ADLAATS: Integrating mesoscale models with DWL data in realtime

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10 July 2008
LWG, Wintergreen, Va

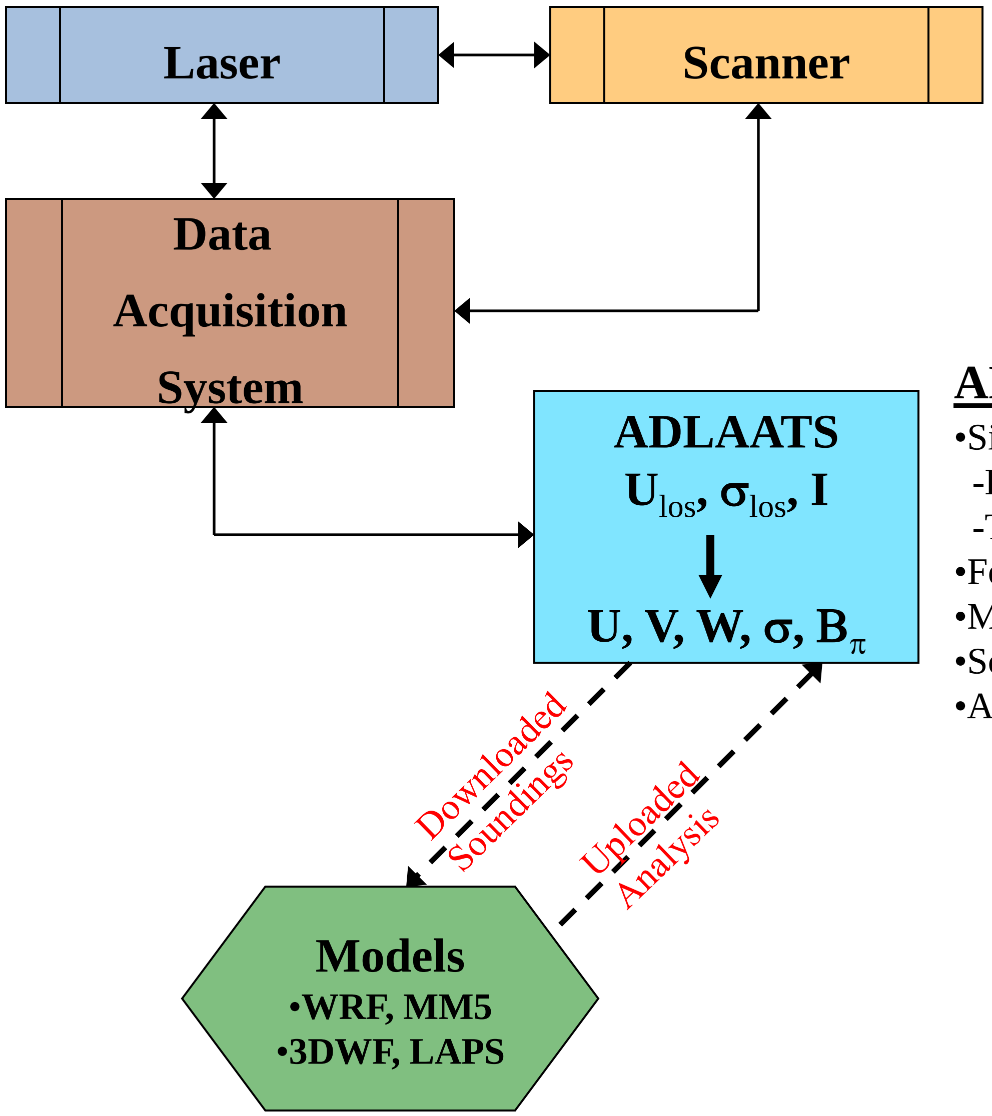
Overview

- ADLAATS concept
- Current status
- Work with ARL (Wang’s WIND)
- Work with NPS (MM5)
- Work with NRL (COAMPS)

Airborne Doppler Lidar Analyses and Adaptive Targeting System (ADLAATS)

- Autonomous on-board observation management and processing of airborne Doppler Wind Lidar data
- On-board comparisons between DWL observations and model predictions with rules for switching observation modes; model validation vs. model initialization
- Transmission of selected data to central site to reinitialize forecast models and/or update the realtime WRE or data cubes (IMETS)

Airborne Doppler Lidar Analysis and Adaptive Targeting System (ADLAATS)



ADLAATS

- Signal Processing
  - -LADSA
  - -Threading
- Forward DWL Model
- Model Validation
- Scan Mode Selection
- Aircraft Guidance

ADLAATS and Numerical Models

- ADLAATS involves the execution of a numerical weather model on-board the aircraft
- Possible models:
  - WRF
  - MM5
  - 3DWF Model
  - NOAA LAPS
  - COAMPS

Model Validation

- During development, critical input from modelers is sought on how to best conduct validation studies and capture known issues (weaknesses) of the model:
  - When is agreement sufficient to continue validation mode?
  - How do we account for time and space phase shift issues?
  - How do we weigh vertical variation in model-data differences?

