

Assessing the Impact of Erroneous Winds from the South Pole, Antarctica Rawinsonde Soundings on Reanalyses for 2005-2007

William Neff¹, Judith Perlwitz^{1,2}, Gilbert Compo^{1,2}

¹NOAA/Earth System Research Laboratory/Physical Sciences Division, Boulder Colorado

²Cooperative Institute for Research in the Environmental Sciences, University of Colorado, Boulder

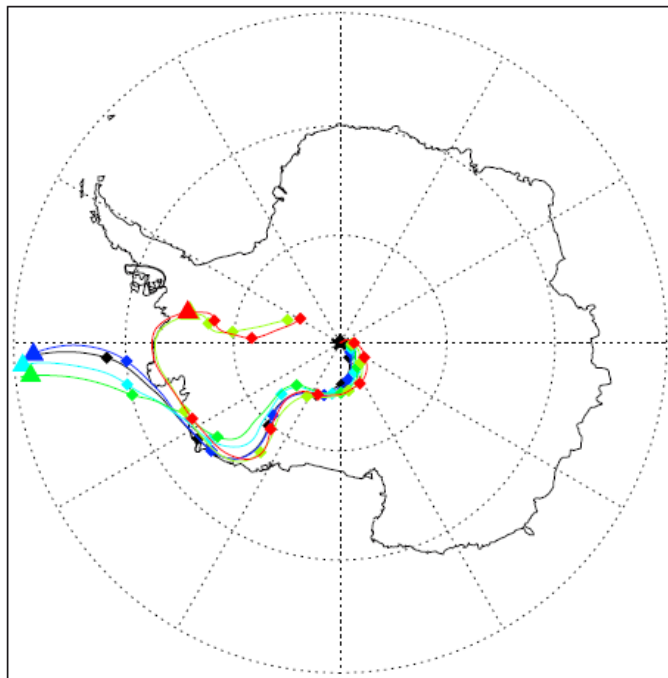


Upper Air Soundings

- Recent discovery of erroneous winds from the RS-92 sonde---RS-90 sonde is fine
- Algorithm causing the error---data at Pole has been in error since February 2005
- Model ingestion of data
- Vaisala correction complete---install underway
Notification of corrected data will come through the AMRC at University of Wisconsin-Madison e-mail

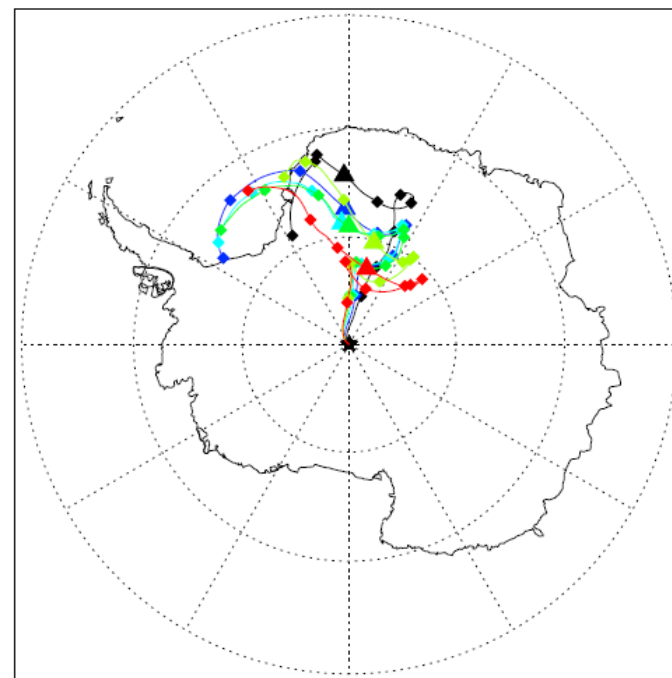
Motivation: Back-trajectories needed to interpret transport of sulfur to the South Pole during 2006: Was there an issue with the use of South Pole sounding data?

Feb-04-2006
(Daily mean NSS: 256.7ng m⁻³)



— 00:00 GMT — 04:00 GMT
— 08:00 GMT — 12:00 GMT
— 16:00 GMT — 20:00 GMT

Feb-11-2006
(Daily mean NSS: 34.8ng m⁻³)

