Validation of meso-scale model winds in complex terrain and coastal regions using an airborne coherent Doppler wind lidar

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MM5 validation*

- Working with Nuss and Miller at NPS
- TODWL collected ~3000 profiles over a period of 4 hours with 50 m vertical resolution, ~ 600 m horizontal resolution and ~ .05 m/s accuracy (over cycloid)
- Initial comparisons with 12 km MM5 runs

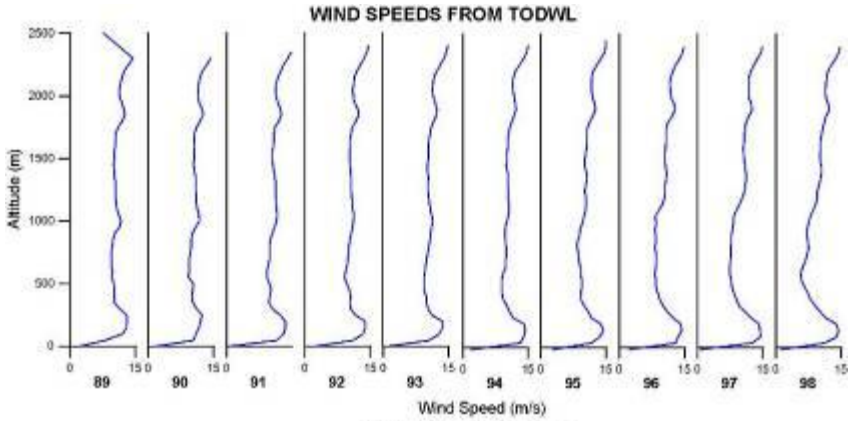
* and demonstration of TODWL support of prescription burning at Ft Ord

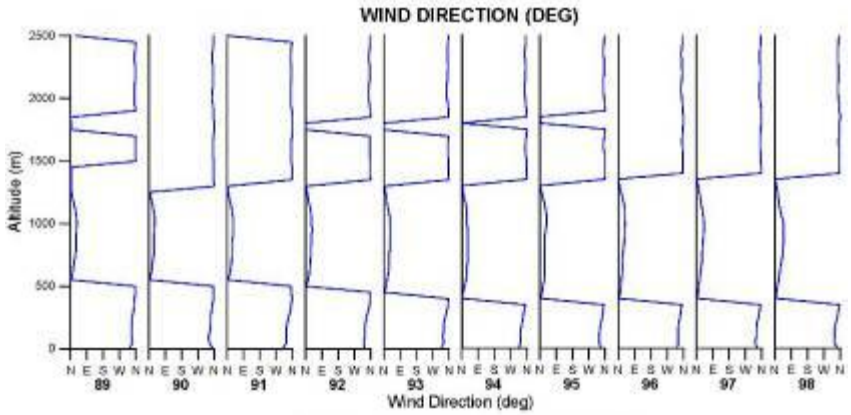
NPS MM5

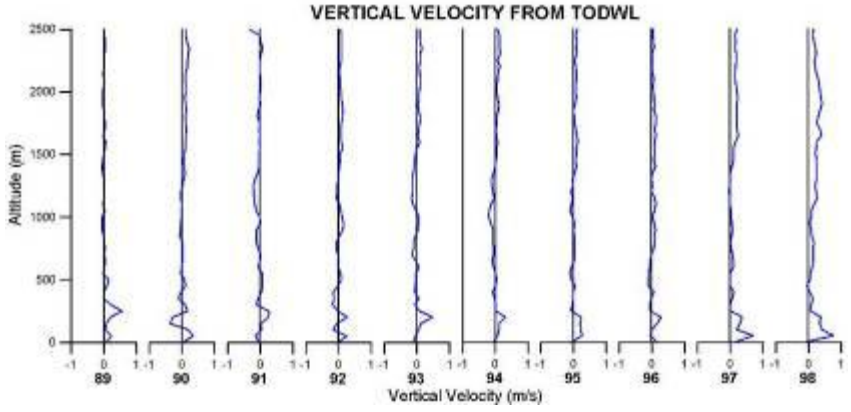
- Run twice daily at the Naval Postgraduate School
- 30 vertical levels, 12 at or below 850 mb level
- Triple nest (108, 36, and 12 km); 4 km nest special run for this case
- “Warm” start (initial conditions generated blending 12-h MM5 forecast with observations)
- MRF PBL scheme
- http://www.weather.nps.navy.mil/~dkmiller/MM5