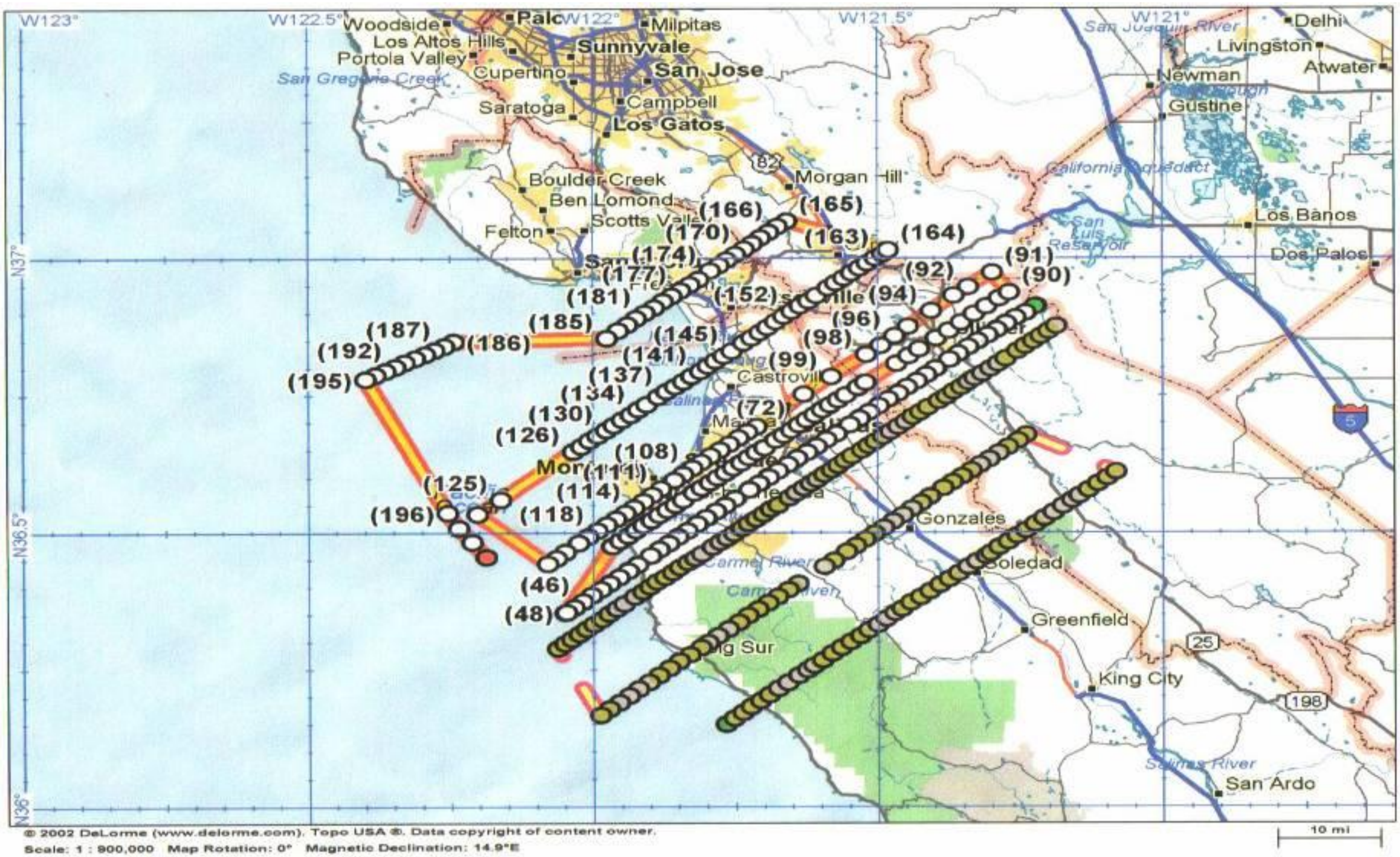
2003 MM5 Model Validation

- Working with Wendell Nuss at NPS
- TODWL collected ~3000 profiles over a period of 4 hours with 50 m vertical resolution, ~ 600 m horizontal resolution and ~ .10 m/s accuracy (over cycloid)
- Comparison with 4 km MM5 runs

NPS MM5

- Run twice daily at the Naval Postgraduate School
- 30 vertical levels, 12 at or below 850 mb level
- Triple nest (108, 36, and 12 km); 4 km nest special run for this case
- “Warm” start (initial conditions generated blending 12-h MM5 forecast with observations)
- MRF PBL scheme
- http://wx.met.nps.navy.mil/~hale/MM5/

