Using the Expected Error in the assimilation of satellite-derived winds
Part 1: Quality control impact

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Outline

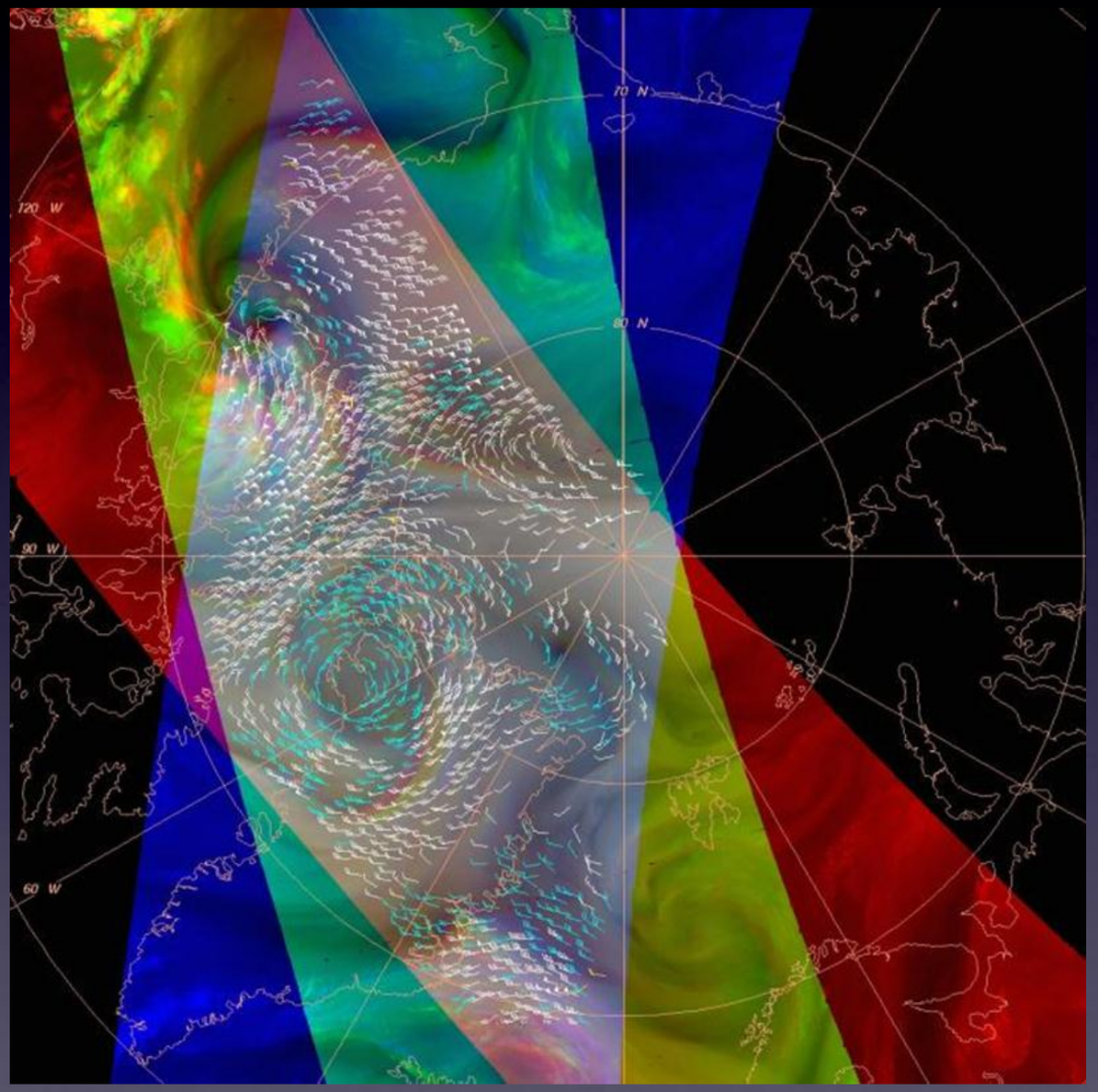
- Polar Winds
- Current QC method
- What is the Expected Error?
- Comparison of QC methods
- O-B and O-A statistics

Satellite-derived Polar Winds

Unlike geostationary satellites at lower latitudes, it is not be possible to obtain complete polar coverage at a snapshot in time with one or two polar-orbiters.

