Cloud Motion Vectors from MISR:
update and comparison with QuickSCAT and NCEP

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Outline

- *MISR update*
- *QuickSCAT and NCEP comparisons*
  - *climatologies*
  - *matched*

MISR Features

- multi-angle (x9) of same scene within 7 min: super-stereo on high-resolution (275 m) cloud features to get height-resolved winds
  - operational approach: statistical, sub-pixel at 70 km
- pole-pole coverage since 3/2000
- BestWinds product operational since 12/2006
- all old data being reprocessed at 12x in 2008

BestWinds Product

"Cloud motion vectors from MISR using sub-pixel enhancements," R Davies, Á Horváth, C Moroney, B Zhang, & Y Zhu, *Remote Sens. Environ*. doi:10.1016/j.rse.2006.09.023, 107, 194–199, 2007.

- **uses agreement between forward and aft triplets for quality control**

product 'errors' (rms)	standard	enhanced
scalar speed (m/s)	2.4	1.5
direction	17°	14°
height (m)	290	165
coverage	67%	45%

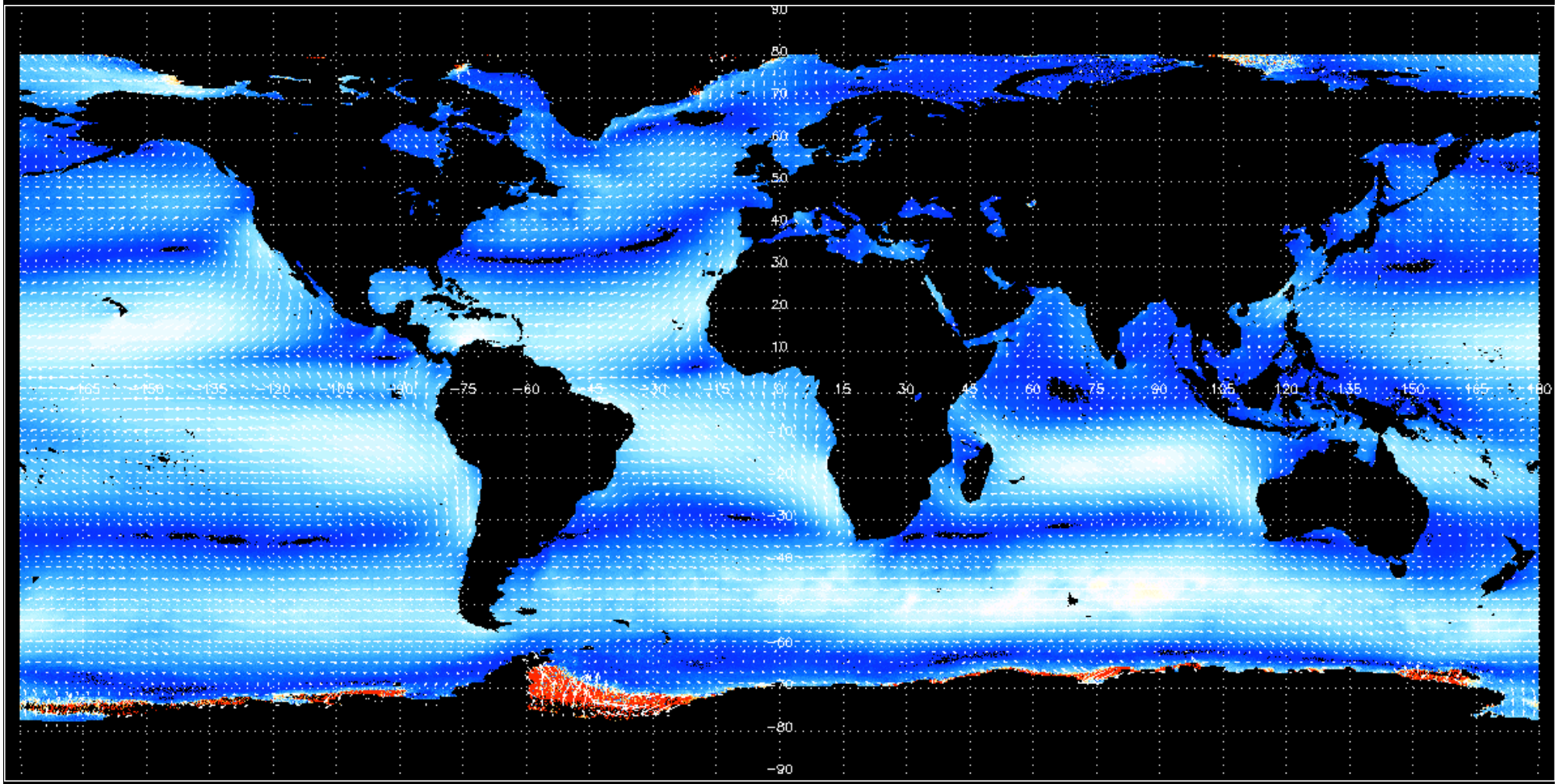
MISR Limitations

- data latency: 2+ days from Terra/MISR
  - needs a real-time downlink in future
- swath width of ≈400 km
  - can be expanded to >1000 km in future
  - Small satellite constellation to provide daily global winds
- daylight only
  - ir approach possible, but yet to be demonstrated
- cannot handle variable contrast from multi-layered clouds
- cannot handle featureless clouds (large cirrus outflow)
- currently at 70.4 km resolution (35.2 km seems possible)
- height and along-track wind errors are correlated
  - very-high-altitude wind bias