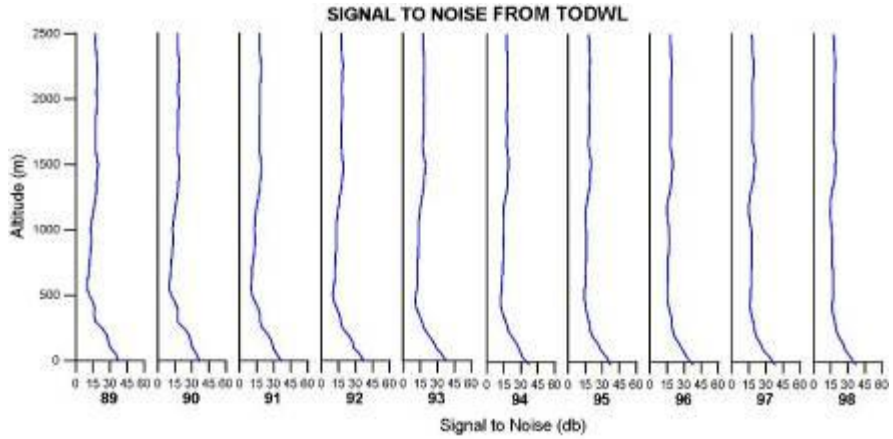
Series of TODWL profiles

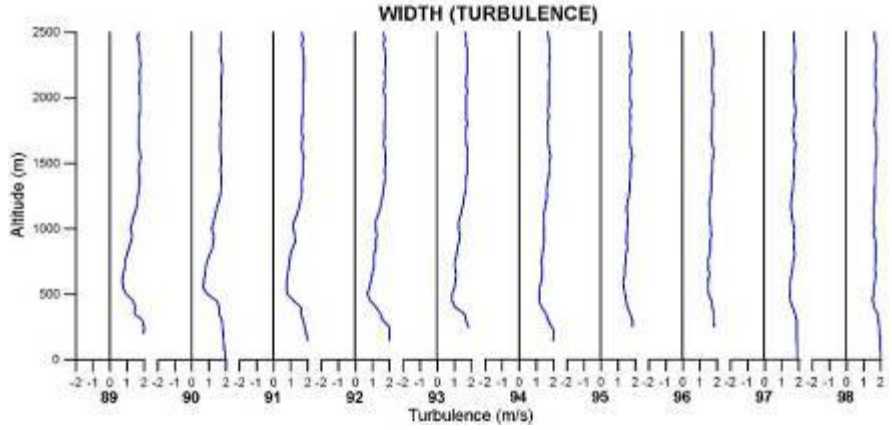
- Profiles taken along transect of California coast (flying west to east) near Point Sur.
- Profiles of wind speed, direction, vertical velocity,signal intensity and turbulence (within the illuminated volume)
- Brown shading indicates land topography
- Numbers (e.g. 97, 98..) reference the profiles identity tag.

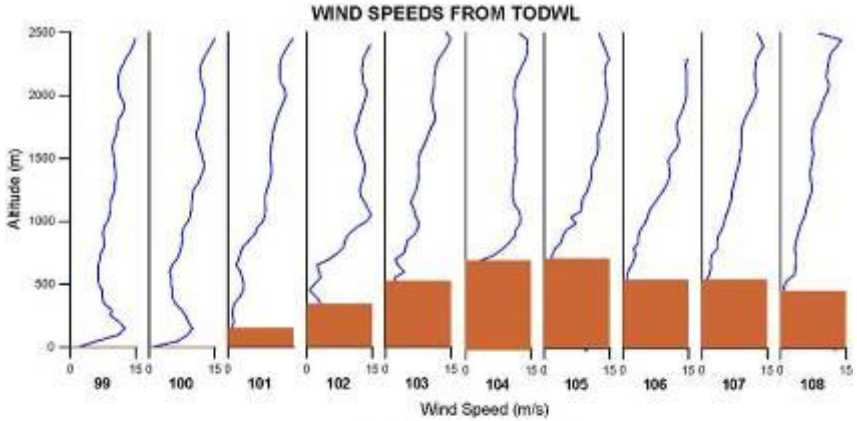

WIND SPEEDS FROM TODWL
Altitude (m)
Wind Speed (m/s)
89
90
91
92
93
94
95
96
97
98

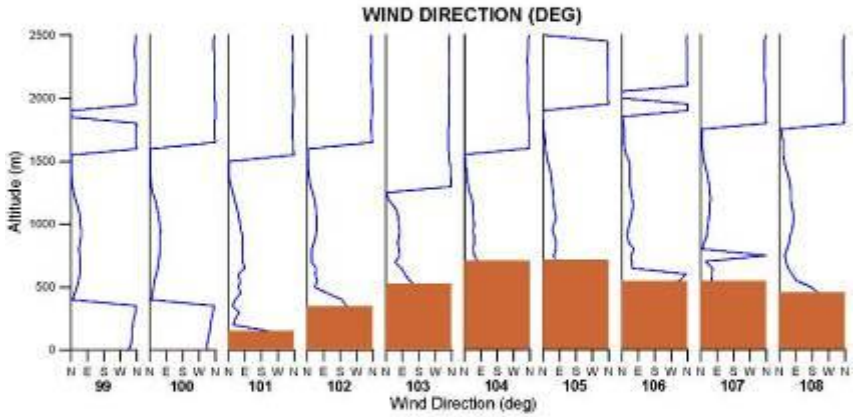

WIND DIRECTION (DEG)
Altitude (m)
Wind Direction (deg)
89
90
91
92
93
94
95
96
97
98

