

Using HEDAS analyses for research: The start of a discussion

Sim Aberson, Altug Aksoy, Kathryn Sellwood, with a
nod to Kevin Yeh for diapost

DA meeting
22 September 2011

The start of a discussion

1. What can users provide to HEDAS developers

The HEDAS group wants users to provide feedback on their estimates of the quality of the analyses and any problems that they might find, so that the system can be improved.

2. What can HEDAS provide to users? How do we go about doing this? What do users want?

(1) can be done once users start looking at the HEDAS analyses. The remainder of this time will mostly be for discussion of (2)

What HEDAS provides

A HEDAS analysis is a statistical estimate of the state of the system at a particular time.

It combines output from a numerical model (in this case, the GFS ensemble run with the EnKF (Whitaker) and HWRFx, and real data (aircraft measurements).

The analyses are only as good as the model(s) and the data and, like any analysis, should be considered only an estimate of the true state. There are known issues with the quality of the HEDAS analyses near the surface, especially in strong storms.

Variables analyzed

Zonal wind speed

Meridional wind speed

Air temperature

Specific humidity

Total condensate

Hydrostatic pressure (PD)

All are analyzed on the model E-grid

Cases available: all cases with Doppler data since 2008 (and a Paloma case without)

Fields and metadata must be gathered from mass storage on jet and gridded fields created. Those interested should request cases of interest once we decide how to proceed.

2008

Dolly	072012, 072100, 072112, 072200, 072212, 072300
Fay	081406, 081418, 081506, 081518, 081818, 081906
Gustav	083000, 083012, 083100, 083112, 090100, 090112
Ike	091000, 091012, 091100, 091112, 091200, 091212
Kyle	092400, 092412, 092500, 092512, 092600, 092612, 092700, 092712
Paloma	110706, 110718, 110806 (G-IV only), 110818

2009

Ana	081700
Bill	081900, 081912, 082000, 082012
Danny	082612, 082700, 082712, 082800

Cases available (continued):

2010

Alex	062900
TD02	070700, 070712, 070800
TD05	081200
Earl	082900, 082912, 083000, 083012, 083100, 090112, 090200, 090212, 090300, 090312, 090400
Karl	091300, 091312, 091400, 091618
Richard	102306
Tomas	110400, 110412, 110500, 110612, 110700

2011

Irene	082400, 082412, 082500, 082512, 082600, 082612, 082700, 082712
-------	---

In addition, we have some cases from 2011 with G-IV or AF data only.

Other cases **might** be doable upon request, depending upon availability of GFS-EnKF boundary conditions and other factors.

Files available: a proposal

vortex_anal_d02_finalanalysis_mean - final analysis in netcdf format on model E-grid

hedaspressure.dat, .ctl - gridded data in pressure coordinates, and GrADS control file

hedasheight.dat, .ctl - gridded data in height coordinates, and GrADS control file

out_diag_postr_mem.enkf_YYYYMMDDHH - diagnostics files including input data, error characteristics, and fit of analysis to data, for each cycle