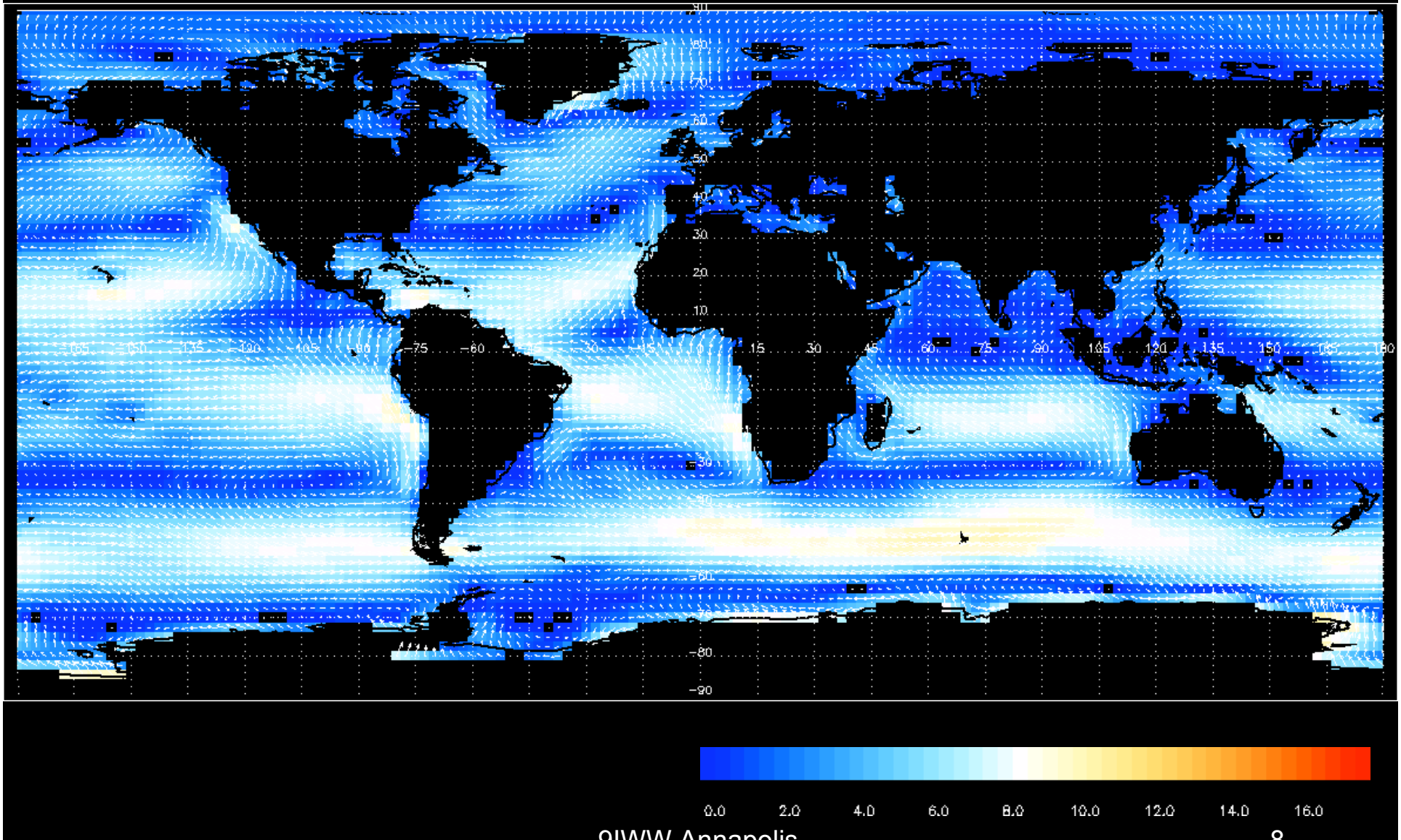
Comparative Studies

- time period: 12/2006–11/2007
- MISR standard (Level 2) BestWinds (1/4 daily, 0.7°)
- QuickSCAT (Level 3) ocean surface wind vectors (2x daily, 0.25°)
- NCEP/NCAR reanalysis wind vectors (4x daily, 2.5°)

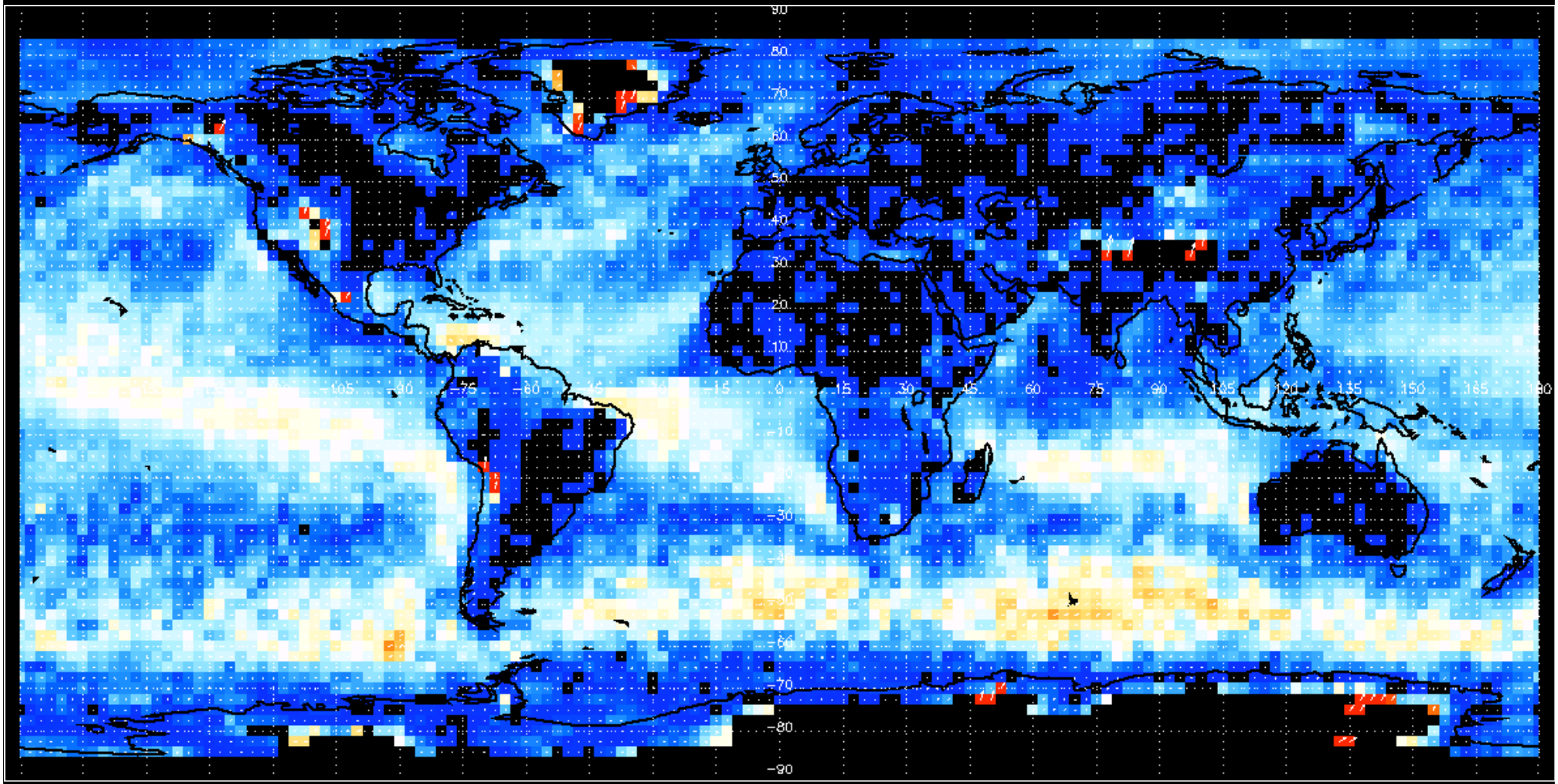
QuikSCAT Mean Ocean Winds Annual Climatology