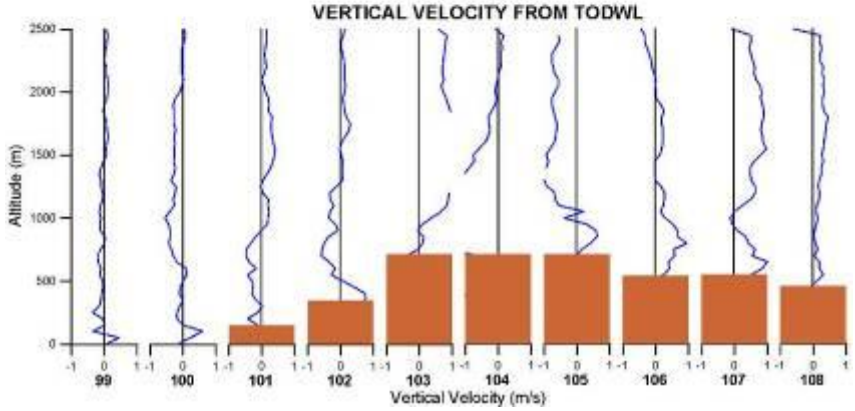

VERTICAL VELOCITY FROM TODWL
Altitude (m)
Vertical Velocity (m/s)
89
90
91
92
93
94
95
96
97
98

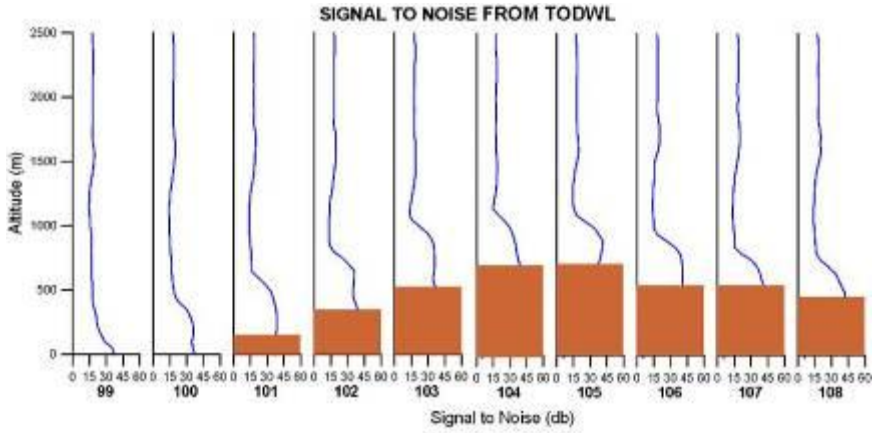

SIGNAL TO NOISE FROM TODWL
Altitude (m)
Signal to Noise (db)
89
90
91
92
93
94
95
96
97
98

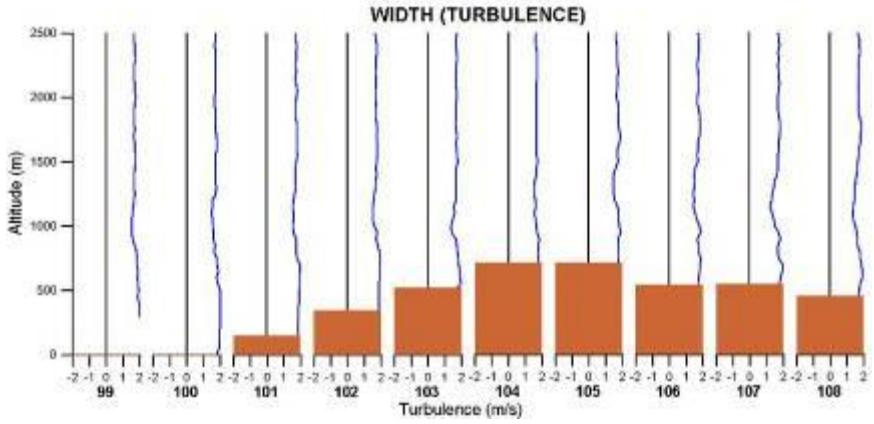

WIDTH (TURBULENCE)
Altitude (m)
Turbulence (m/s)
89
90
91
92
93
94
95
96
97
98


WIND SPEEDS FROM TODWL
Altitude (m)
Wind Speed (m/s)
99
100
101
102
103
104
105
106
107
108