Winds must be derived for areas that are covered by three successive orbits

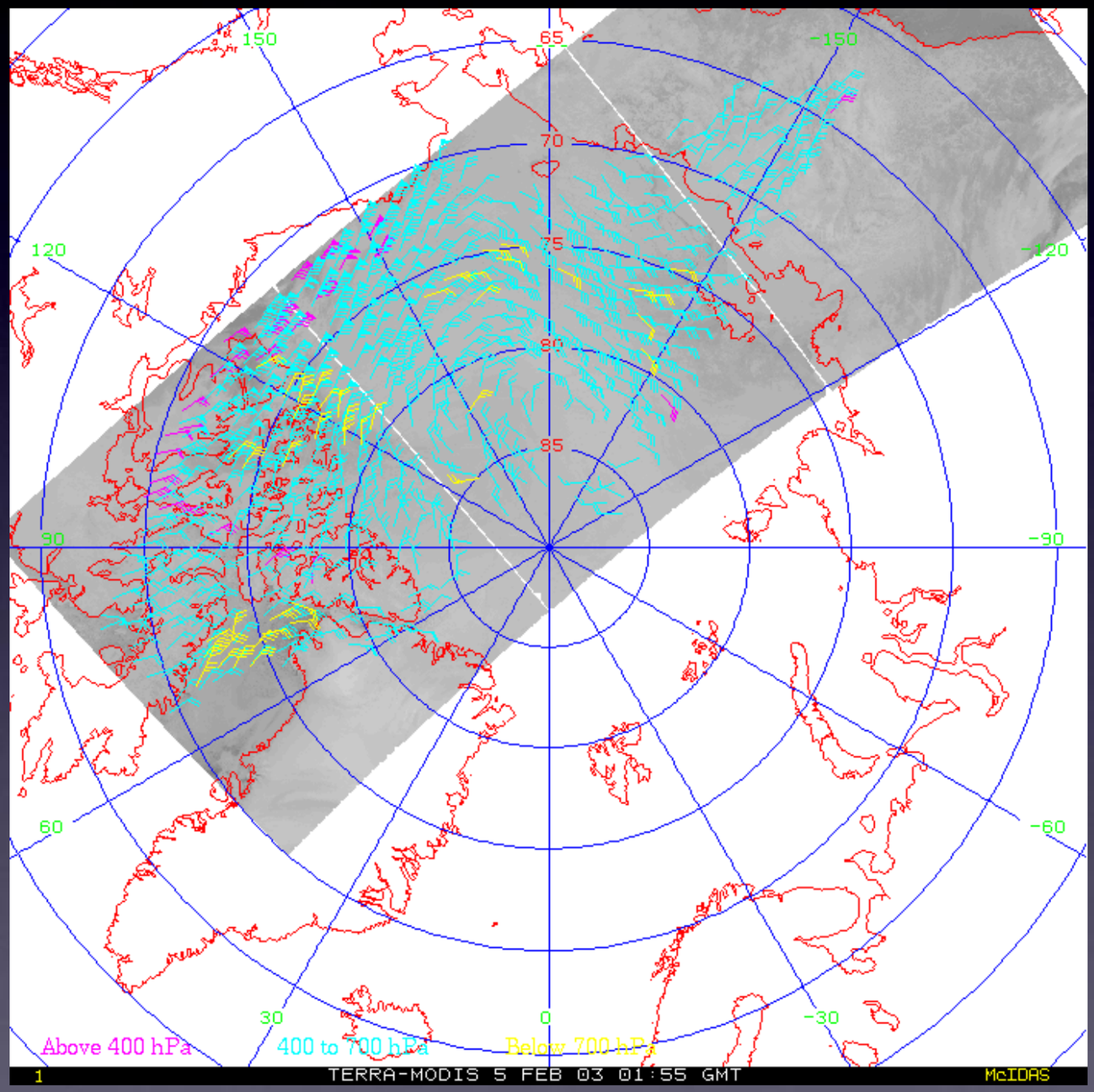
The gray area is the overlap between three orbits.



Three overlapping Aqua MODIS passes, with WV and IR winds superimposed. The white wind barbs are above 400 hPa, cyan are 400 to 700 hPa, and yellow are below 700 hPa.

One Day of Arctic Orbits

Terra MODIS



MODIS band 31 (11 μm)

MODIS Polar Winds QC

Thinning criteria

Within 50 hPa of the tropopause
Within 200 hPa of the surface, if over land

Current

qcU* = qcV = 7 ms^{-1}

$(O\text{-}B)_U$ > qcU OR

$(O\text{-}B)_V$ > qcV

Proposed

EE > 5 ms^{-1} AND

EE > 0.1 * ObsSpd

* Special case:

qcU = qcV = (ObsSpd + 15)/3

(IR wind within 200 hPa of surface OR
WV wind below 400 hPa) AND

(GuessSpd +15)/3 < qcU

Expected Error

Least square regression is used to compute the RMSE (ms^{-1}) from the EE components as compared to co-located RAOBs.