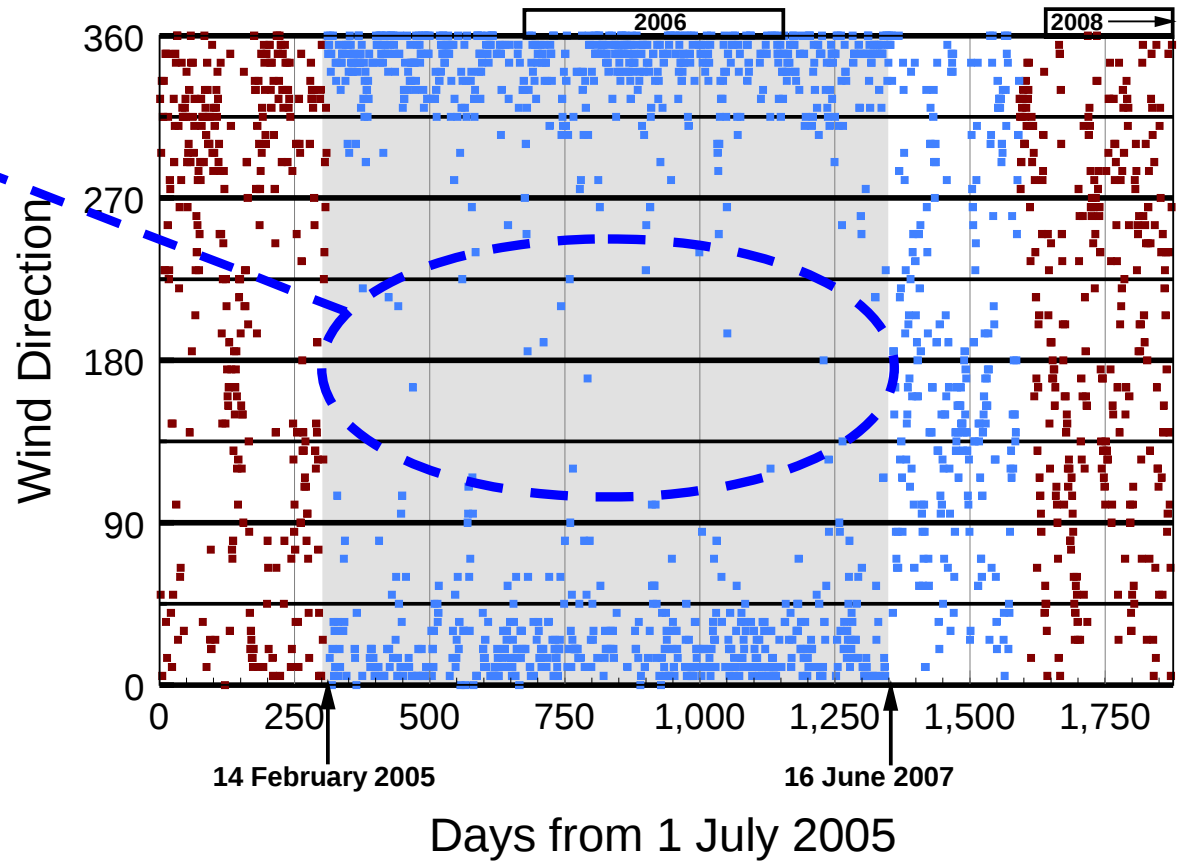
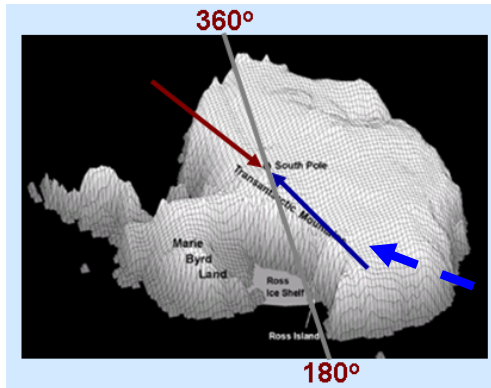