TODWL Flight Patterns



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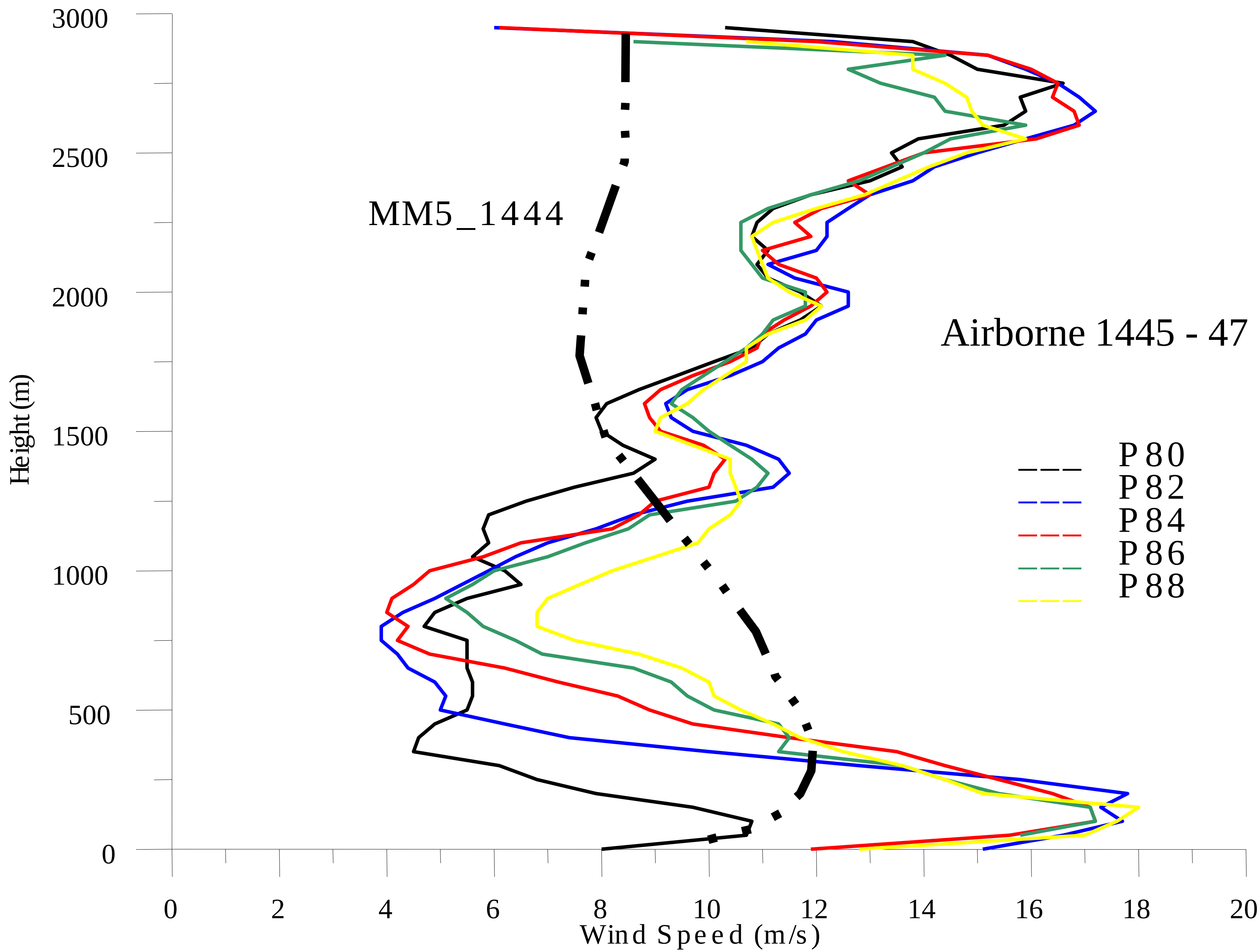