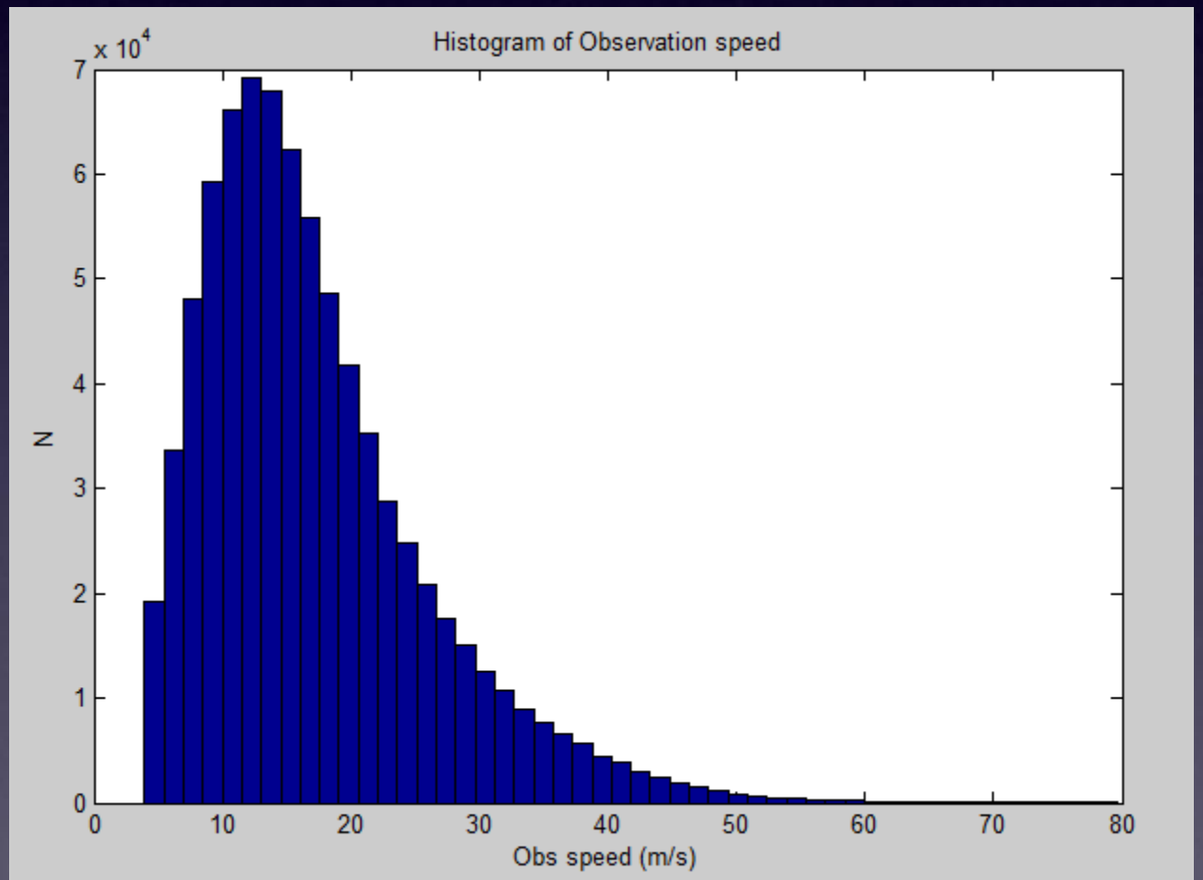
EE Components:	[Terra NH cloud drift]
• Five QI values	[-0.1 to -2.8]
• Wind speed	[+0.1]
• Wind shear	[0.03]
• Temperature shear	[-0.01]
• Pressure level	[-0.003]
• Constant	[8.4]

Experiments

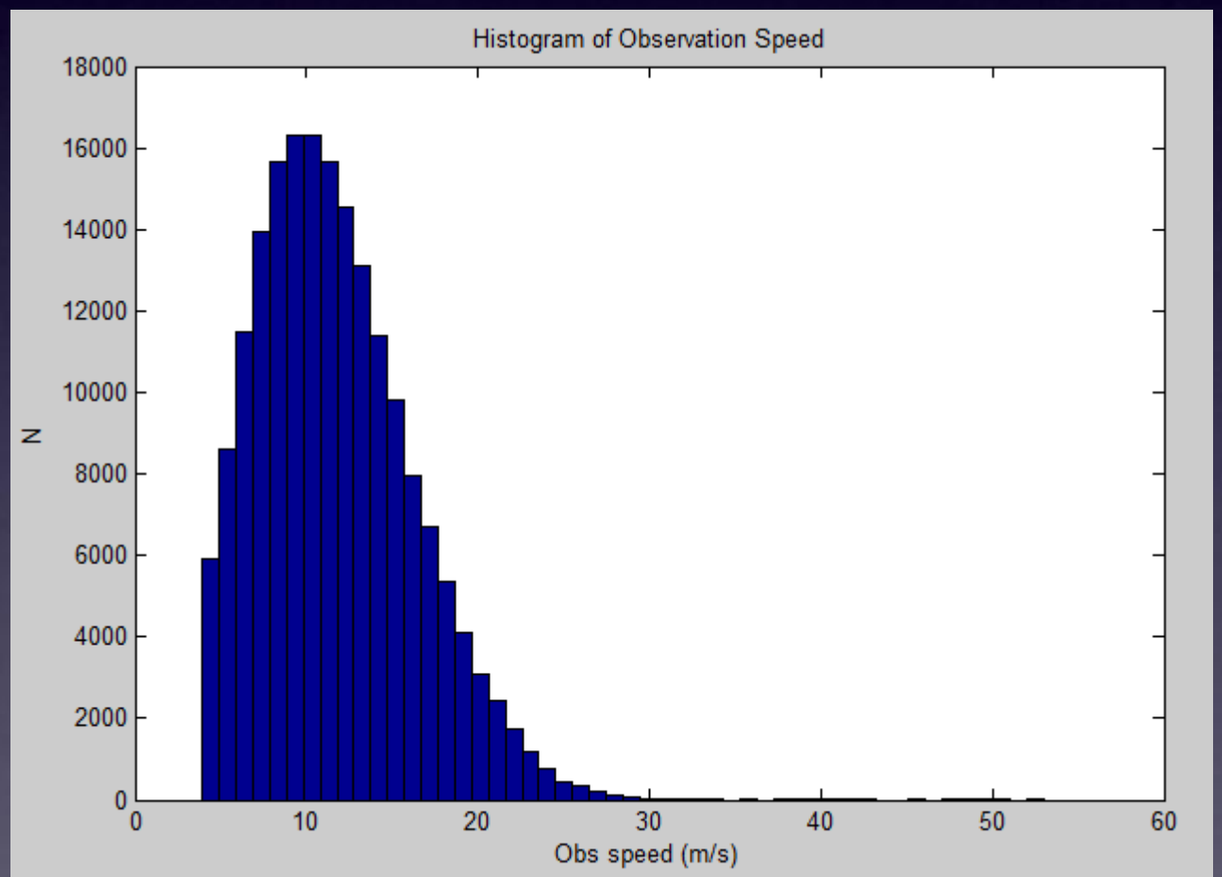
- Running latest GDAS/GFS on ‘vapor’
- September 2010
- January – February 2011
- EE > 5 ms^{-1}
- EE > 7.5 ms^{-1}
- Following statistics based on 10 days with EE > 5 ms^{-1} both Arctic and Antarctic: 10 to 19 September 2010