— 00:00 GMT — 04:00 GMT
— 08:00 GMT — 12:00 GMT
— 16:00 GMT — 20:00 GMT

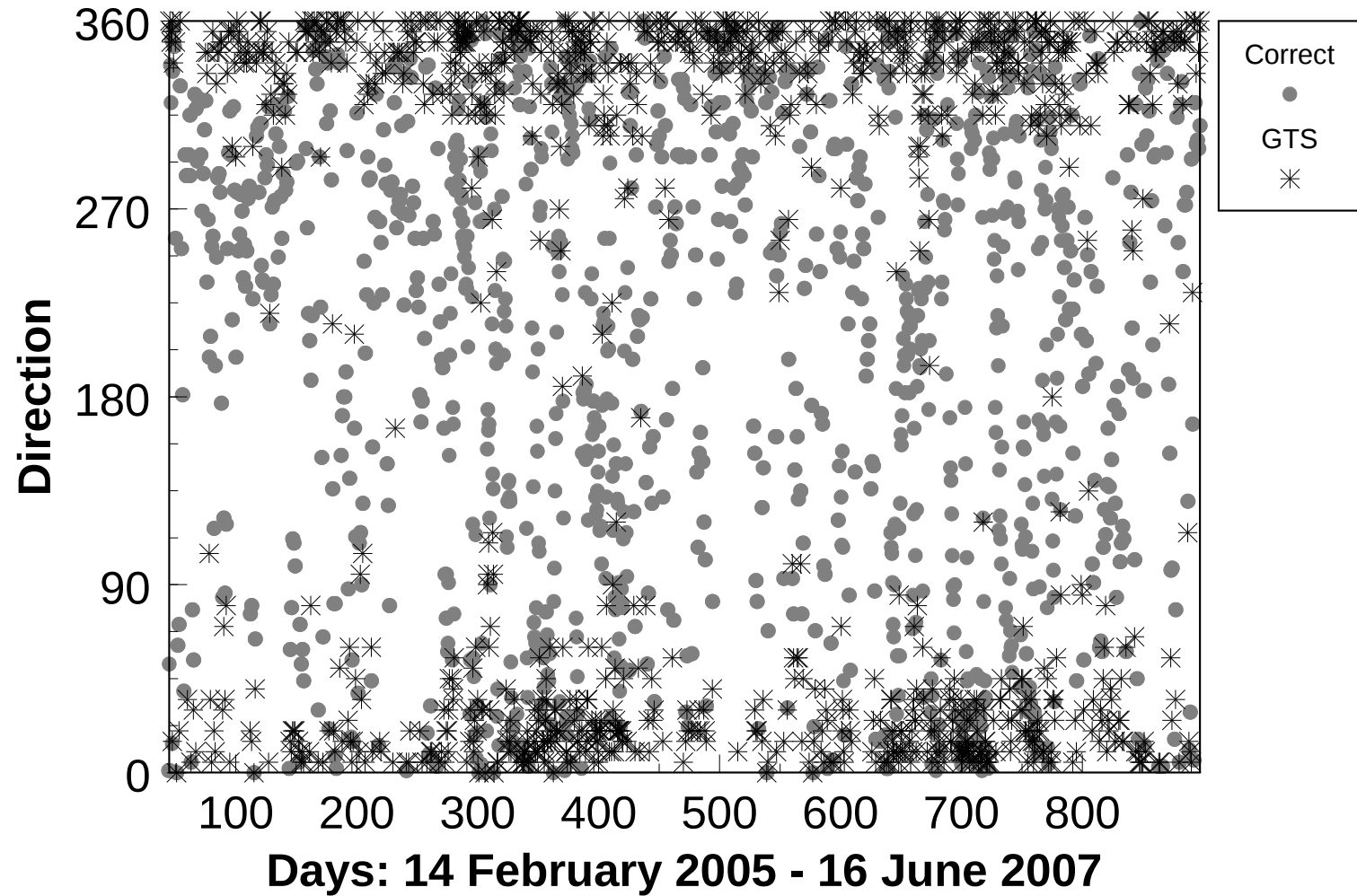
---see poster by Davis et al.

The effect of the rawinsonde error was to “lose” winds between “southeast and southwest” directions

500 hPa wind direction



Corrected and original data (GTS)



Question: What was the effect on various Reanalyses

We used:

- ***The original NCEP/NCAR (NCEP-I) Reanalysis***
- ***The NCEP/DOE II Reanalysis (NCEP-II)***

(which fixed a number of bugs and improved the parameterizations in the original NCEP/NCAR Reanalysis)

- ***The ERA Interim Reanalysis (ERA-I) from 1989 to the present which is expected to replace the older ERA-40 reanalysis.***

(Unlike NCEP-II, ERA Interim introduced both satellite winds and radio occultation measurements of the atmospheric mass field in its data assimilation system)

- ***The Twentieth Century Reanalysis (20CR)***

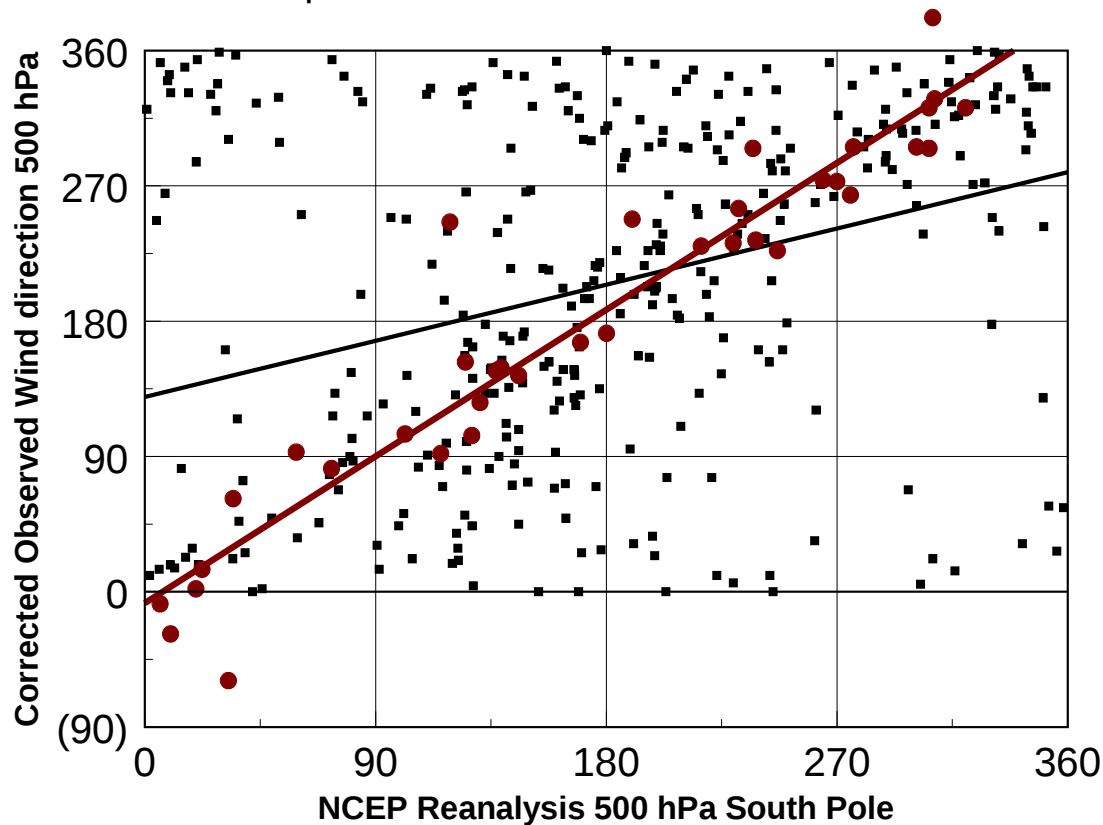
(which uses only surface and sea-level pressure observations (Compo et al., 2011))