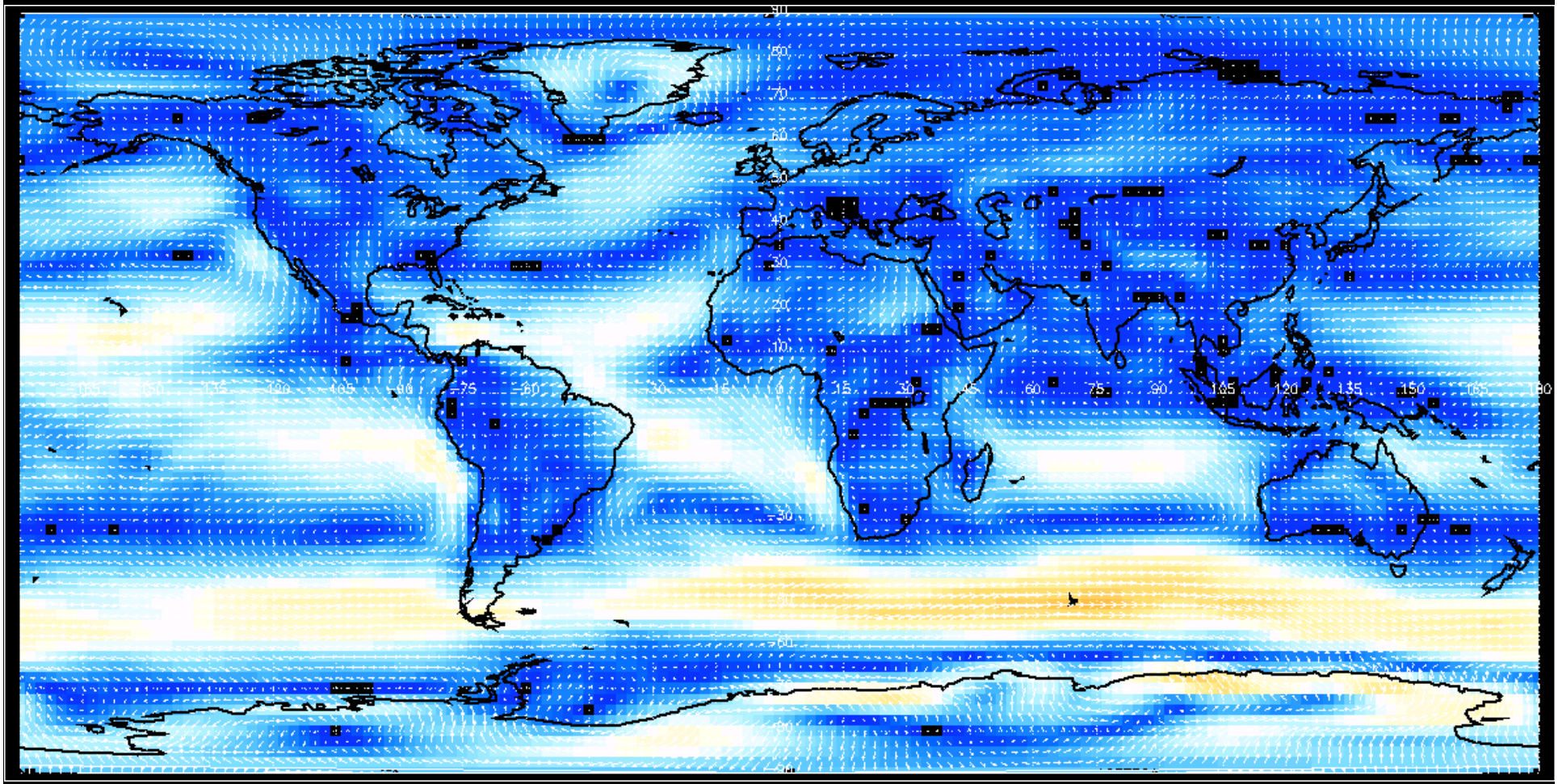
NCEP Reanalysis Mean Ocean Surface Winds Annual Climatology



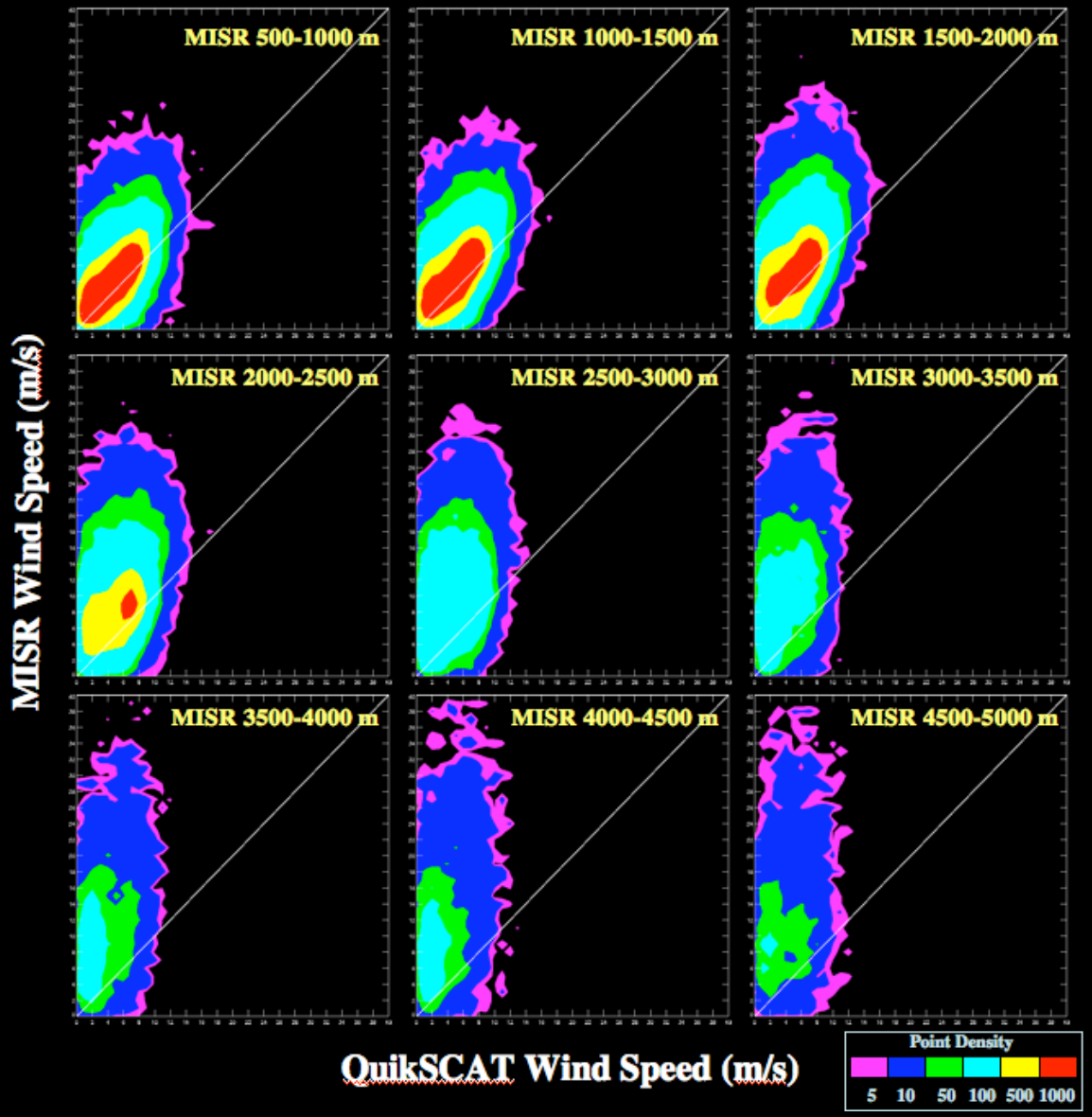
MISR Mean Winds Annual 0 - 1000 m Climatology