10 – 19 Sept. 2010

	Control	Experiment
Raw vectors	2500K	2500K
Good vectors	790K	187K



Control accepted obs

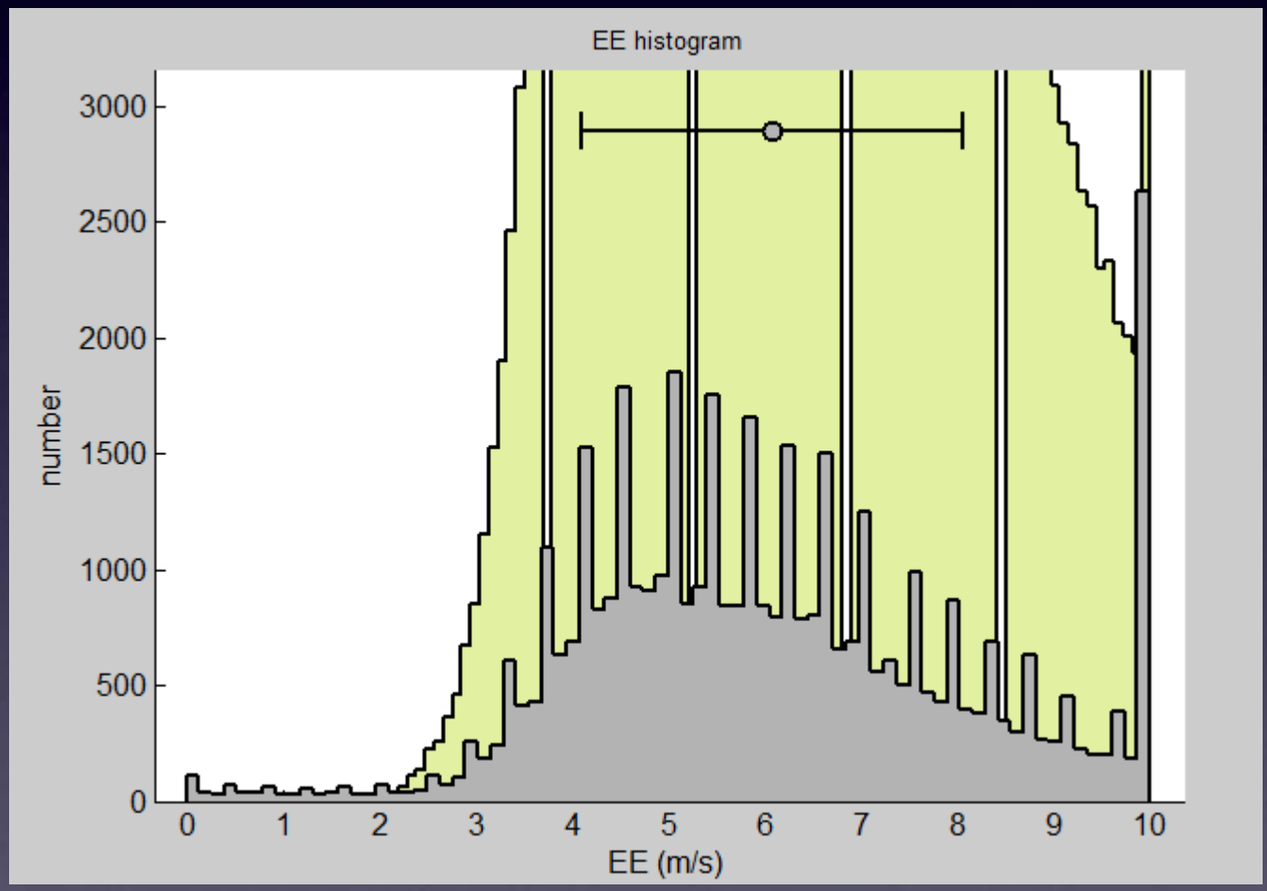


Experiment accepted obs

Control QC

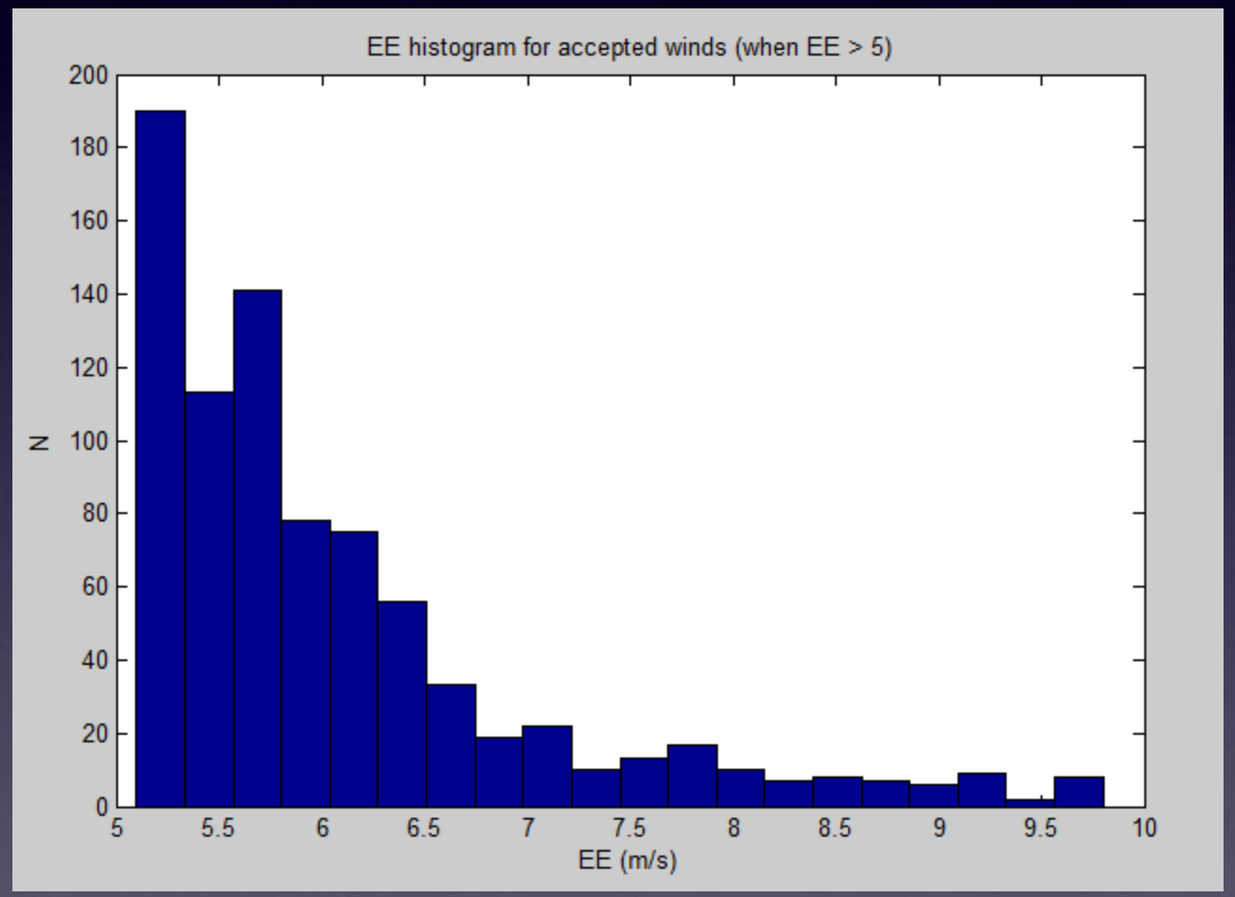
Yellow: Histogram of EE for control accepted winds