A look at wind directions Observed versus NCEP I

2006 500-hPa Wind Directions

Black: all data

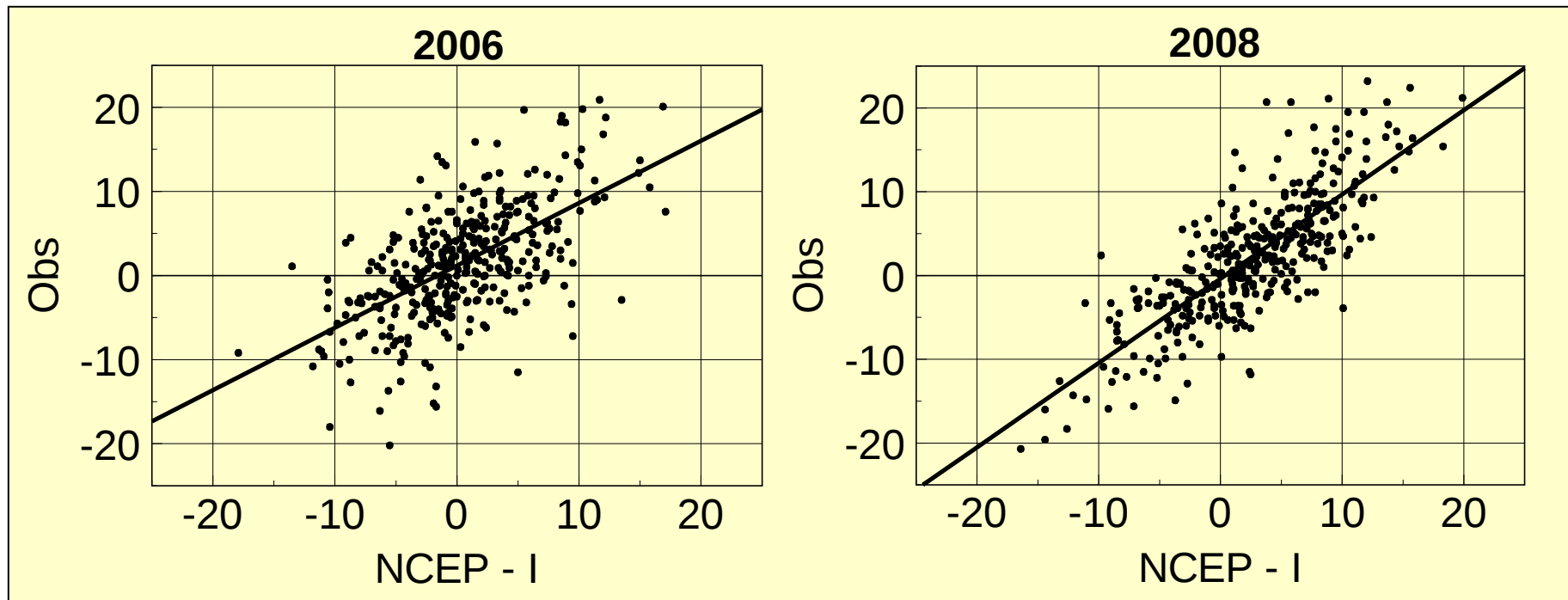
Red: wind speed > 15 m/s



Generally large scatter except for higher wind speeds: presumably with higher winds the reanalysis captures the larger scale dynamics.

Next: look at u- and v-components.....