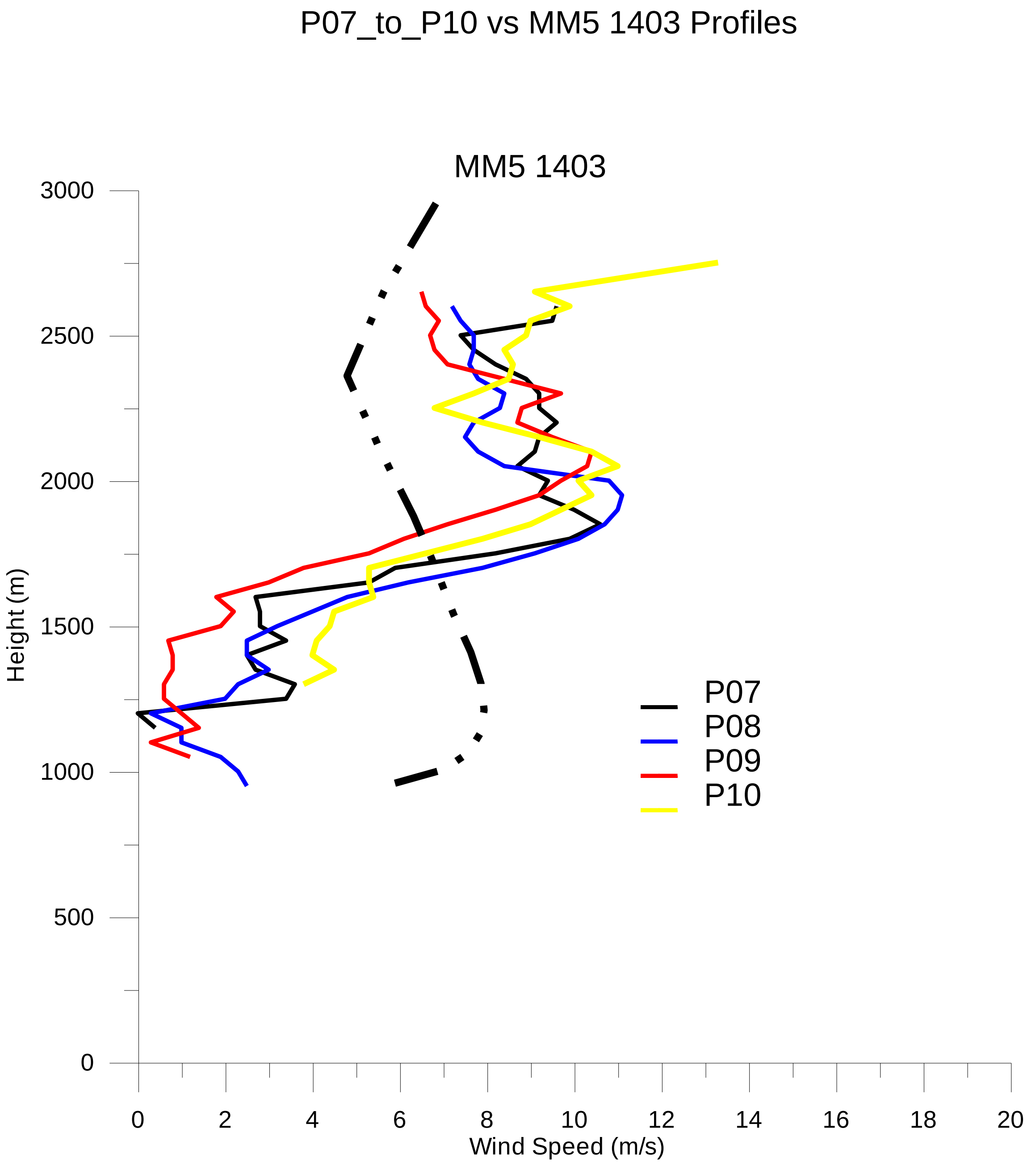
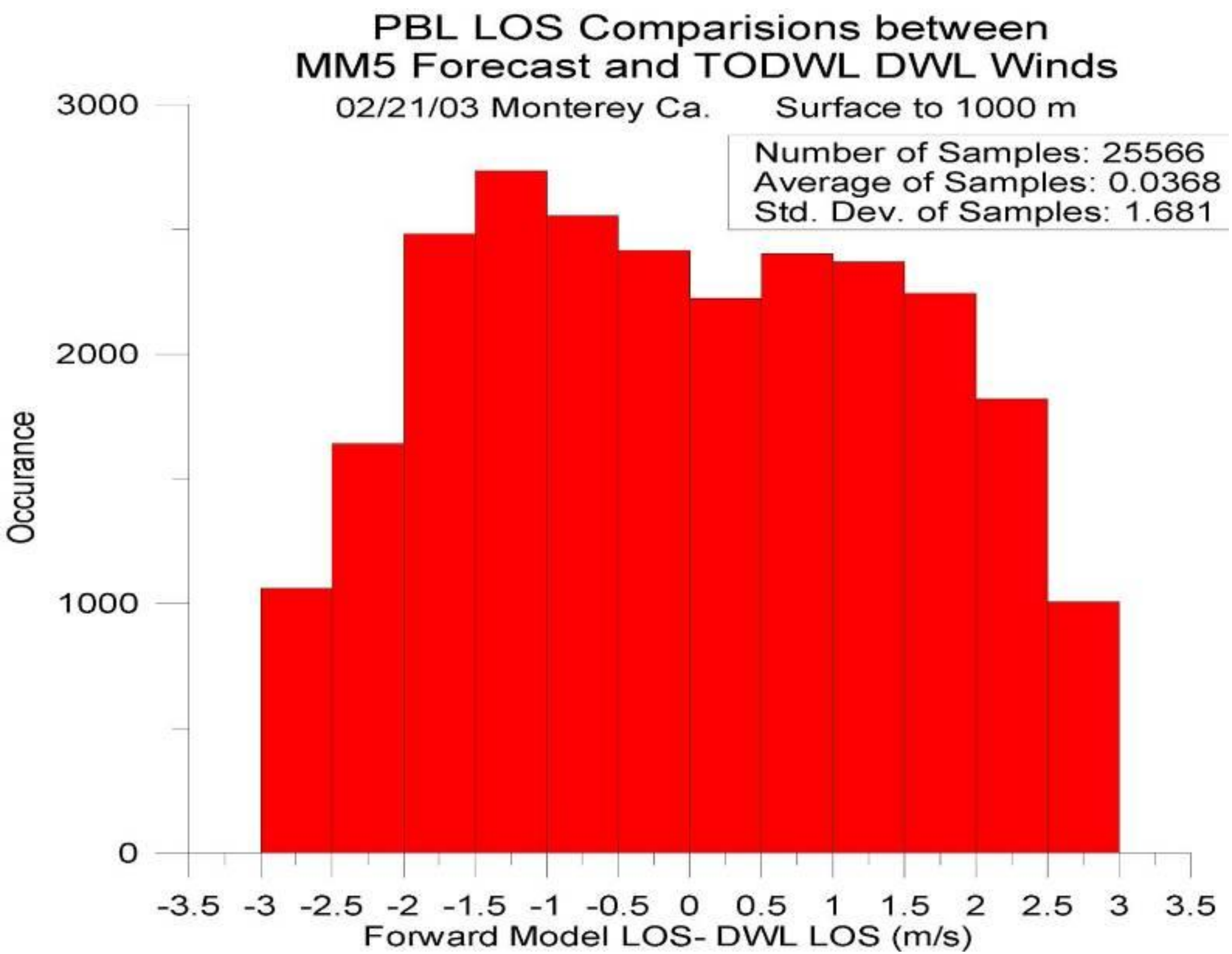
Airborne wind lidar comparisons with MM5 model profiles