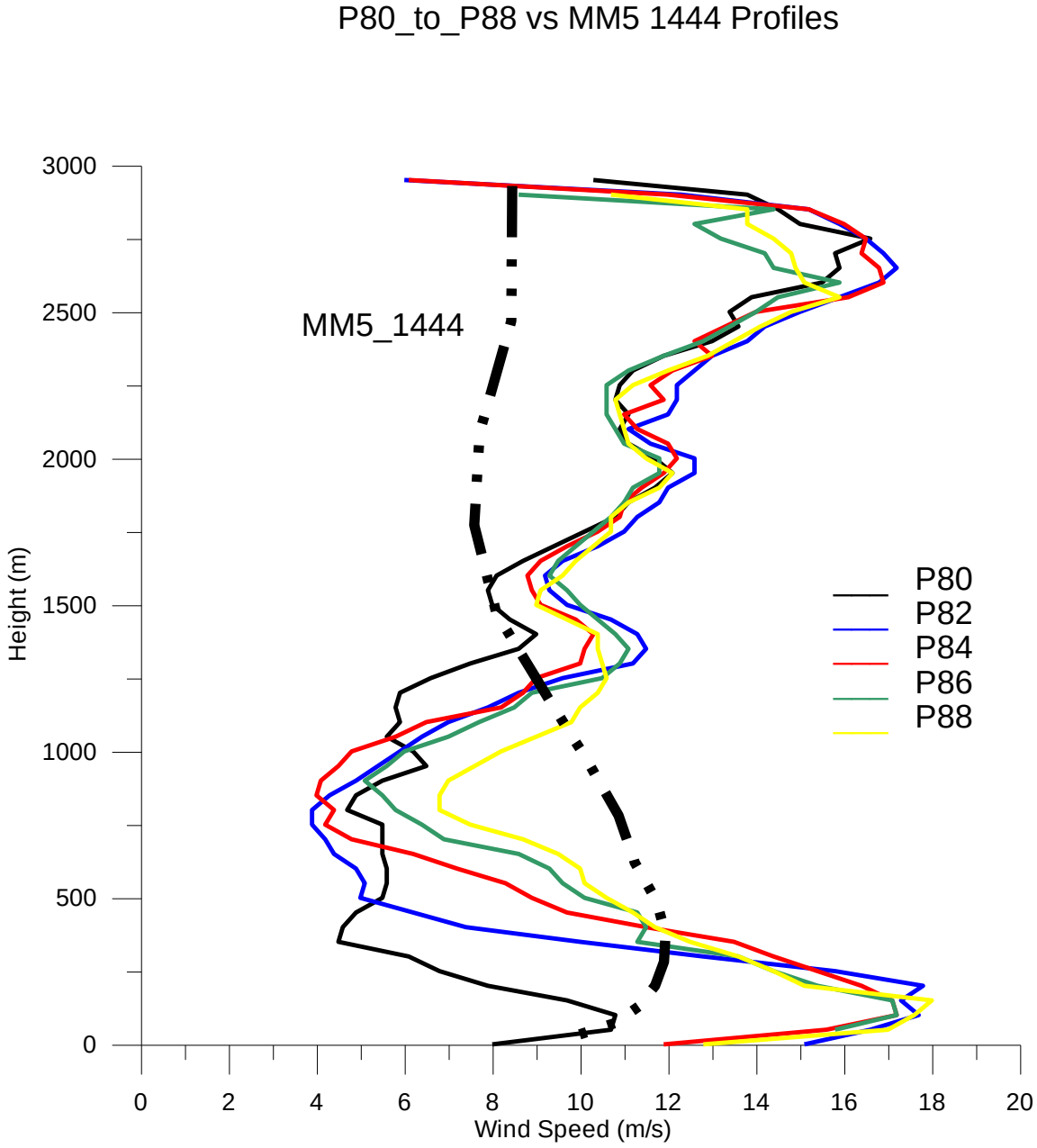

WIND DIRECTION (DEG)
Altitude (m)
Wind Direction (deg)
99
100
101
102
103
104
105
106
107
108