Gray: Histogram of EE for control for rejected winds



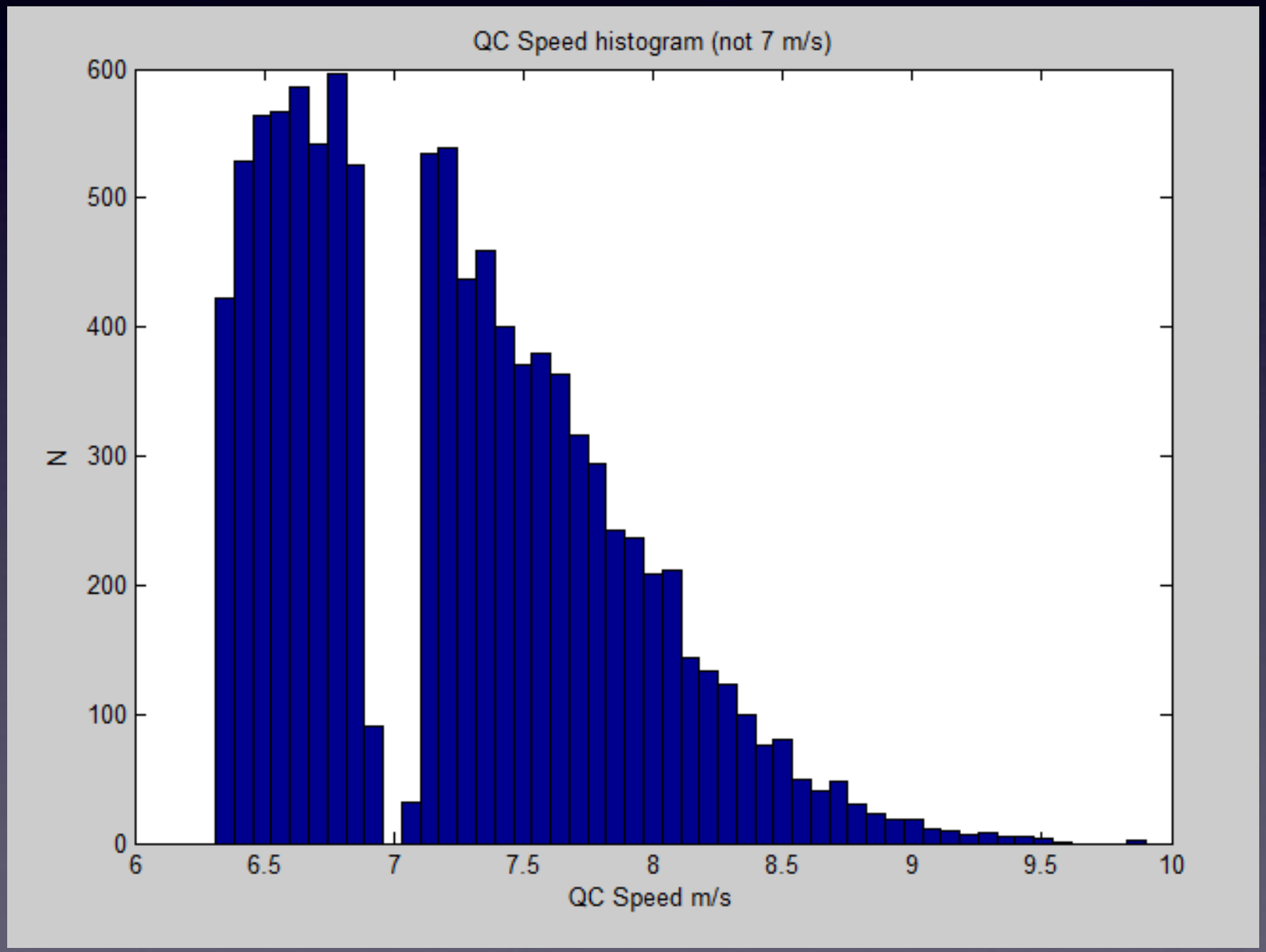
Experiment EE > 5 m/s

Some winds are retained by allowing the EE larger than 5 m/s for high wind speeds (only about 100 out of 100,000)