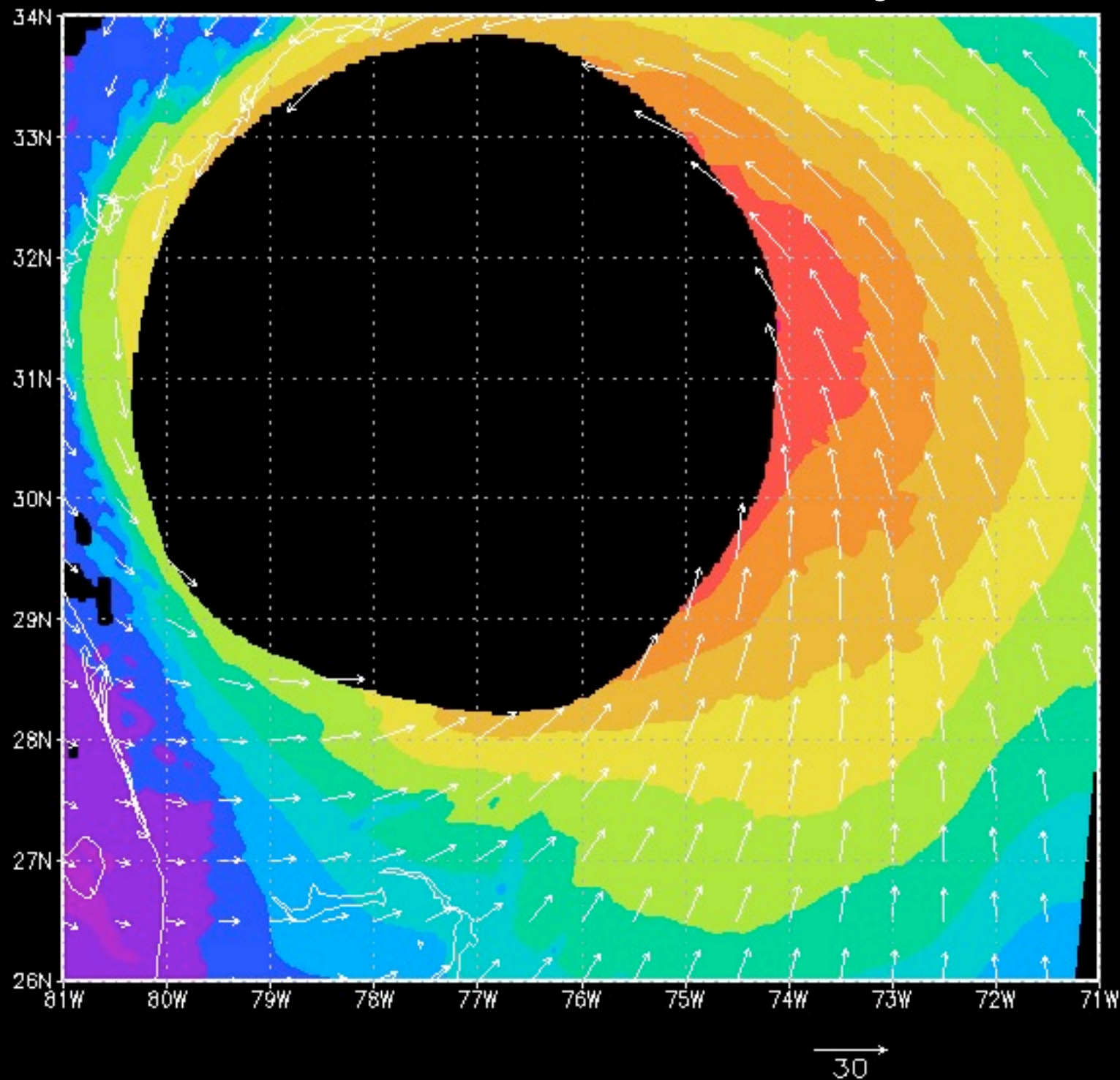
HEDAS pressure-level output

DSET hedaspresure.dat ← File name
TITLE Basic p-level data on standard latlon grid
OPTIONS sequential big_endian ← Type of file
UNDEF -9.99e+08 ← Undefined (missing) values in file
XDEF 501 LINEAR -81.00000 0.02000 ← Southwest point lat/lon, number of
YDEF 401 LINEAR 26.00000 0.02000 data points, and data resolution
ZDEF 20 LEVELS
1000.0000 950.0000 900.0000 850.0000
800.0000 750.0000 700.0000 650.0000
600.0000 550.0000 500.0000 450.0000 ← Pressure levels
400.0000 350.0000 300.0000 250.0000
200.0000 150.0000 100.0000 55.00000
TDEF 1 LINEAR 14:00Z26AUG2011 1yr ← Analysis time
VARS 7
uu 20 0 zonal wind comp (m/s)
vv 20 0 meridional wind (m/s)
tt 20 0 air temperature (K)
qq 20 0 specific humidity (kg/kg) ← Variables
gh 20 0 geopotential height (m)
rh 20 0 relative humidity (%)
cw 20 0 total condensate (kg/kg)
ENDVARS