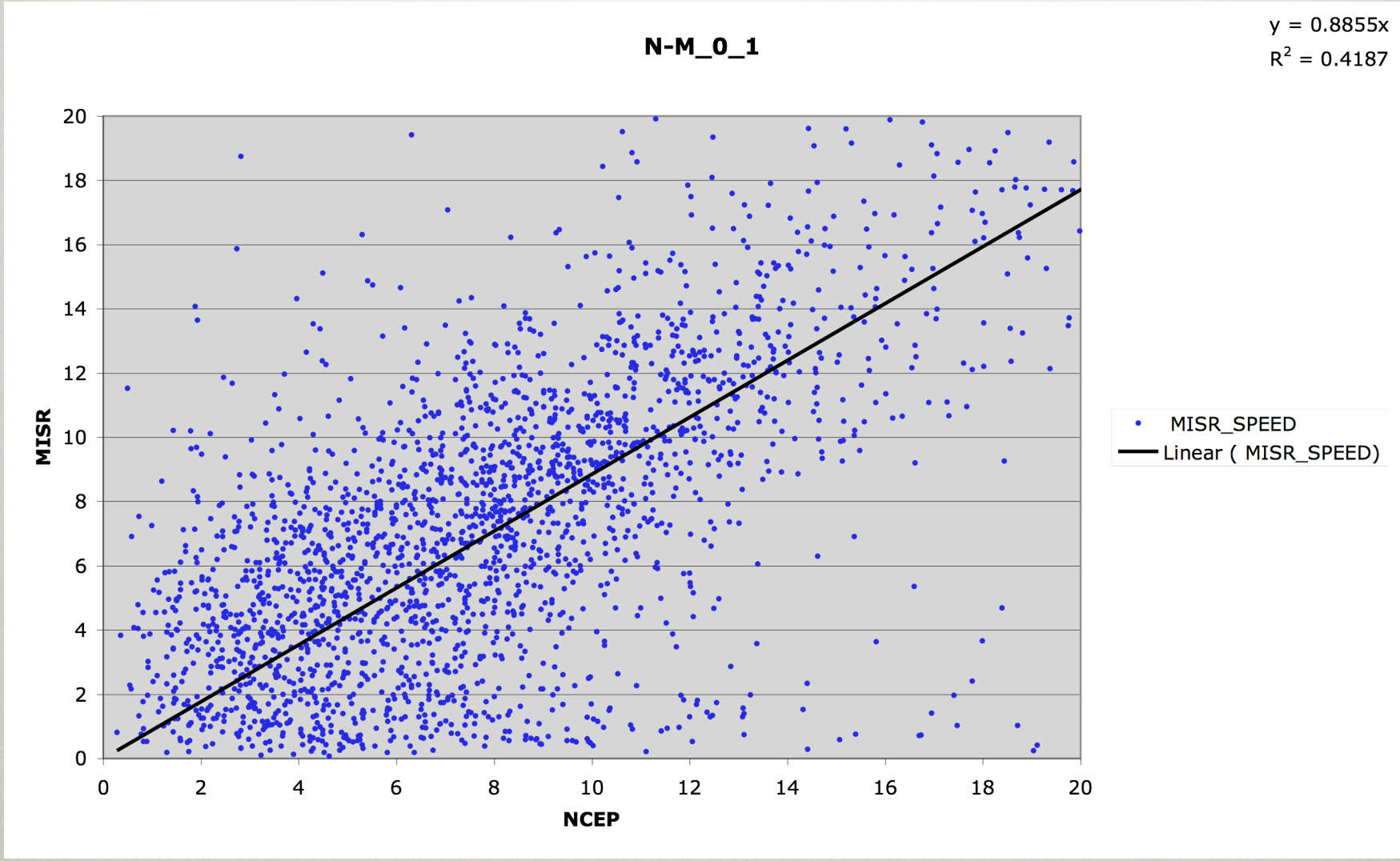
NCEP Reanalysis Mean Winds Annual 0 - 1000 m Climatology