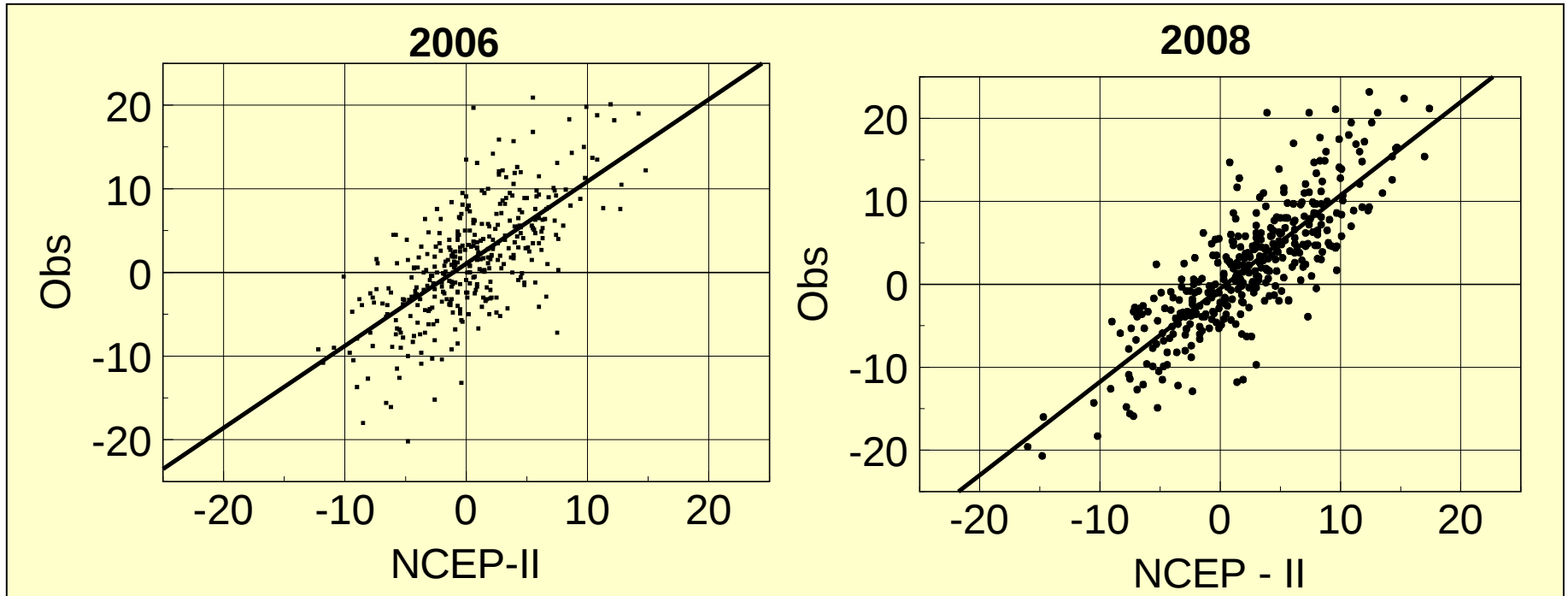
Comparison NCEP I with observations, u-component at 500 hPa
2006-corrected, 2008



$r^2=0.37$ / slope=0.74

$r^2=0.64$ / slope=1.00

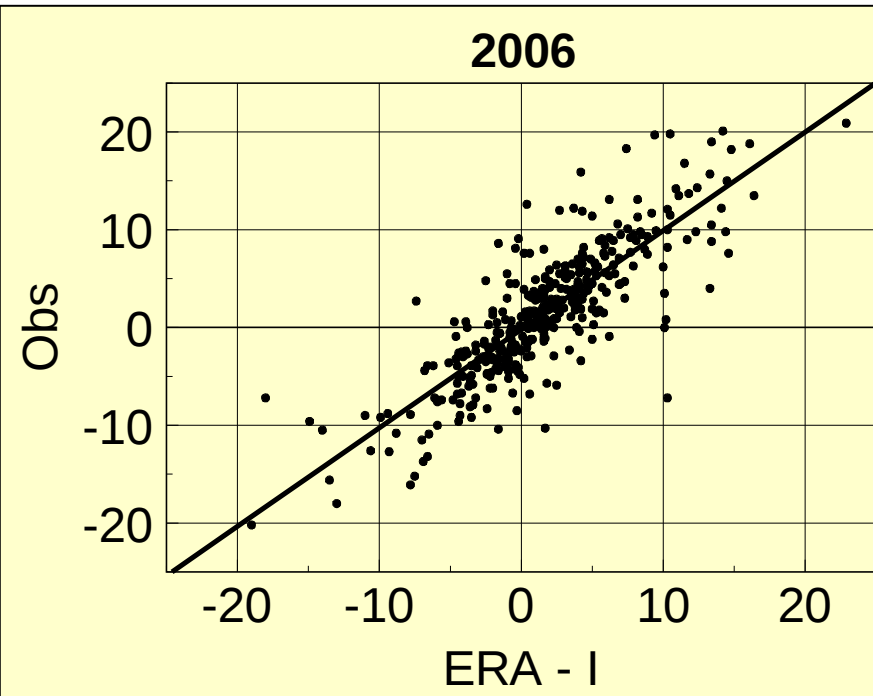
Comparison NCEP II with observations, u-component at 500 hPa
2006-corrected, 2008