Current QC threshold

Usually 7 ms^{-1}



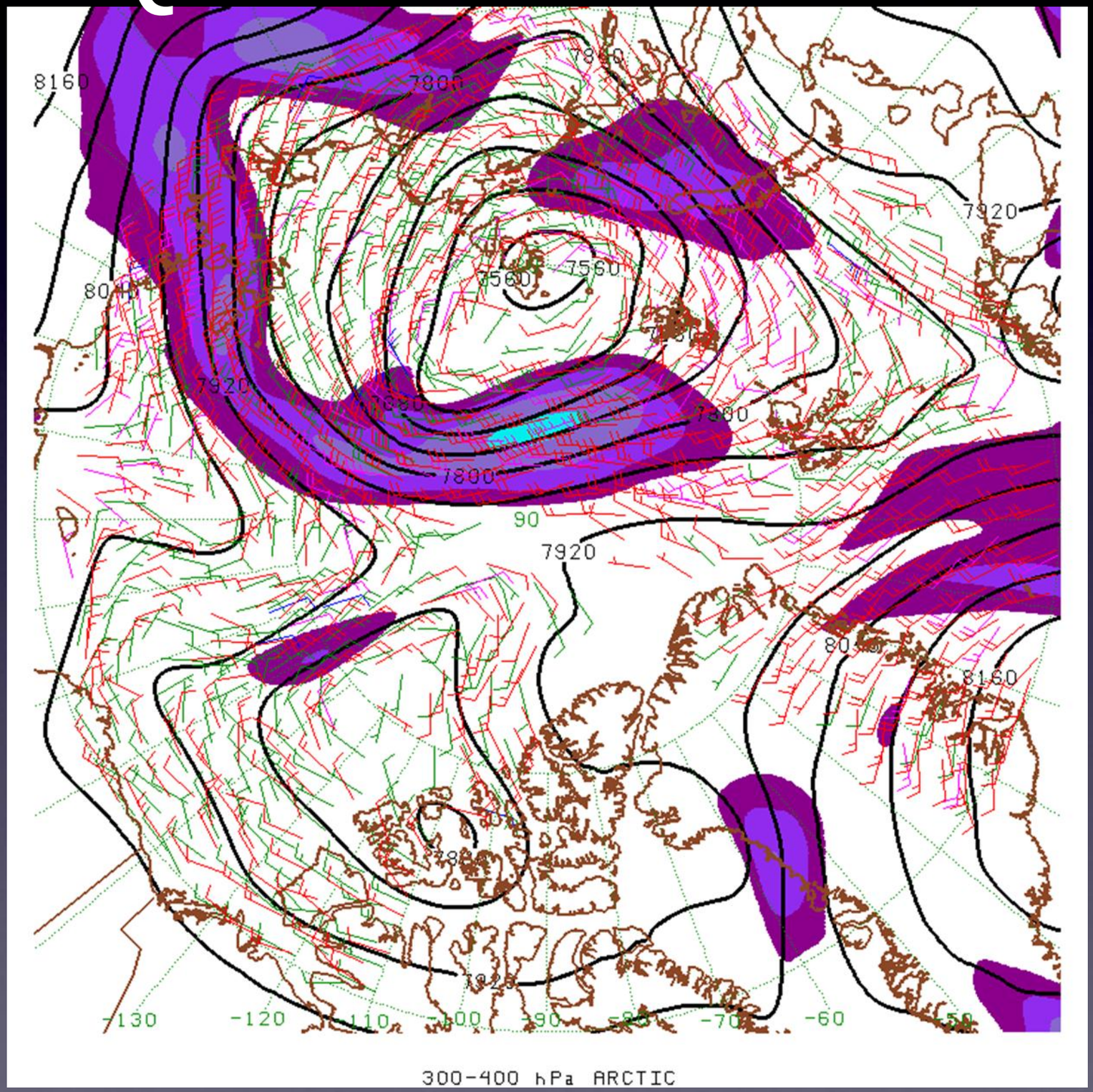
Example QC Difference

- Green: communal accepted
- Magenta: communal rejected
- Blue: EE accepted
- Red: EE rejected