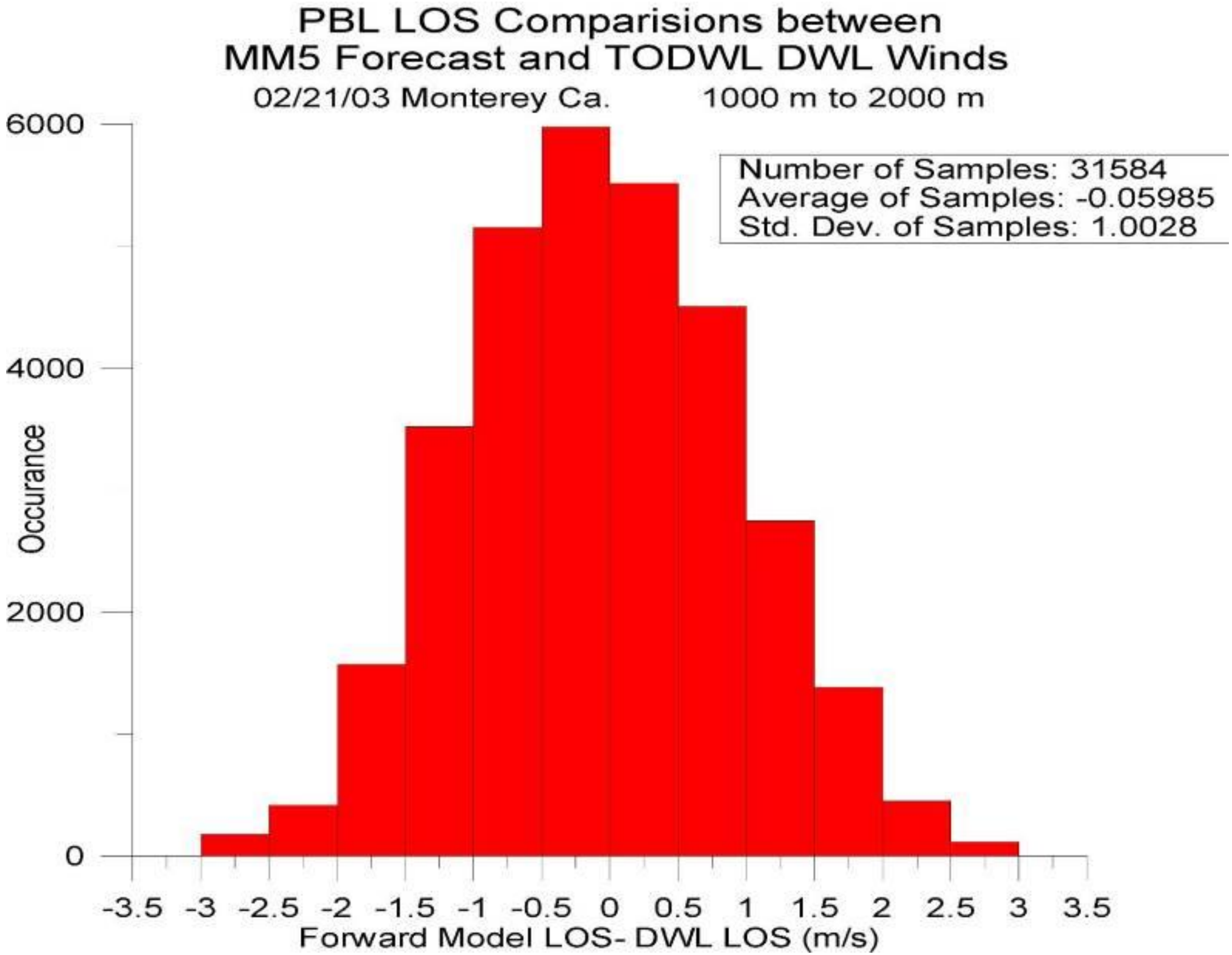




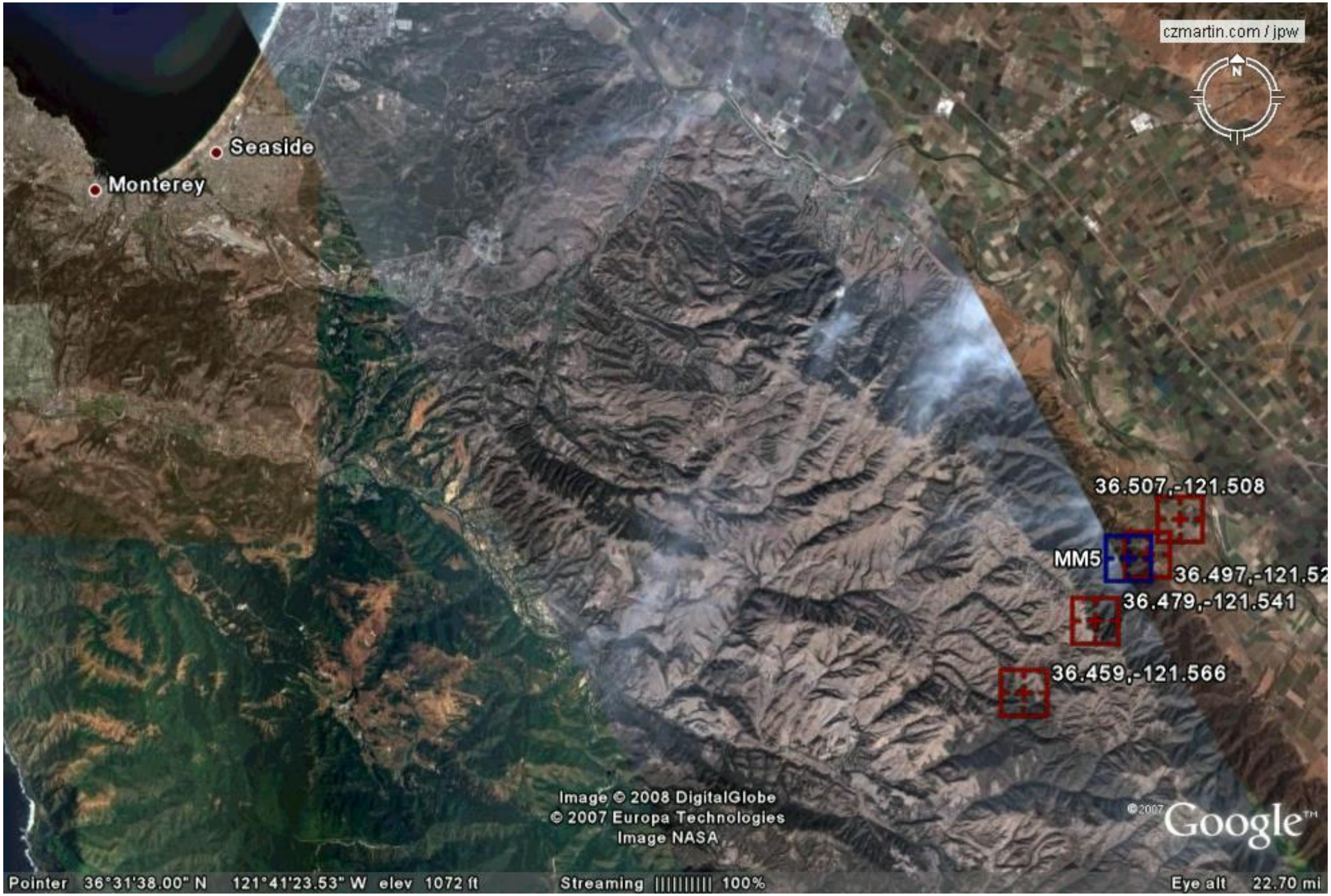
P07_to_P10 vs MM5 1403 Profiles
MM5 1403
3000
2500
2000
1500
1000
500
0
Height (m)
0
2
4
6
8
10
12
14
16
18
20
Wind Speed (m/s)
P07
P08
P09
P10



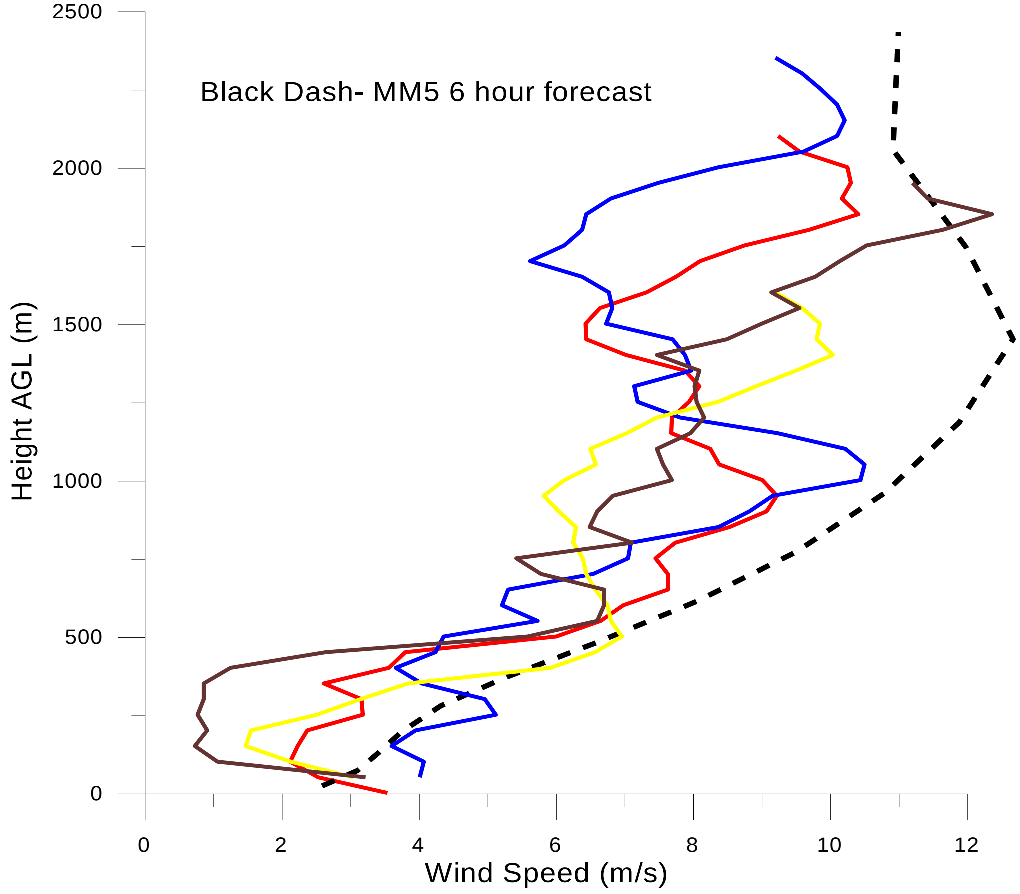
PBL LOS Comparisions between
MM5 Forecast and TODWL DWL Winds
02/21/03 Monterey Ca.
Surface to 1000 m
Number of Samples: 25566
Average of Samples: 0.0368
Std. Dev. of Samples: 1.681
Occurance
3000
2000
1000
0
-3.5 -3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3 3.5
Forward Model LOS- DWL LOS (m/s)