created by diapost

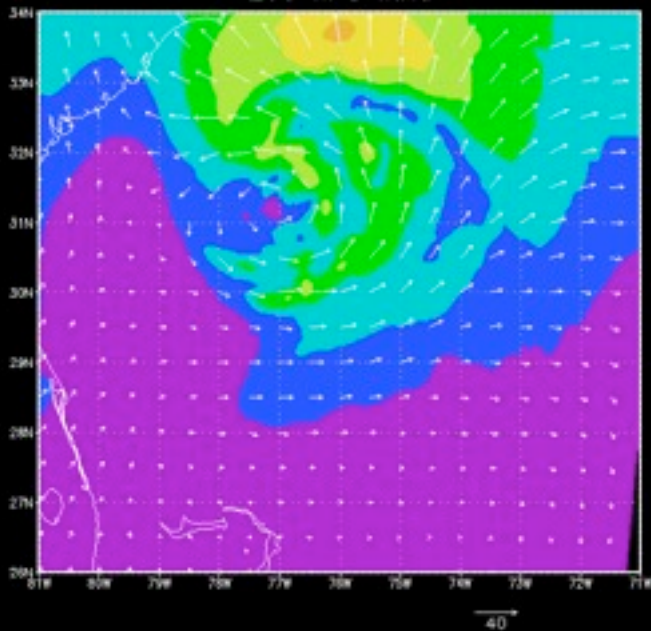
Example: Hurricane Irene 26 August 1200 UTC