Arctic

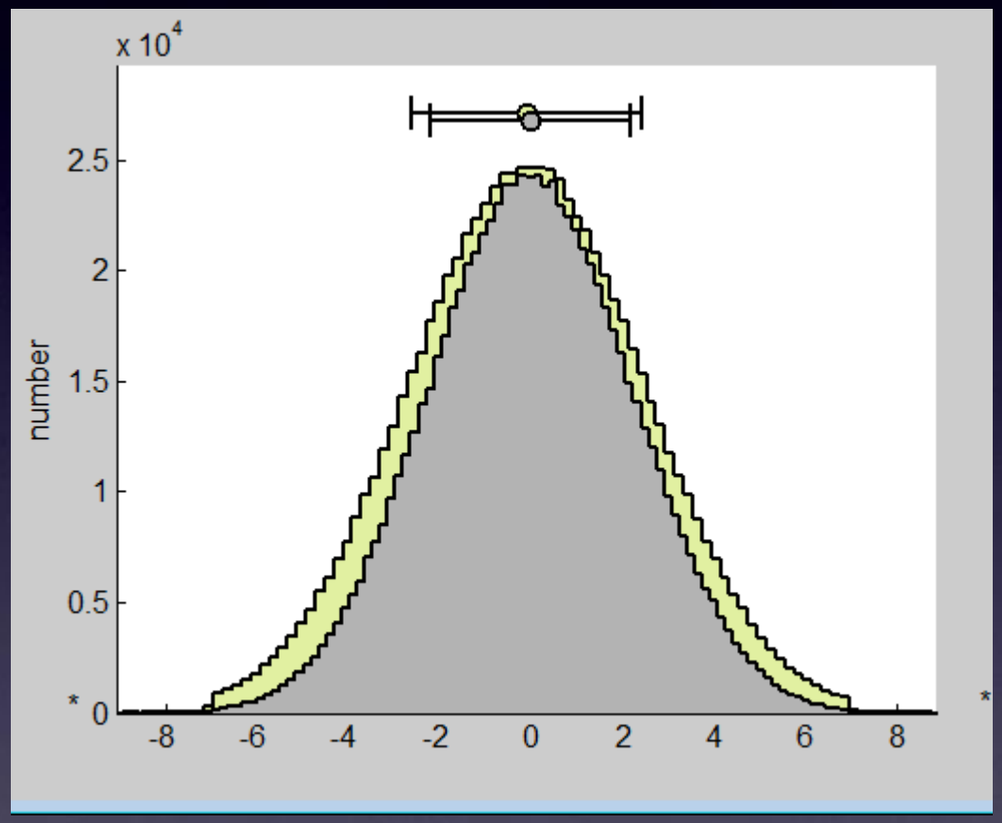
01 Sept 2010 06 UTC

300 – 400 hPa winds



Control:O-B and O-A

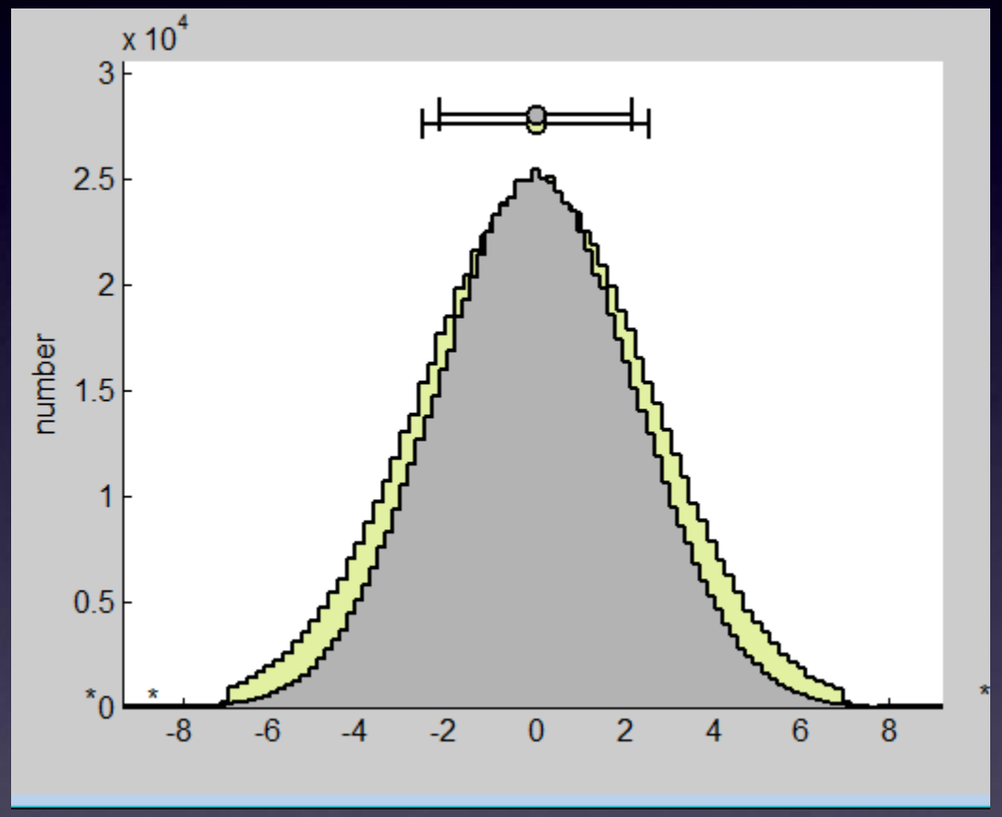
Yellow: Obs – Background Gray: Obs - Analysis



U-component (ms^{-1})