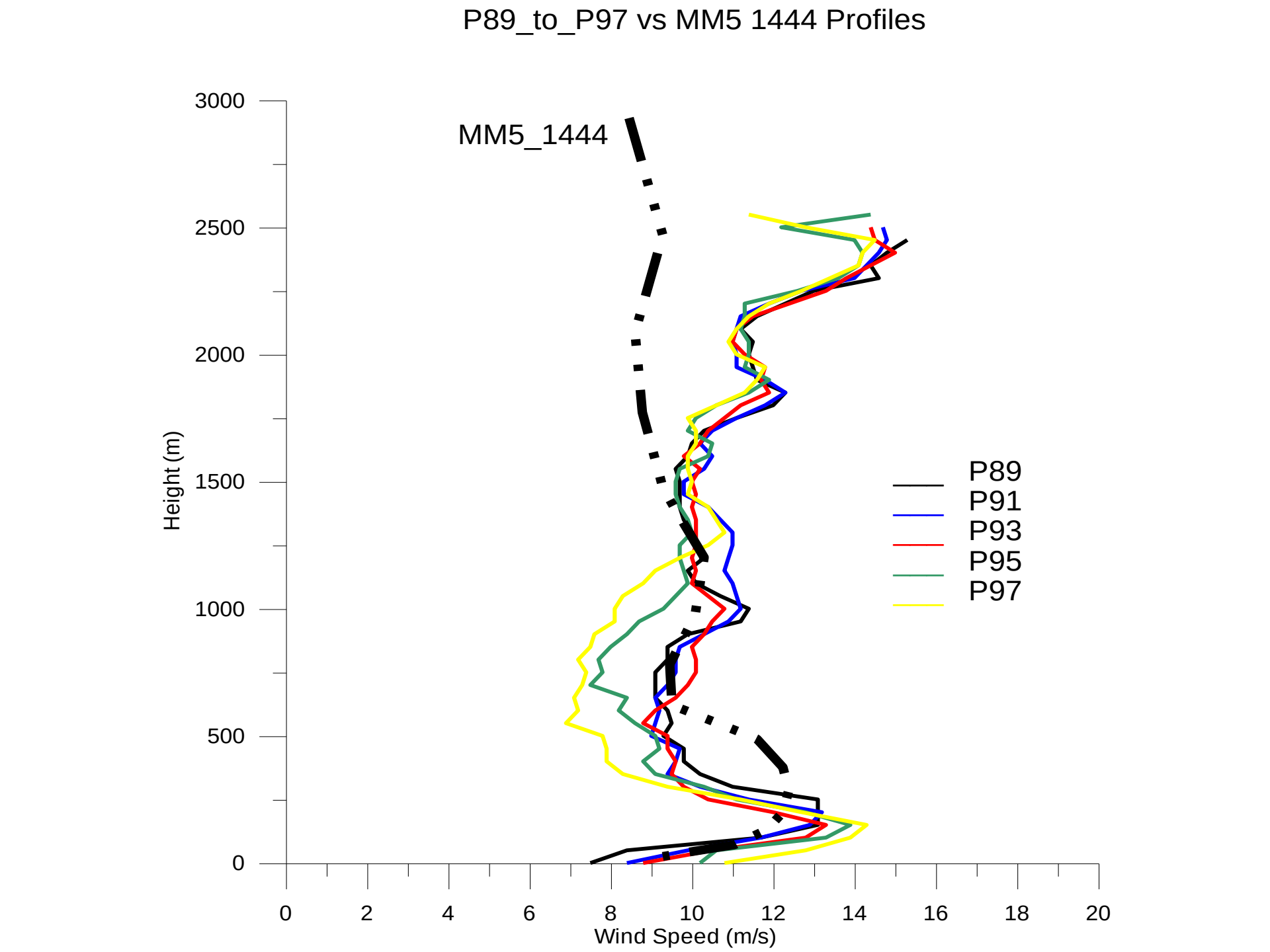

VERTICAL VELOCITY FROM TODWL
Altitude (m)
Vertical Velocity (m/s)
99
100
101
102
103
104
105
106
107
108

