind Cals Flight 13 Jan2012, Tampa, FL



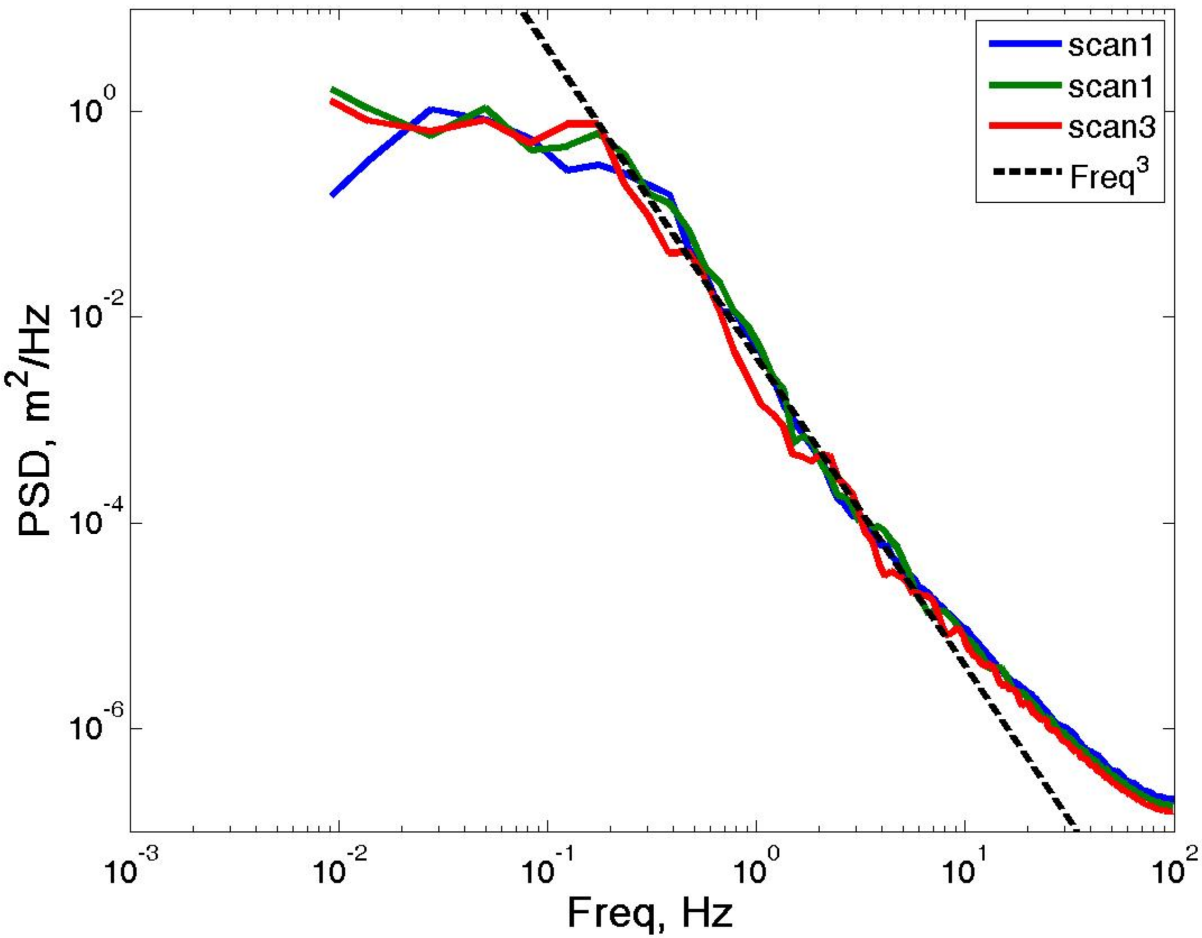


Wave field example on 111204 Along North East Track




DYNAMO RF10 111204 063750_NEscan
Y, m
X, km
80
70
60
50
40
30
20
18
18.5
19
19.5
20
3
2
1
0
-1
-2

Wave Spectra



Summary

- Turbulence instrumentation we installed on the NOAA P3 performed reasonably well as evidenced by the flux measurements capturing the suppressed to active MJO transition.
- Our vertical wind passes the pitching maneuver tests and is an improvement from the standard AOC's 1-Hz data
- High-rate data from AOC had dropouts and occasional data gaps due to new data system hickups.
- Wave measurements from the new lidar system yielded promising results though its point density is limited by the high speed of the P3.
- Finalize the data set especially the 3 flights with gaps to proceed with more in-depth analysis.