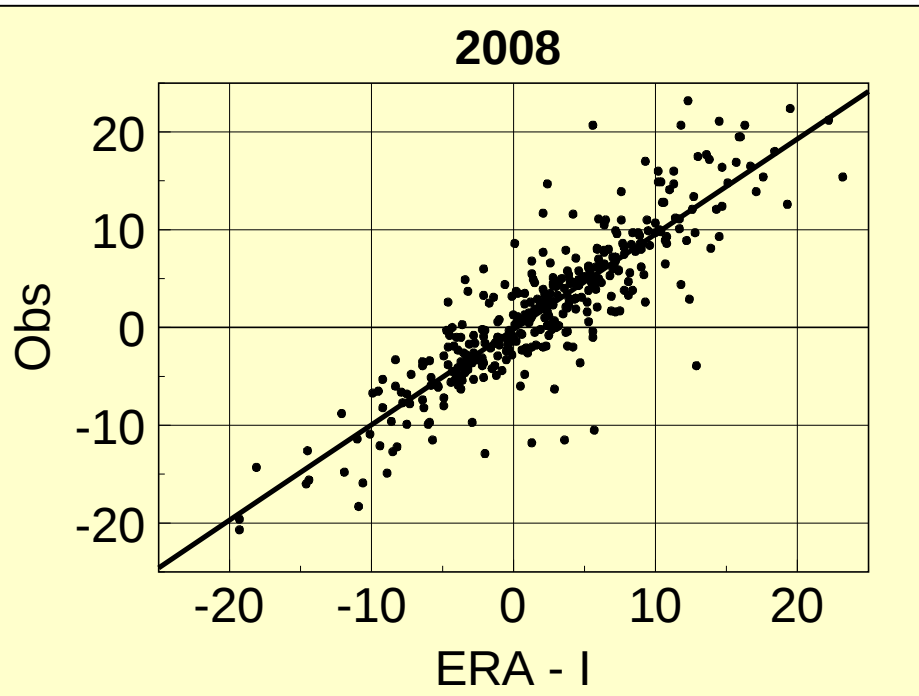
$r^2=0.46/$ slope=0.98

$r^2=0.68/$ slope=1.12

Comparison ERA-I with observations, u-component at 500 hPa
2006-corrected, 2008



$r^2=0.69$ / slope=1.00



$r^2=0.77$ / slope=0.97

Summary

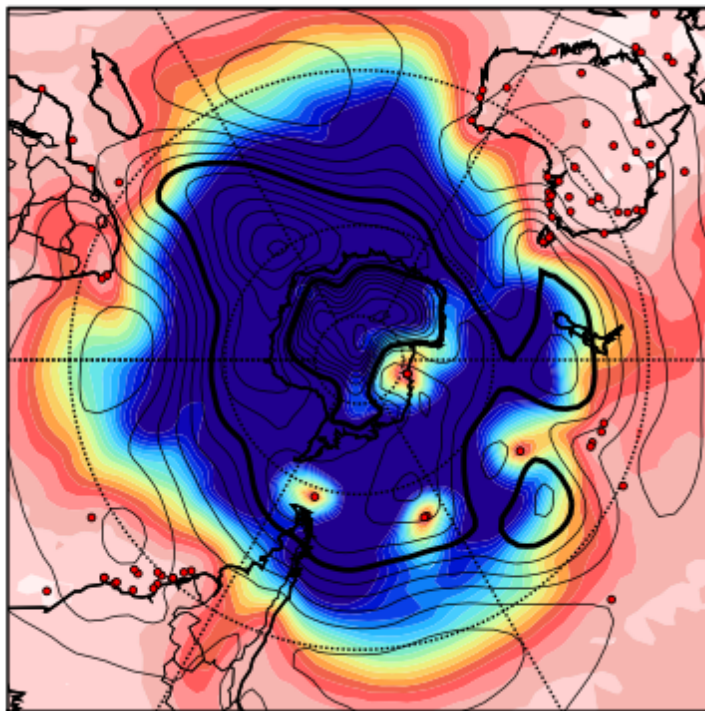
	2008 (correct data in GTS)		
	NCEP - I	NCEP - II	ERA - Interim
U	0.64/1.00	0.68/1.12	0.77/0.97
V	0.68/0.98	0.67/1.11	0.77/0.96
	2006 (Erroneous data in GTS)		
U	0.37/0.74	0.46/0.98	0.69/1.00
V	0.36/0.71	0.48/0.99	0.70/0.97