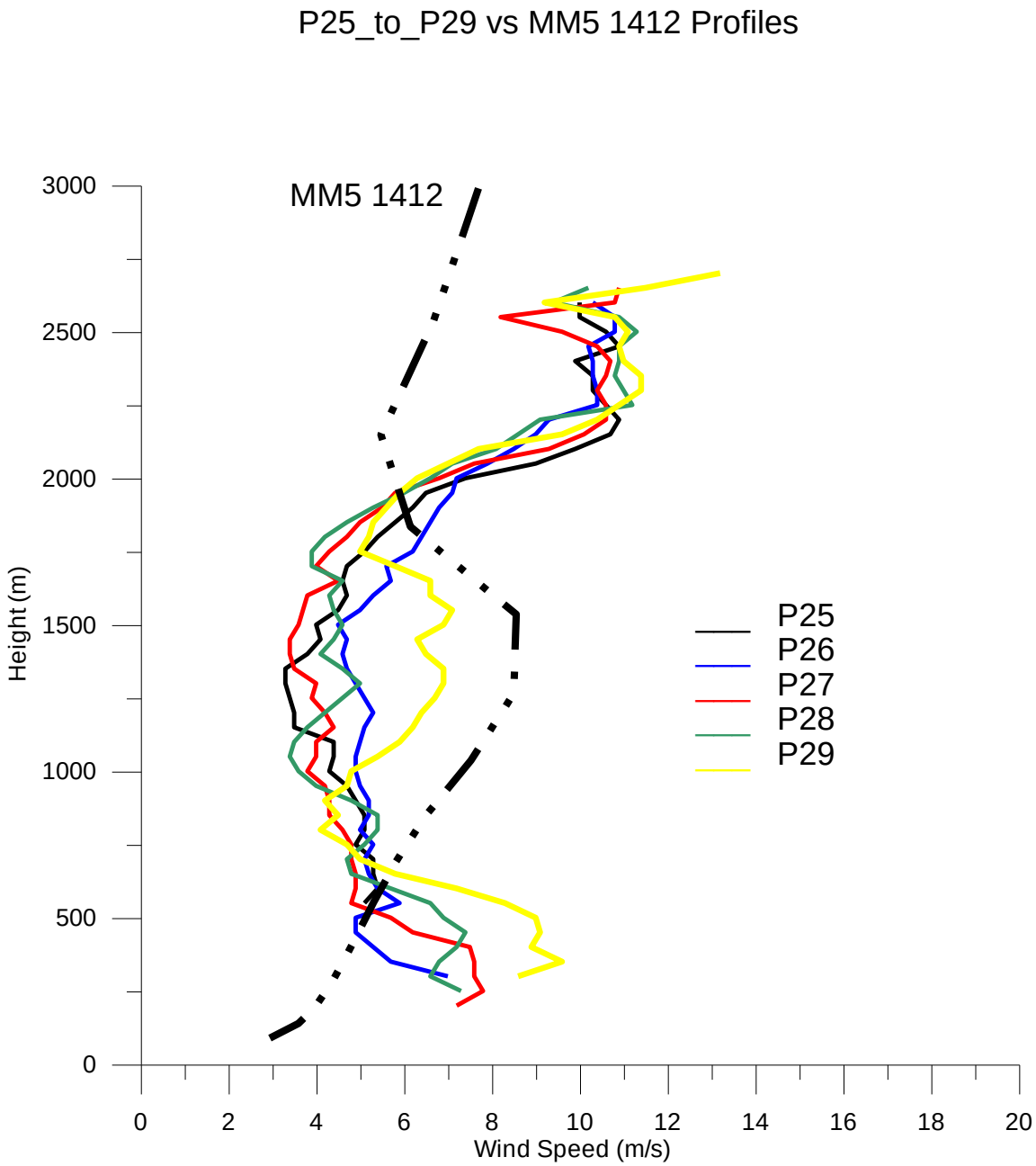

SIGNAL TO NOISE FROM TODWL
Altitude (m)
Signal to Noise (db)
99
100
101
102
103
104
105
106
107
108