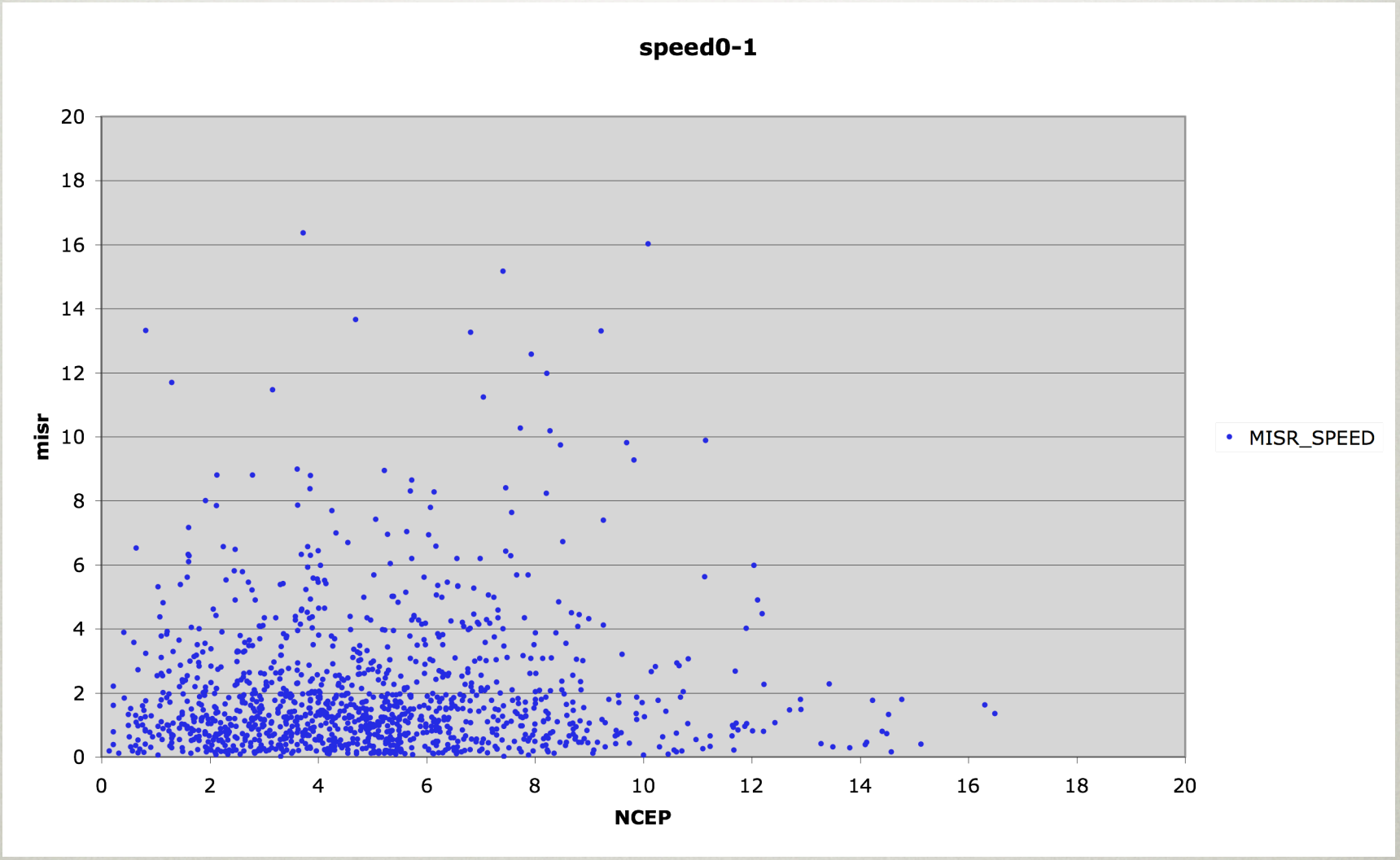
Altitude Dependence of MISR Mean Winds vs. QuikSCAT (JJA)