Degrades by almost
a factor of two

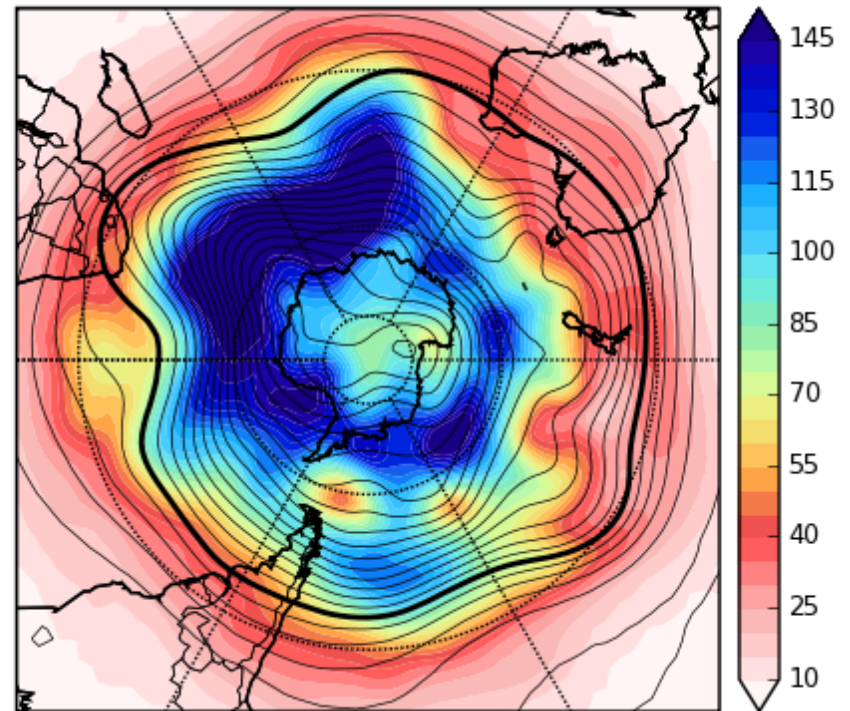
Degrades by about
ten percent

20th Century Reanalysis

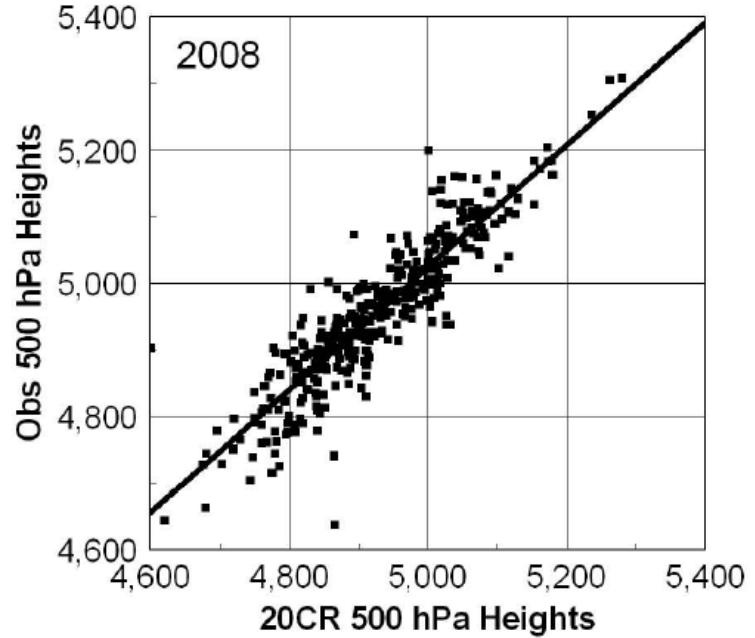
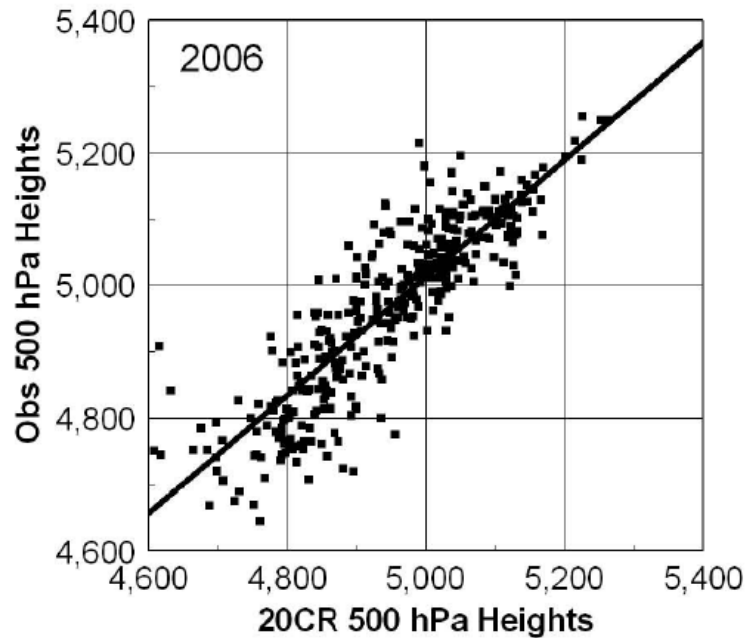
Ensemble Mean SLP and SLP spread (hPa) 1929062518