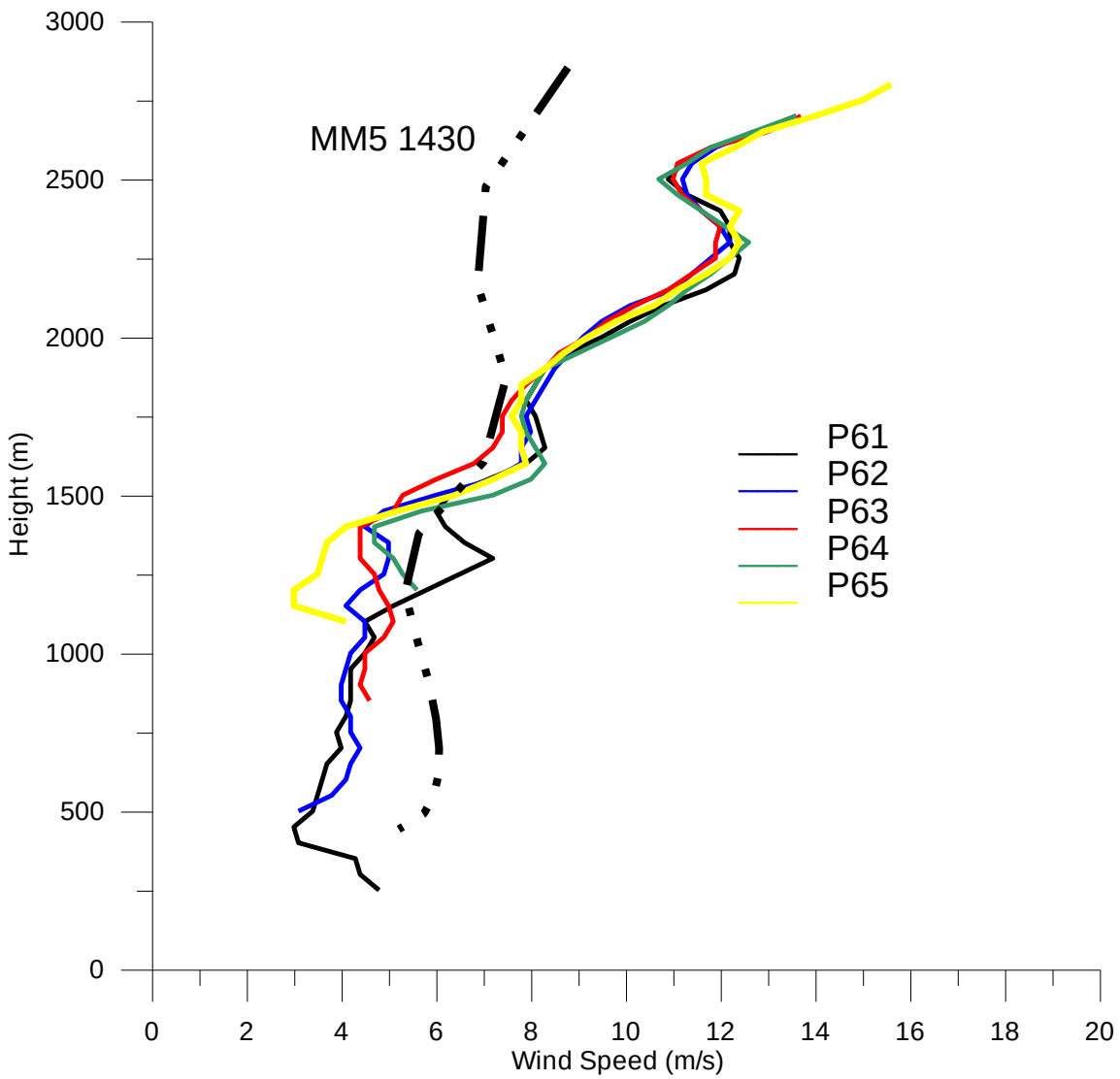

WIDTH (TURBULENCE)
Altitude (m)
Turbulence (m/s)
99
100
101
102
103
104
105
106
107
108

The following six slides are examples of comparisons between the TODWL soundings and the MM5 soundings within 5 minutes and 2 km of the TODWL soundings

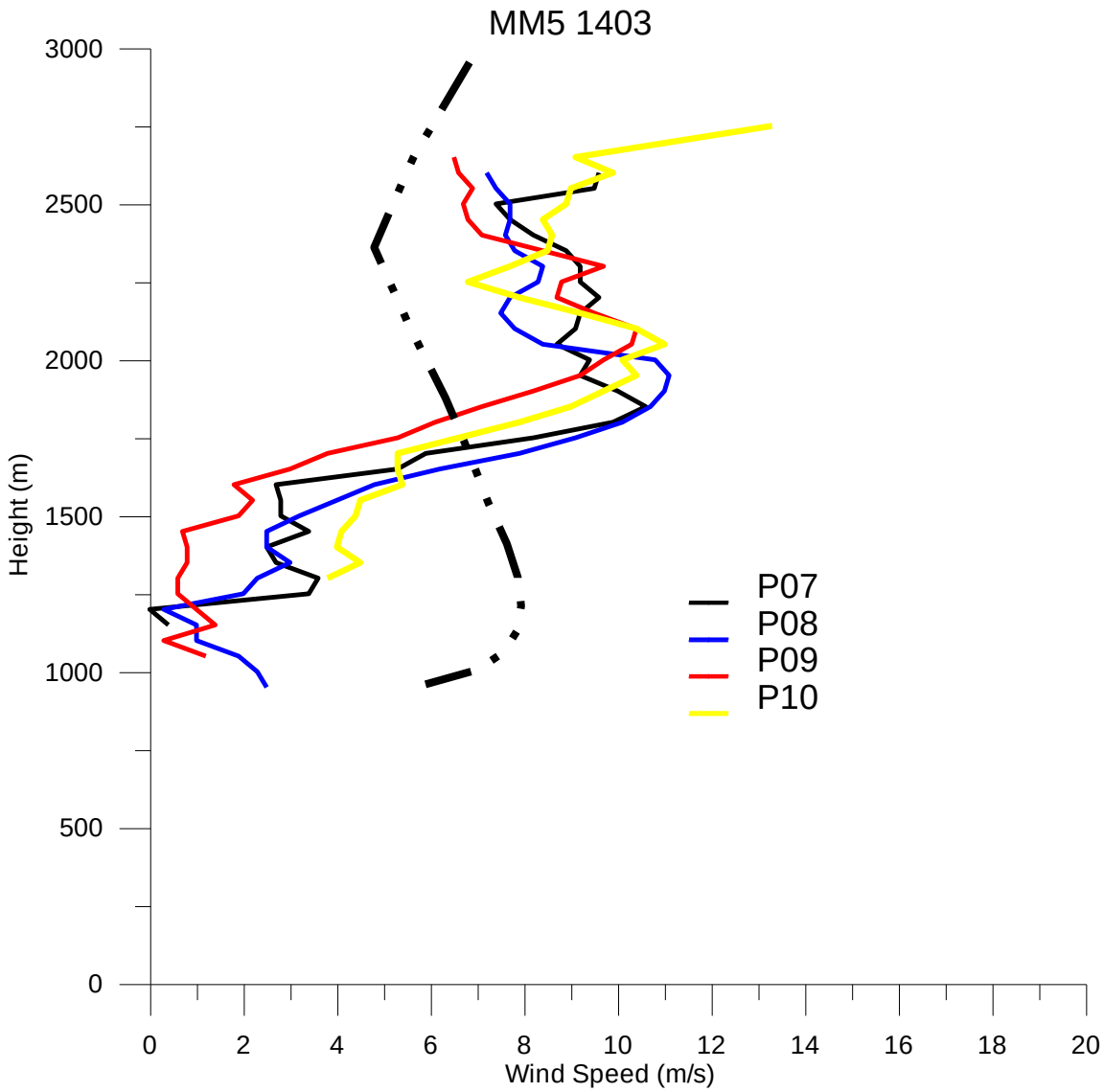

P80_to_P88 vs MM5 1444 Profiles
MM5_1444
P80
P82
P84
P86
P88
Height (m)
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
14
16
18
20
Wind Speed (m/s)