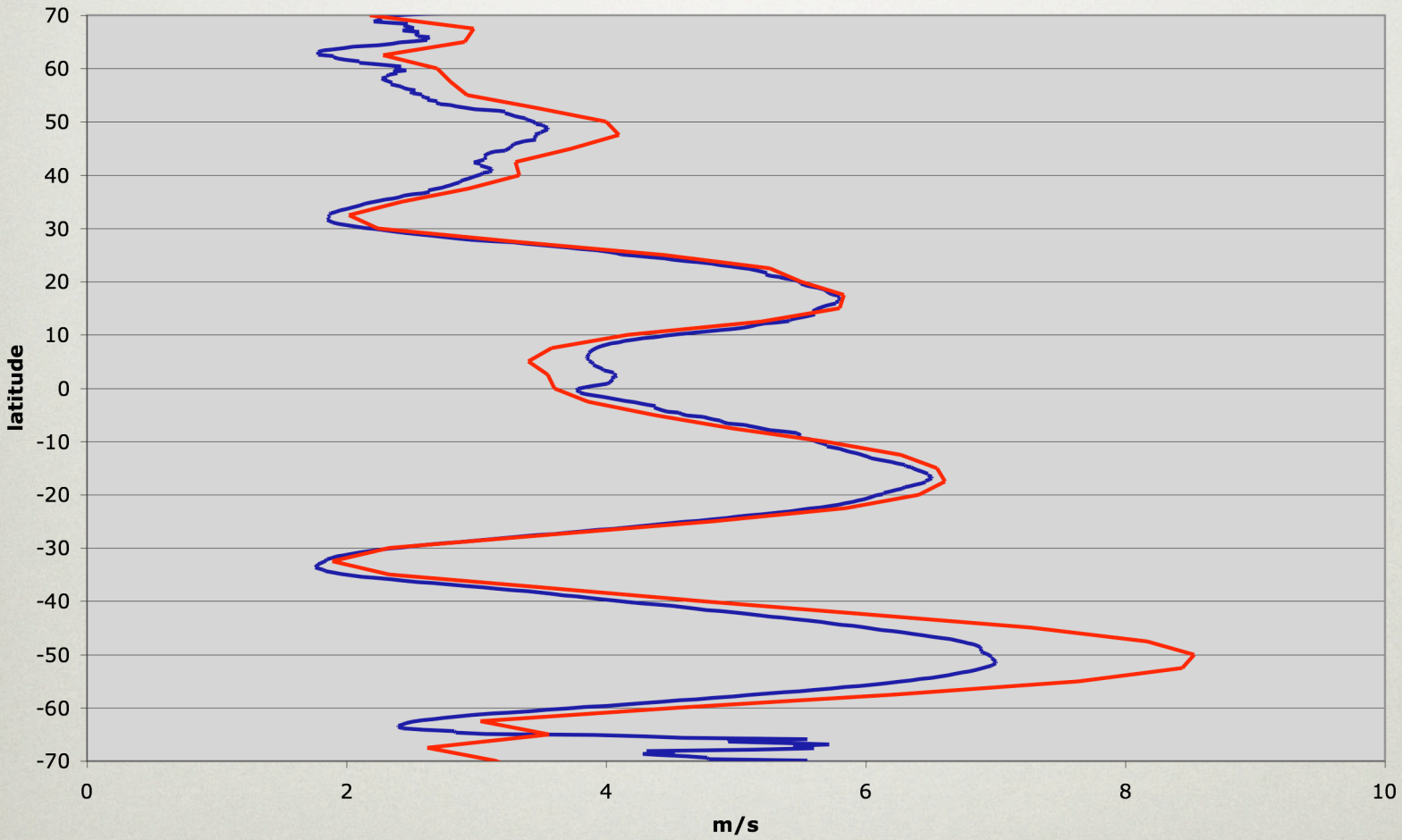
MISR vs NCEP ocean 0–1 km



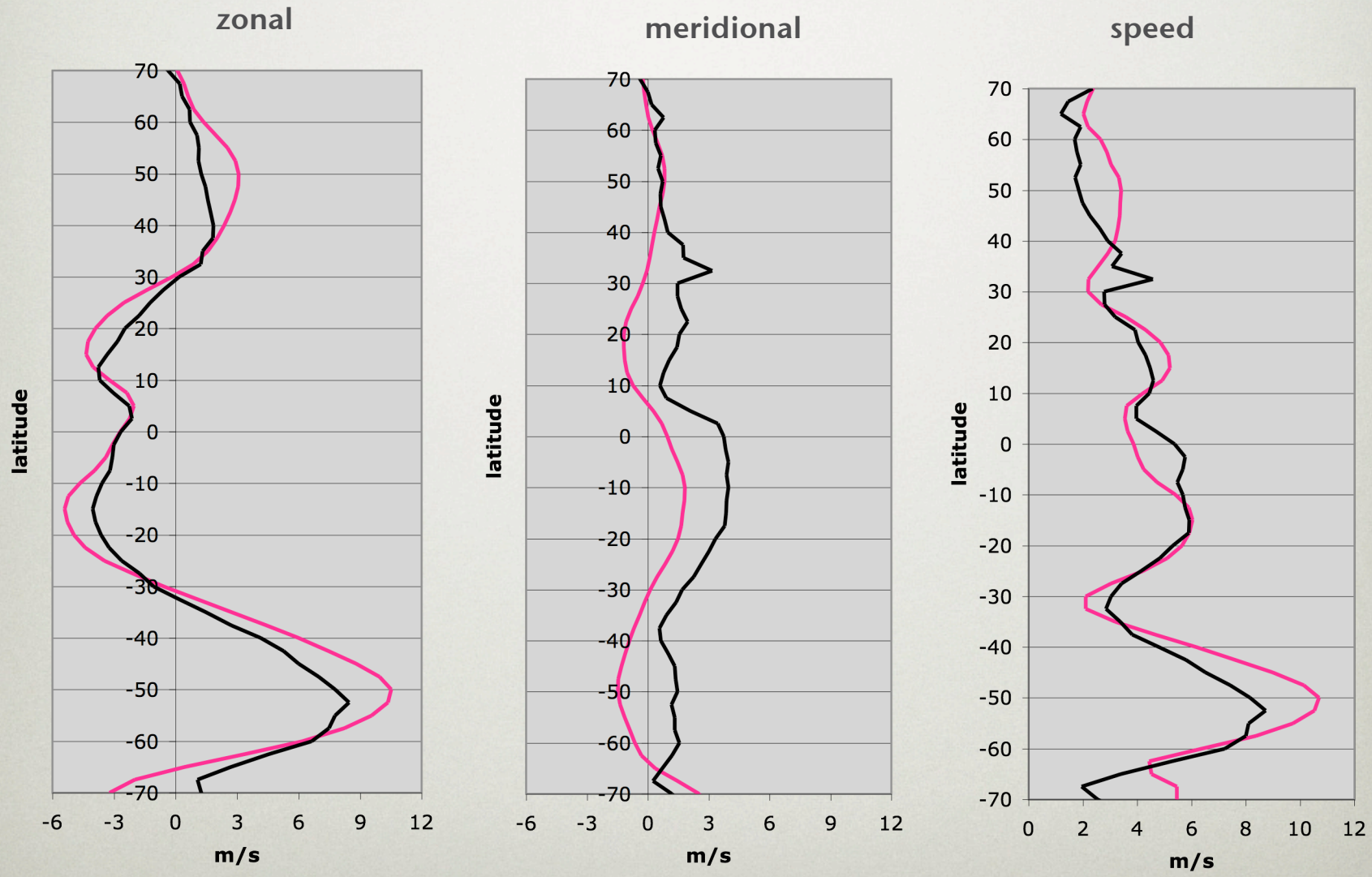
MISR vs NCEP land 0-1 km



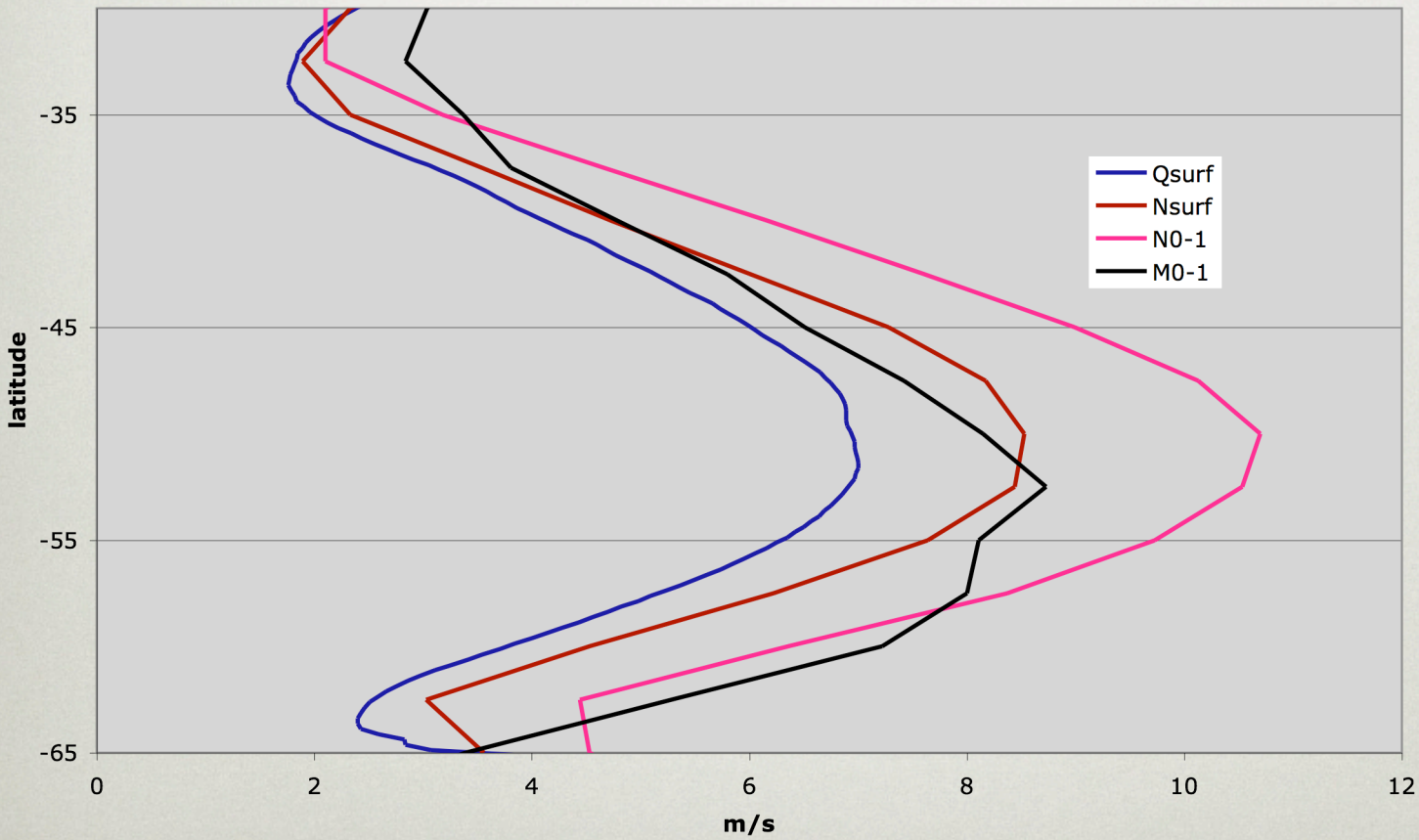
NCEP and QuikSCAT Annual Surface Ocean Winds