Ensemble Mean Z500 and Z500 spread (m) 1929062518



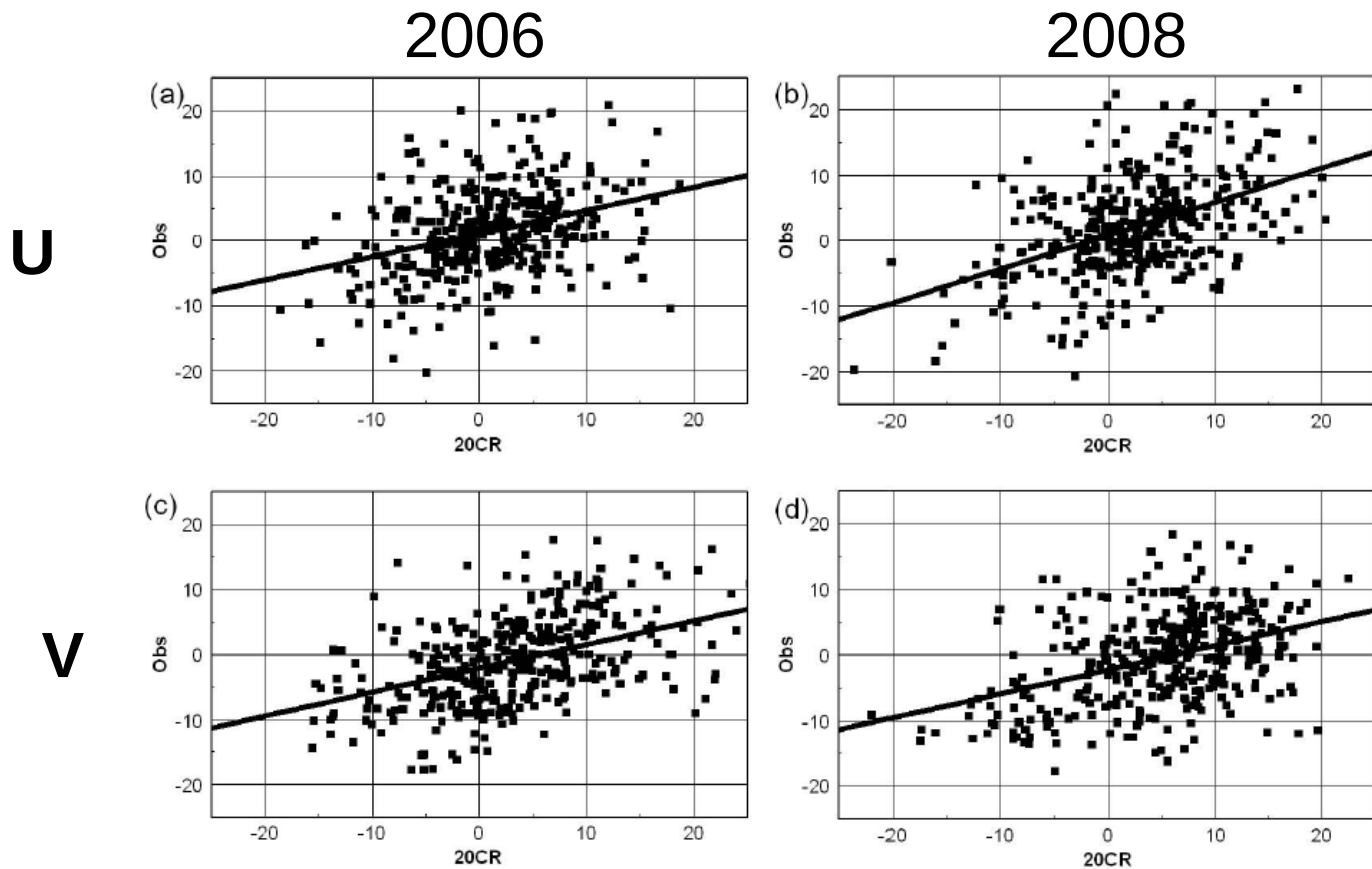
SLP and 500 mb height map for 25 June 1929 18Z generated by the Ensemble Kalman Filter data assimilation system of the 20th Century Reanalysis Project using monthly HadISST and subdaily station and sea level pressure (red dots for a 3 hour window \pm the indicated time) from the International Surface Pressure Databank. The 56 member ensemble spread (standard deviation) is shown in colored contours. The resolution of the NCEP model is T62 (about 2 degrees) and 28 levels. Thanks to Jeff Whitaker, Prashant Sardeshmukh, and Gil Compo of ESRL/PSD



Geopotential height comparison, regressing the observed heights on the modeled heights for 2006 and 2008.

2006: $r^2=0.75$ /slope=0.89,

2008: $r^2=0.82$ /slope=0.92



Observed u- and v-component of winds from 500 hPa at the South Pole regressed on the 18Z 20CR u- and v- components:

- a) $r^2=0.11$ /slope=0.36), b) $r^2=0.22$ /slope=0.51),
 c) $r^2=0.21$ /slope=0.36), d) $r^2=0.16$ /slope=0.36).

Summary results for the 20CR comparisons:

- Comparison of observations of 500-hPa geopotential heights reflects very credibly on the 20th Century Reanalysis which suggests that the geopotential heights at the South Pole from the 20CR may provide a useful index of long-term circulation changes over the interior of Antarctica.
- Comparison of wind components show much lower correlations as might be expected in comparing a derivative field with an instantaneous sample from a rawinsonde.