O-B: mean = -0.1 stddev = 2.5

O-A: mean = 0.0 stddev = 2.2



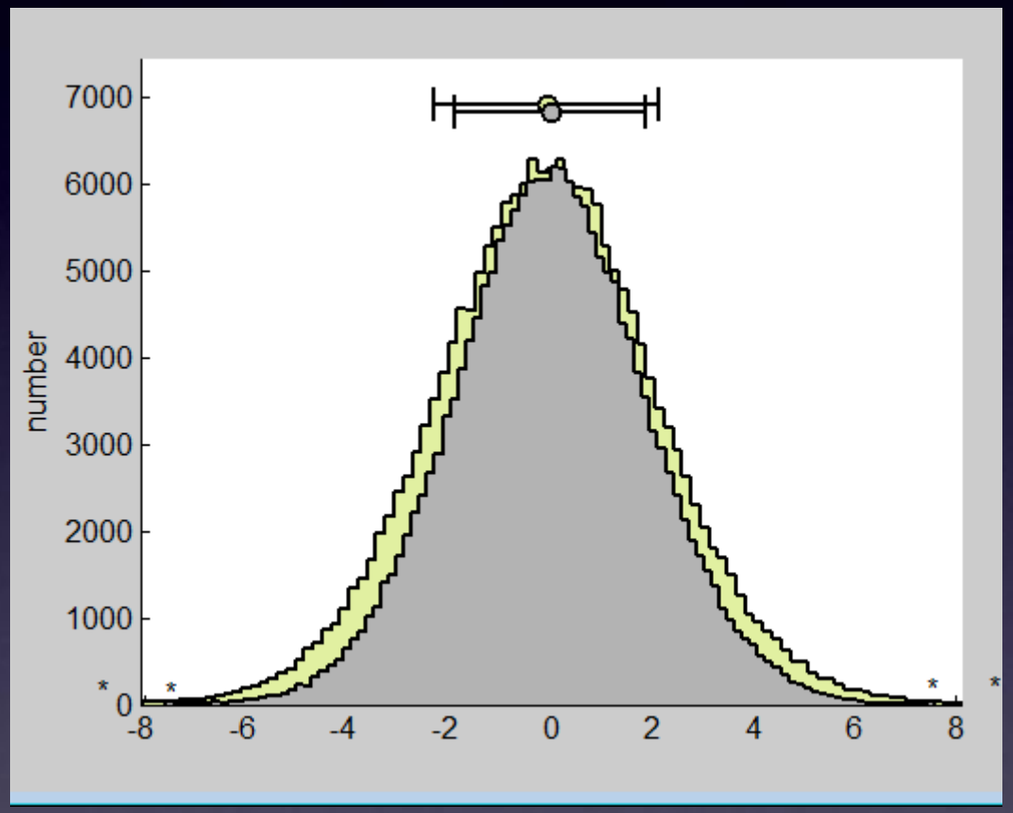
V-component (ms^{-1})

O-B: mean = 0.0 stddev = 2.6

O-A: mean = 0.0 stddev = 2.2

Experiment: O-B and O-A

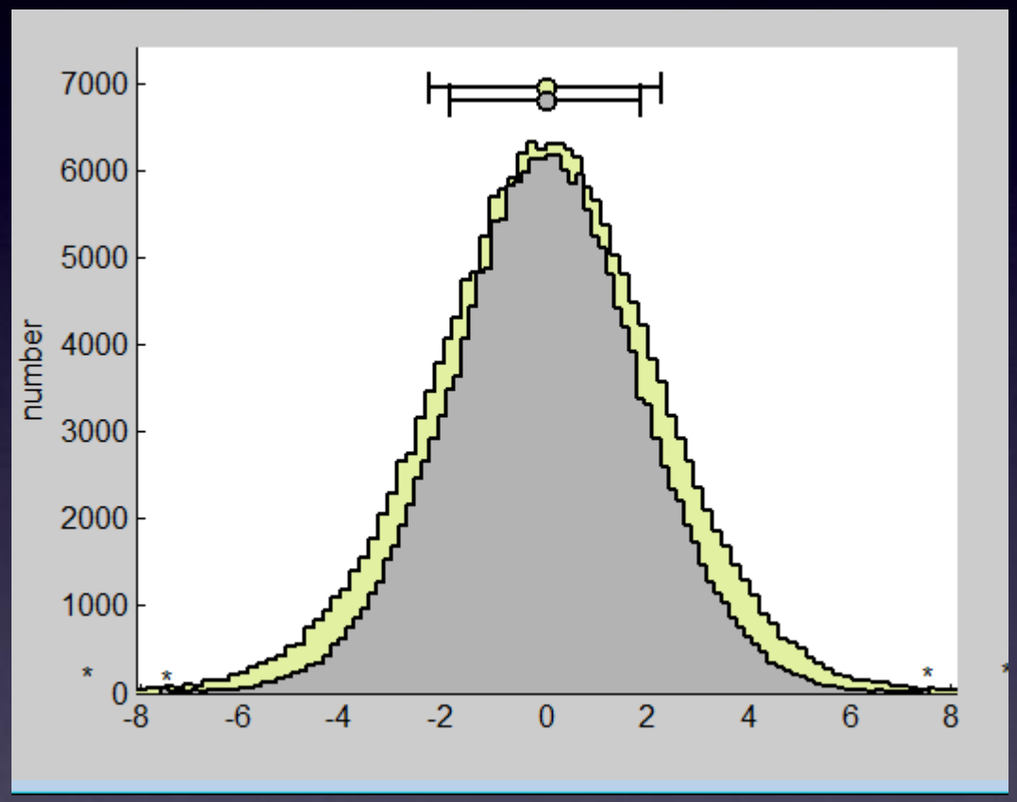
Yellow: Obs – Background Gray: Obs - Analysis



U-component (ms^{-1})

O-B: mean = -0.1 stddev = 2.2

O-A: mean = 0.0 stddev = 1.9



V-component (ms^{-1})

O-B: mean = 0.0 stddev = 2.3

O-A: mean = 0.0 stddev = 1.9

Summary

- O-B and O-A statistics are comparable to current QC method
- On going analysis of the two-season experiments
- Examining dropout cases
- See Brett Hoover's poster for Part 2: Forecast Impact

NOAA: NA10NES4400011