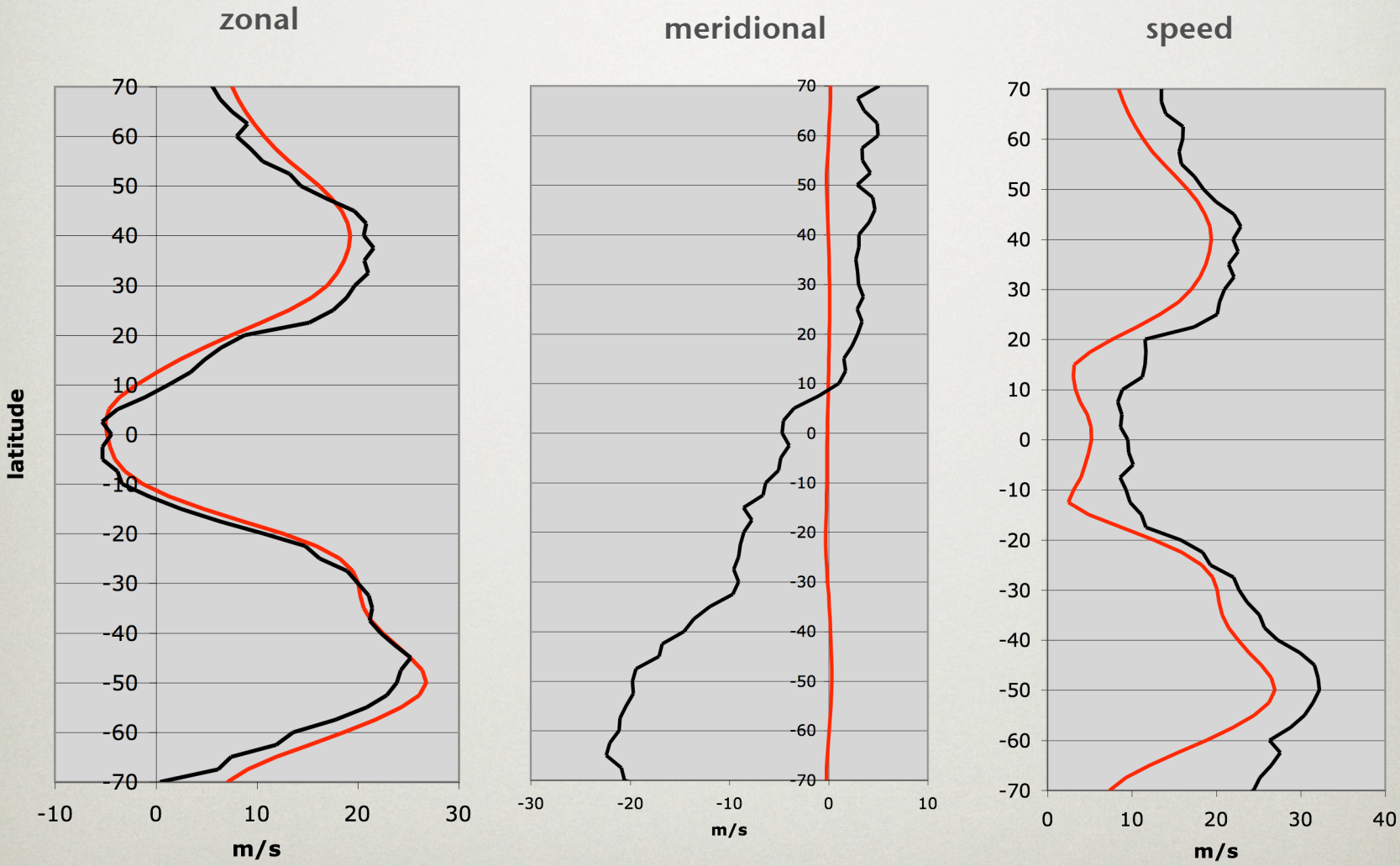
NCEP and MISR 0-1 km Annual (Global)