PBL LOS Comparisions between
MM5 Forecast and TODWL DWL Winds
02/21/03 Monterey Ca. 1000 m to 2000 m
Number of Samples: 31584
Average of Samples: -0.05985
Std. Dev. of Samples: 1.0028
Occurance
6000
4000
2000
0
-3.5 -3 -2.5 -2 -1.5 -1 -0.5 0 0.5 1 1.5 2 2.5 3 3.5
Forward Model LOS- DWL LOS (m/s)

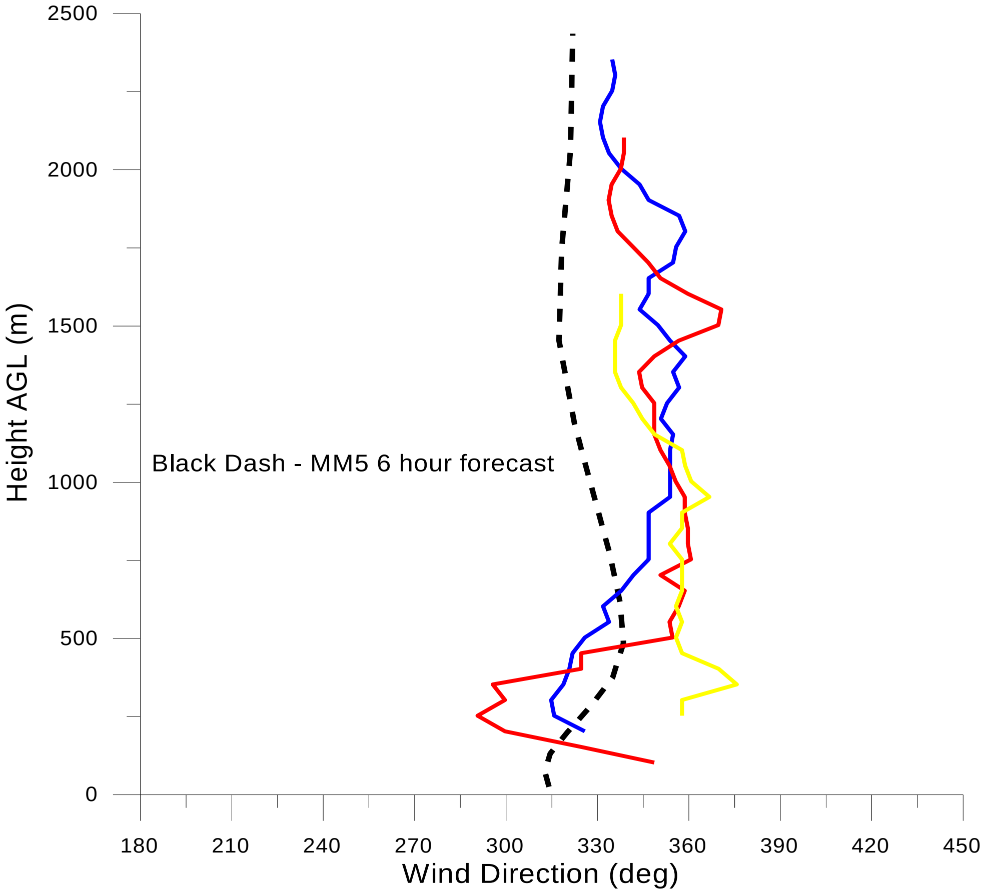
2007 MM5 Comparison



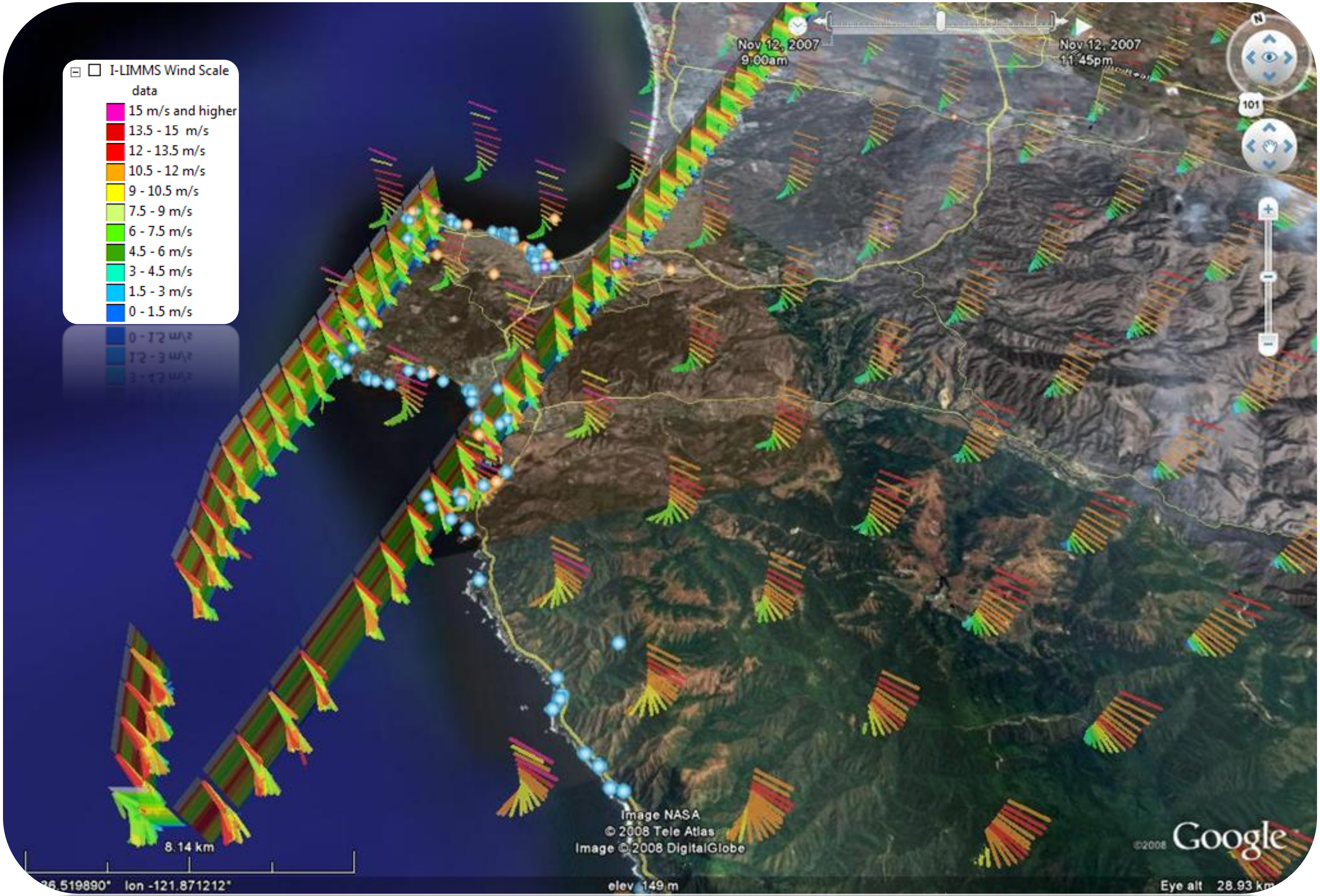
MM5 Forecast vs TODWL Profiles (Wind Speed) (November 12, 2007)