1000 hPa wind analysis

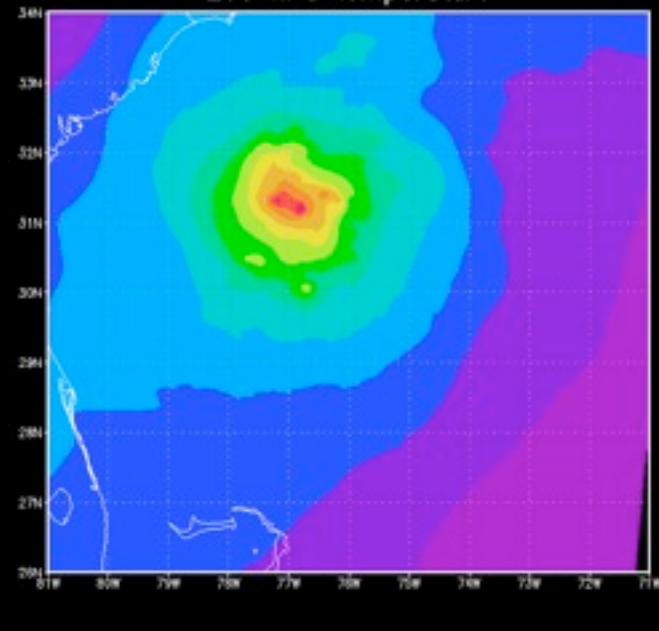


Example of
“UNDEF” data

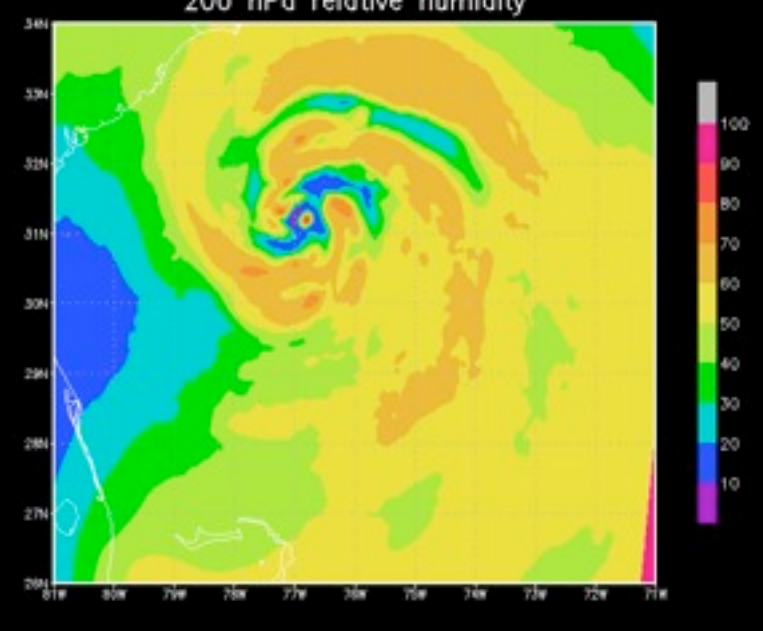
200 hPa wind



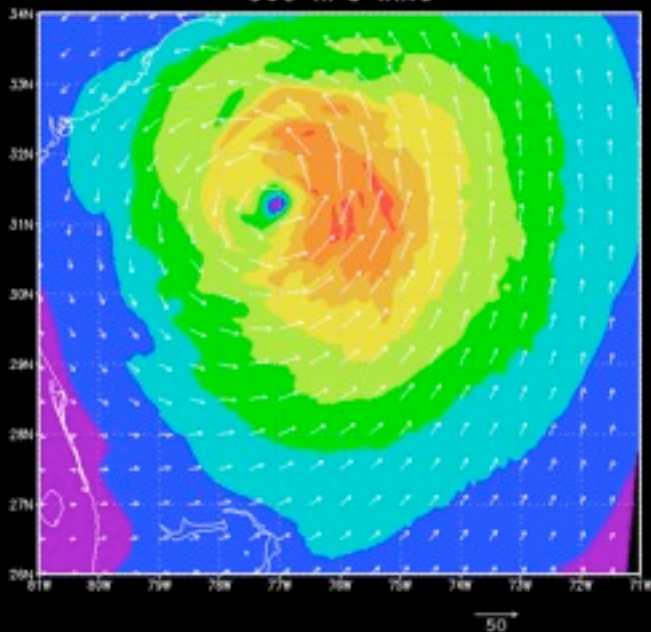
200 hPa temperature