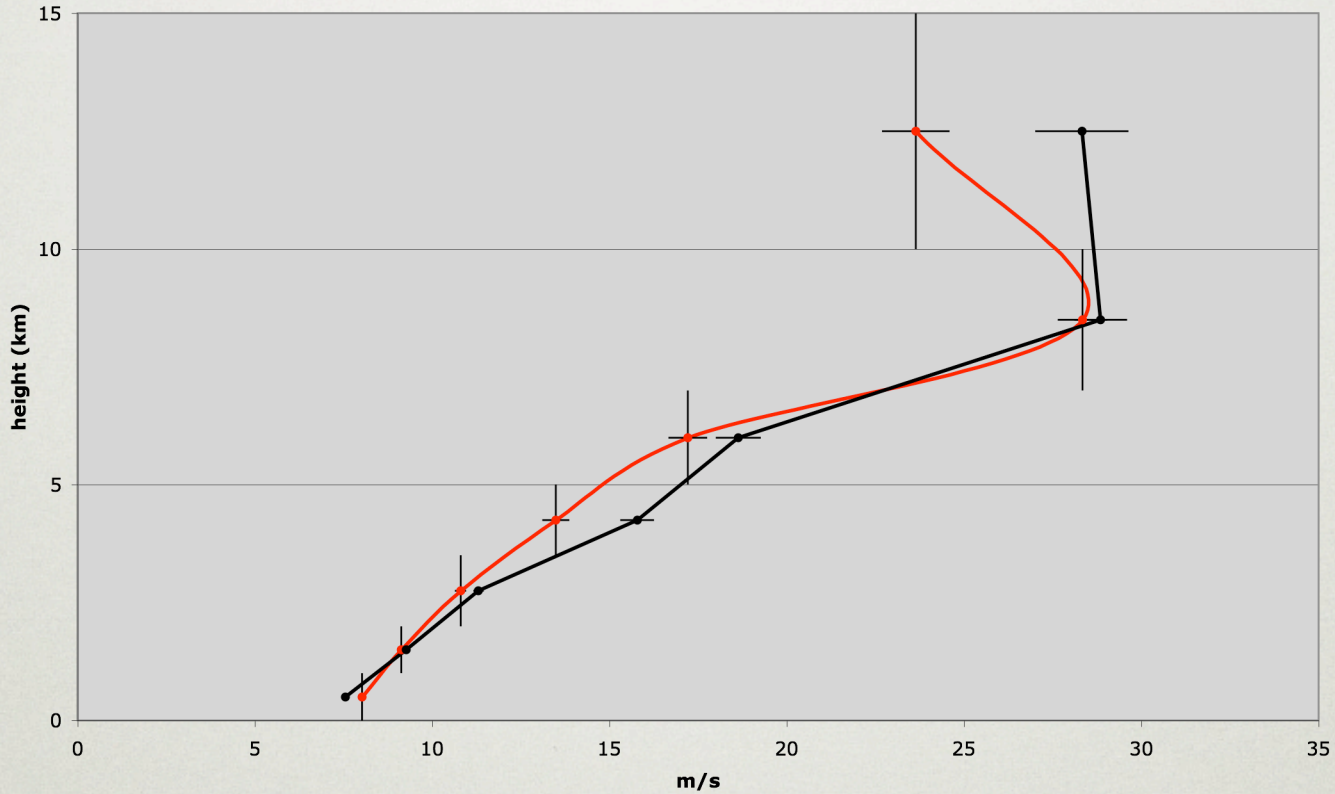
Southern Ocean Anomaly



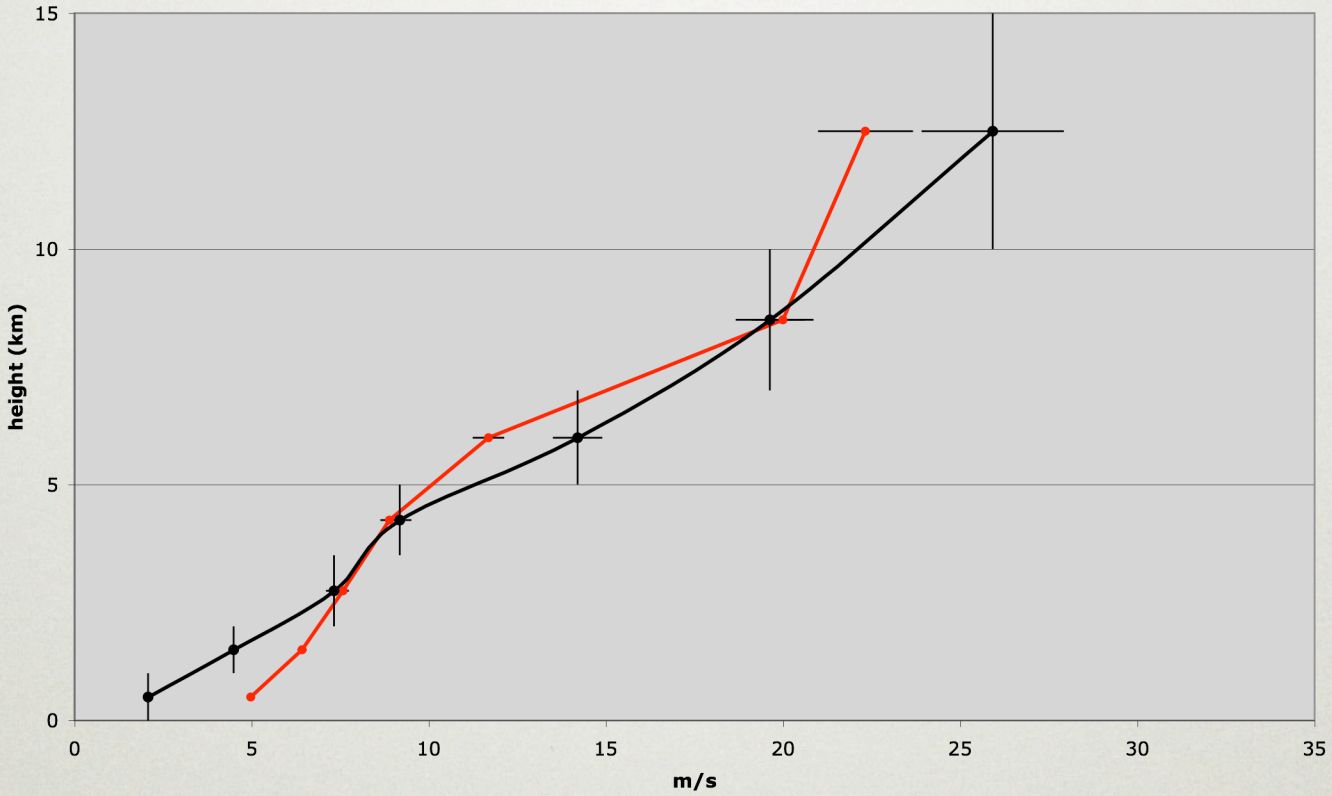
NCEP and MISR 7-10 km Annual



NCEP and MISR Matched Speeds Over Ocean



NCEP and MISR Matched Speeds Over Land



Summary

- comparisons show general climatological agreement, but matches are too coarse in time and space to provide definitive rms errors
- QuikSCAT and MISR show differences that grow in height above surface, as expected
- NCEP and QuikSCAT agree very well, except over Southern Oceans
- NCEP and MISR show similar climatologies, but NCEP winds become more zonal with height
- slow bias of MISR CMV evident over land to altitude $\lesssim 3$ km, absent over ocean
- implication that MISR wind data will add value to global wind reanalyses
- next: more detailed matched summary, closer in time and space, using higher spatial resolution model data