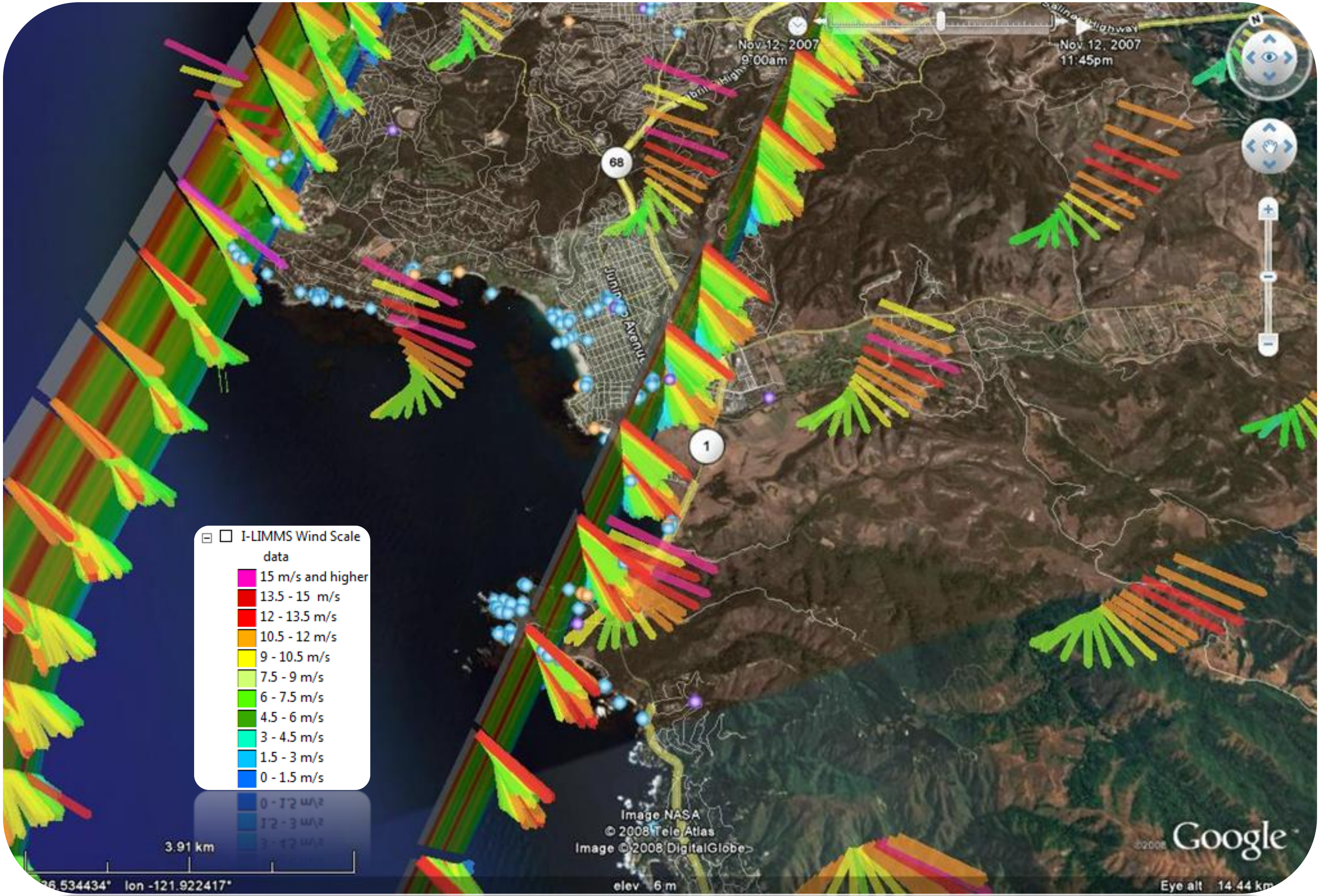
MM5 Forecast vs TODWL Profiles (Wind Direction)
(November 12, 2007)