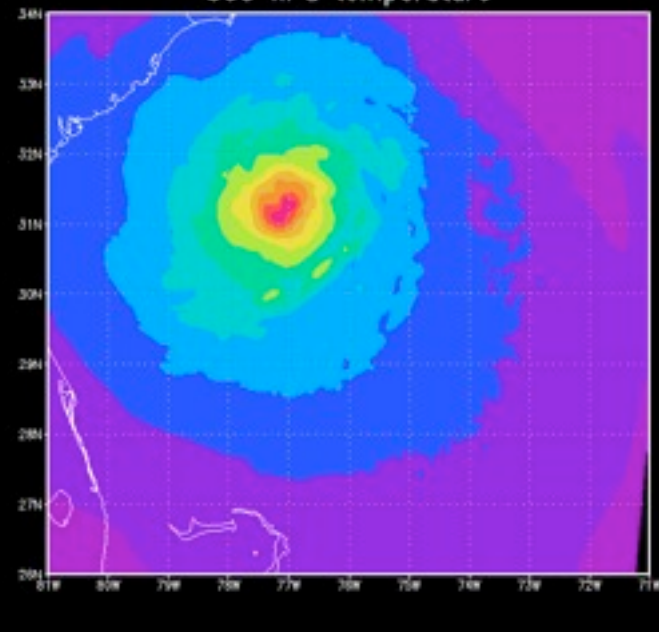
200 hPa relative humidity



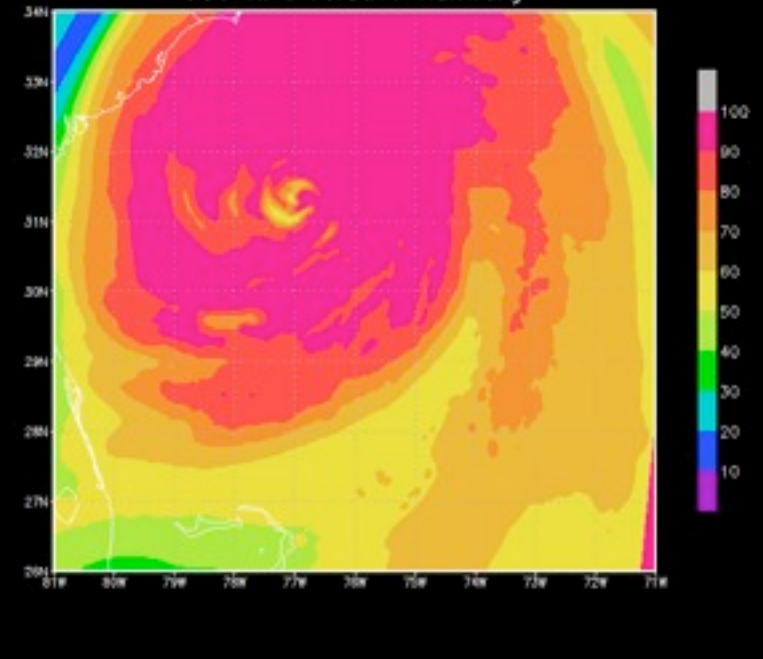
500 hPa wind



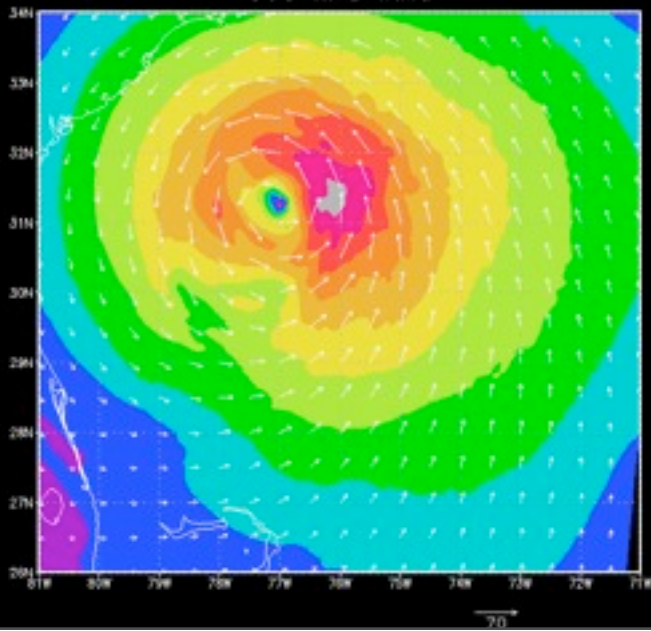
500 hPa temperature