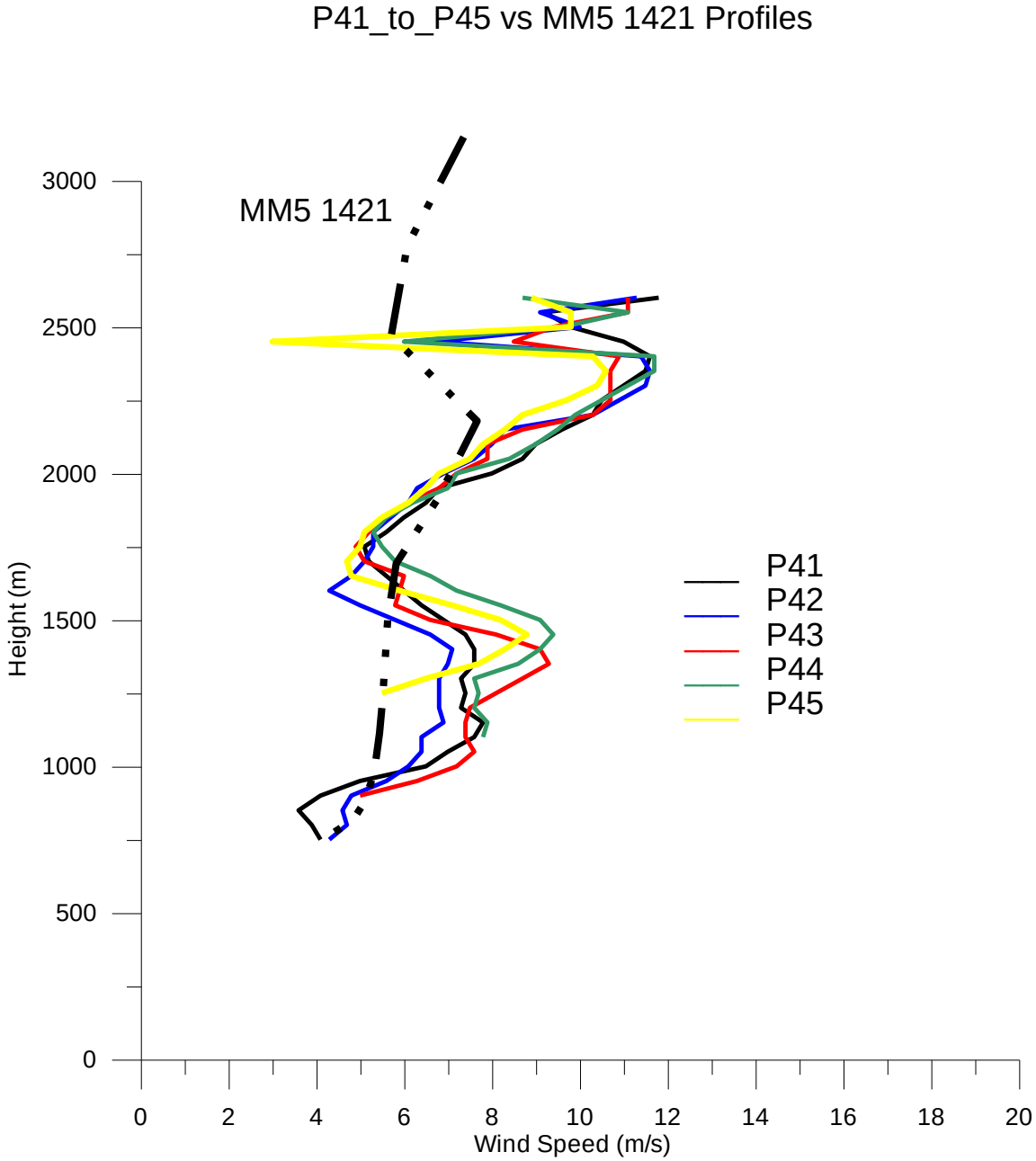

P89_to_P97 vs MM5 1444 Profiles
MM5_1444
Height (m)
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
14
16
18
20
Wind Speed (m/s)
P89
P91
P93
P95
P97


P25_to_P29 vs MM5 1412 Profiles
MM5 1412
Height (m)
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
14
16
18
20
Wind Speed (m/s)
P25
P26
P27
P28
P29


P61_to_P65 vs MM5 1430 Profiles
MM5 1430
P61
P62
P63
P64
P65
Height (m)
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
14
16
18
20
Wind Speed (m/s)

P07_to_P10 vs MM5 1403 Profiles




P41_to_P45 vs MM5 1421 Profiles
MM5 1421
Height (m)
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
14
16
18
20
Wind Speed (m/s)
P41
P42
P43
P44
P45

Summary

- The TODWL soundings have been processed to obtain accuracies of <.10 m/s in each component (u,v,w).
- Comparisons with other sounders must be interpreted with caution since integration times and sample volumes are different.
- Comparisons with model predictions suggest a significant effort is needed to understand the differences.