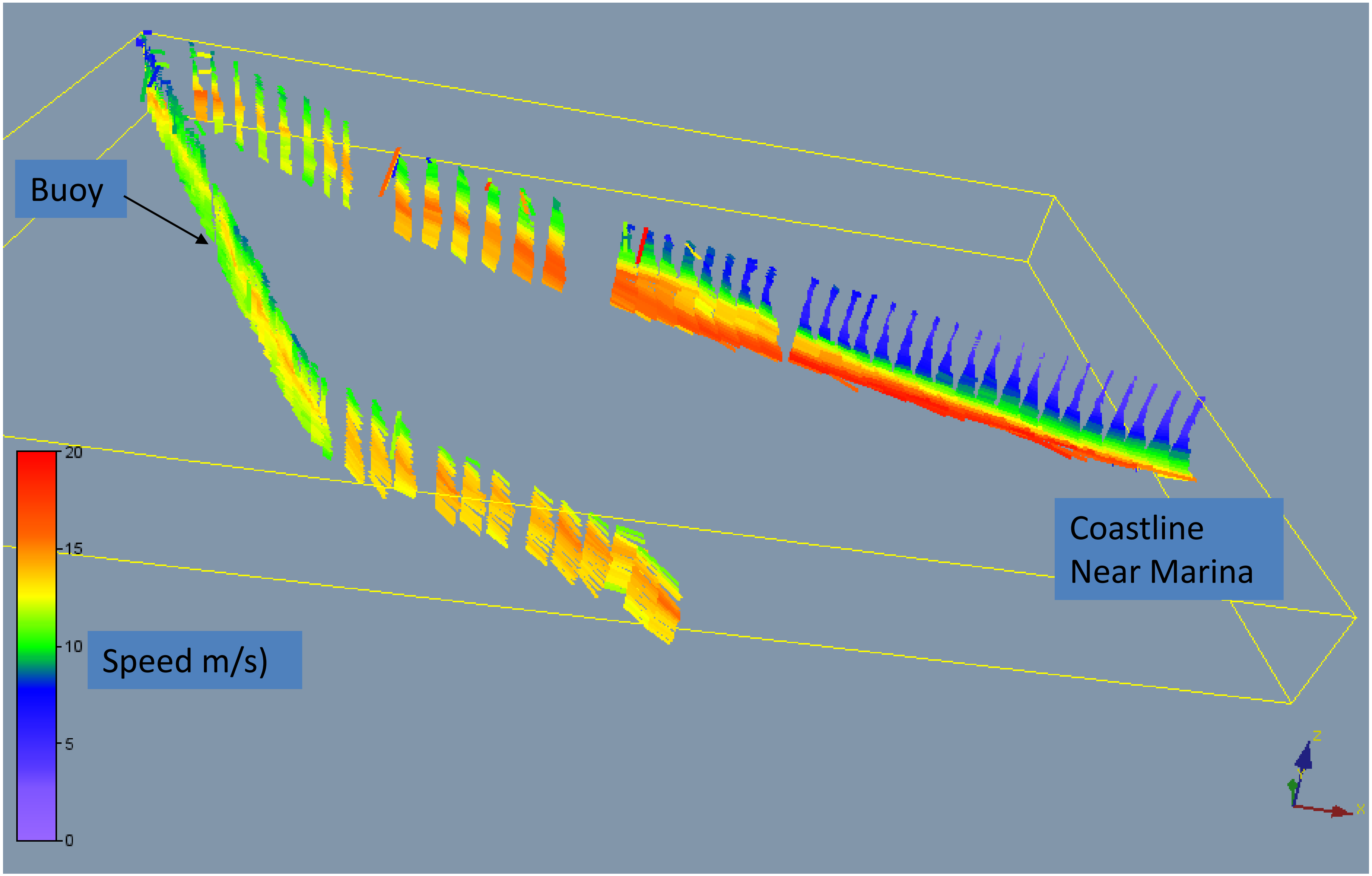
Comparison with 4km MM5

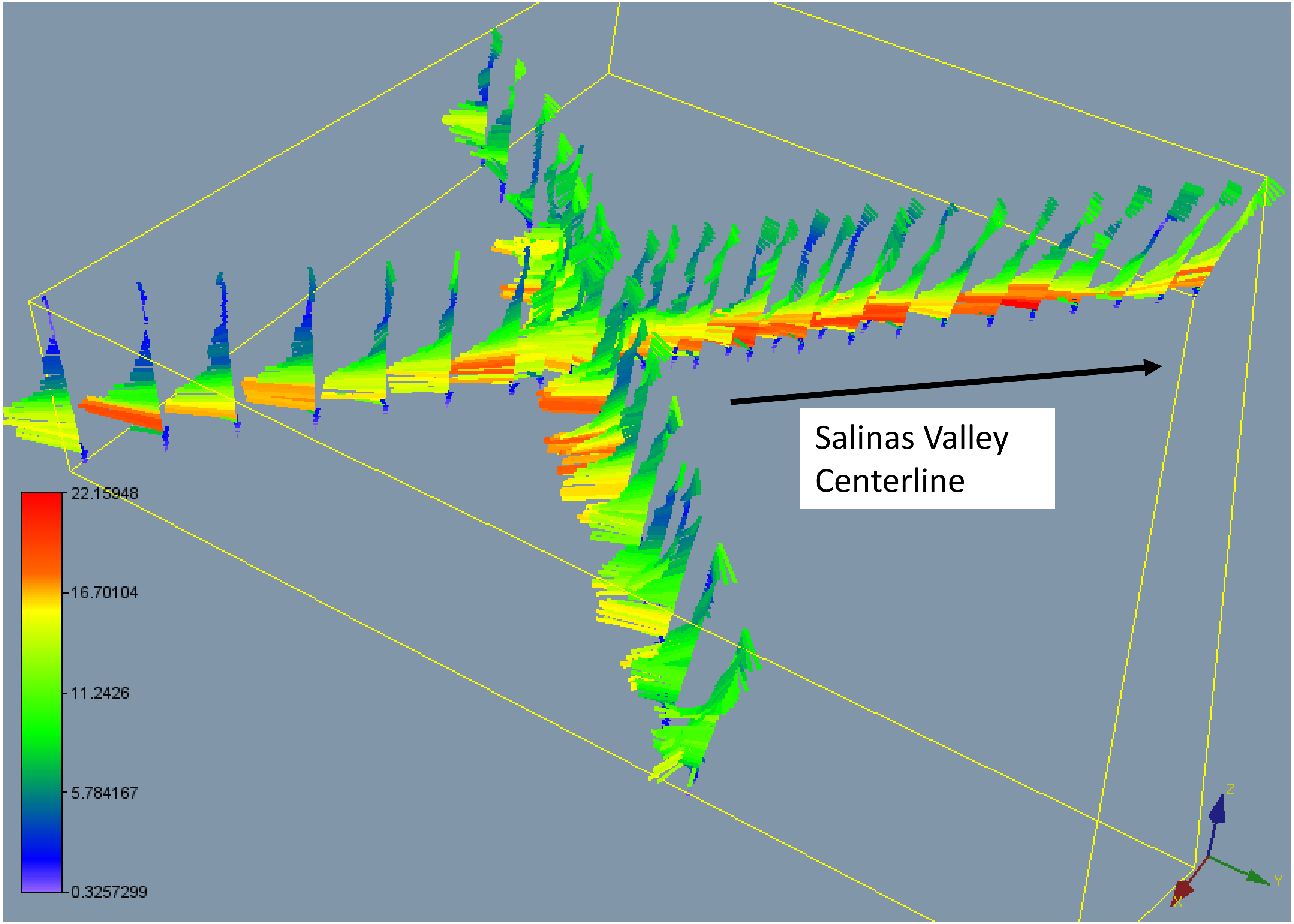


Comparison with 4km MM5



TODWL underflight 18 April 6:07 pm PST
Monterey Bay, California





22.15948
16.70104
11.2426
5.784167
0.3257299
Salinas Valley Centerline
Z
Y
X

Summary

- Airborne DWL can provide targeted and adaptive wind measurement s at high temporal and spatial resolution and high measurement precision (~.05 m/s).
- These airborne DWL measurements can compliment or enhance existing data networks or observing systems. The ultimate goal is a full time space-based DWL
- Comparisons with model predictions suggest a significant effort is needed to define threshold differences requiring ADLAATS sample mode change.

Summary

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