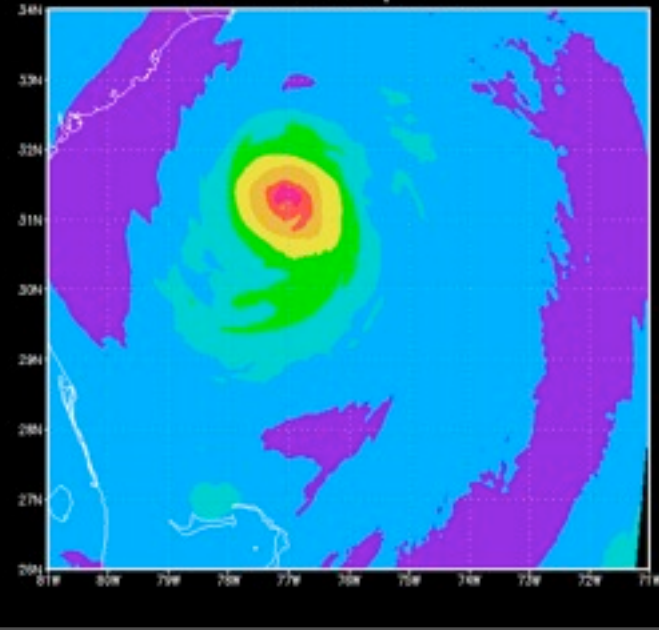
500 hPa relative humidity



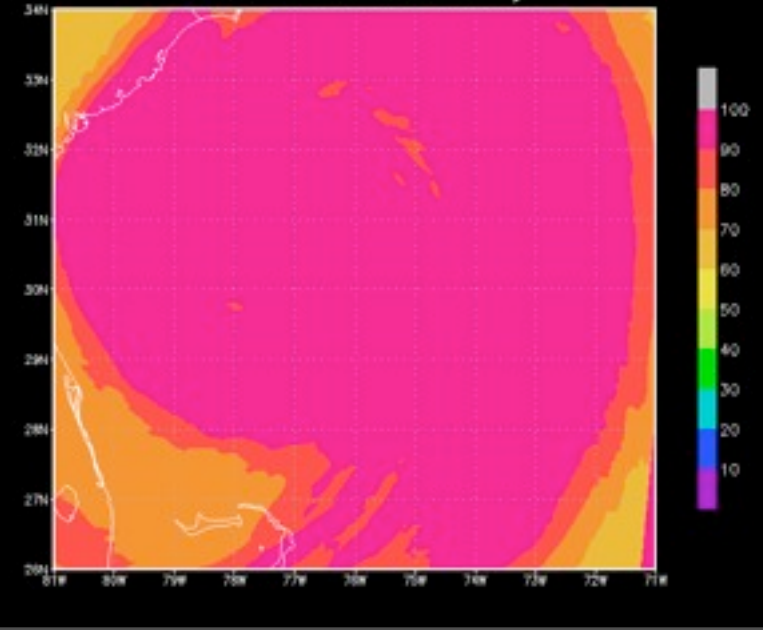
850 hPa wind



850 hPa temperature

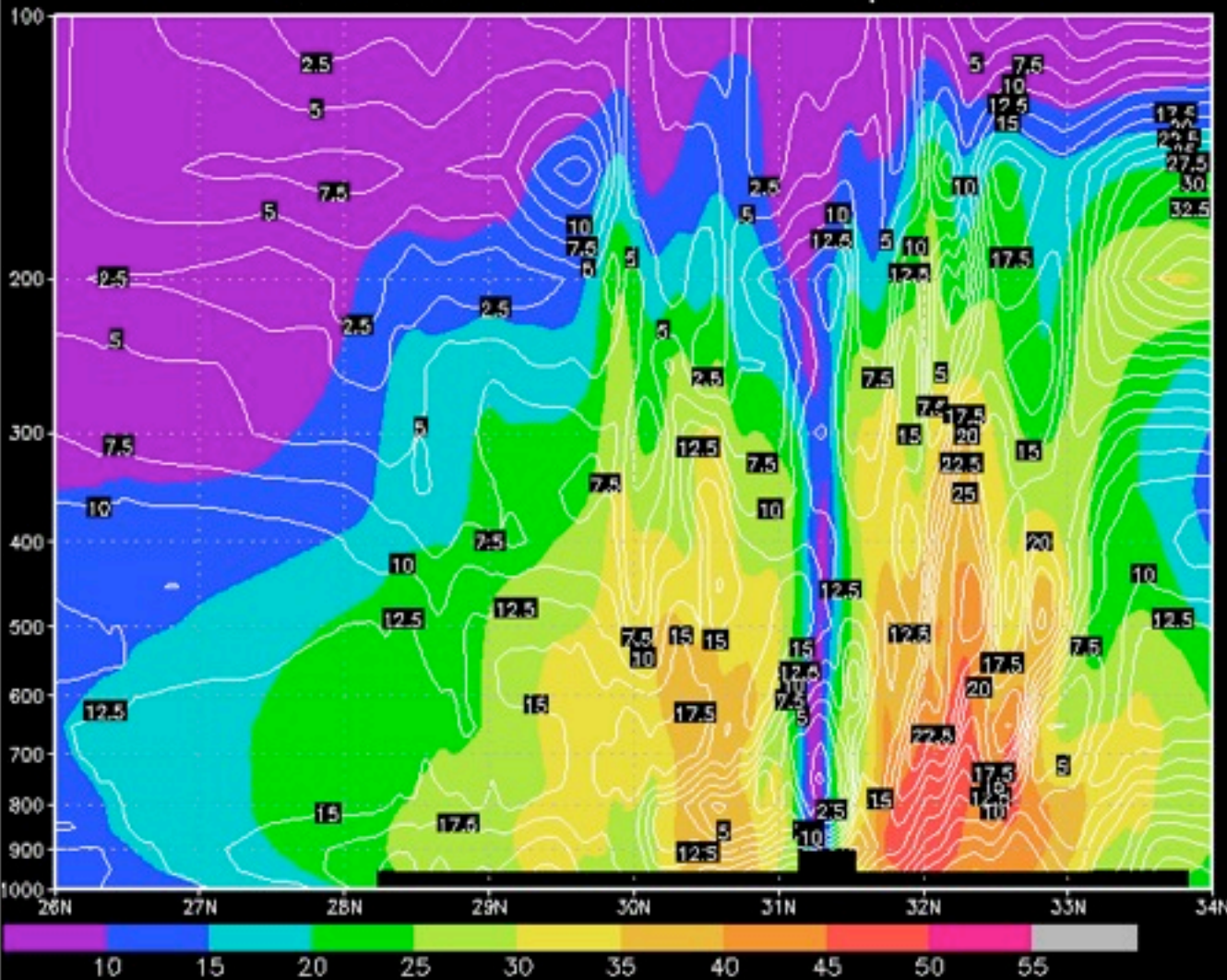


850 hPa relative humidity

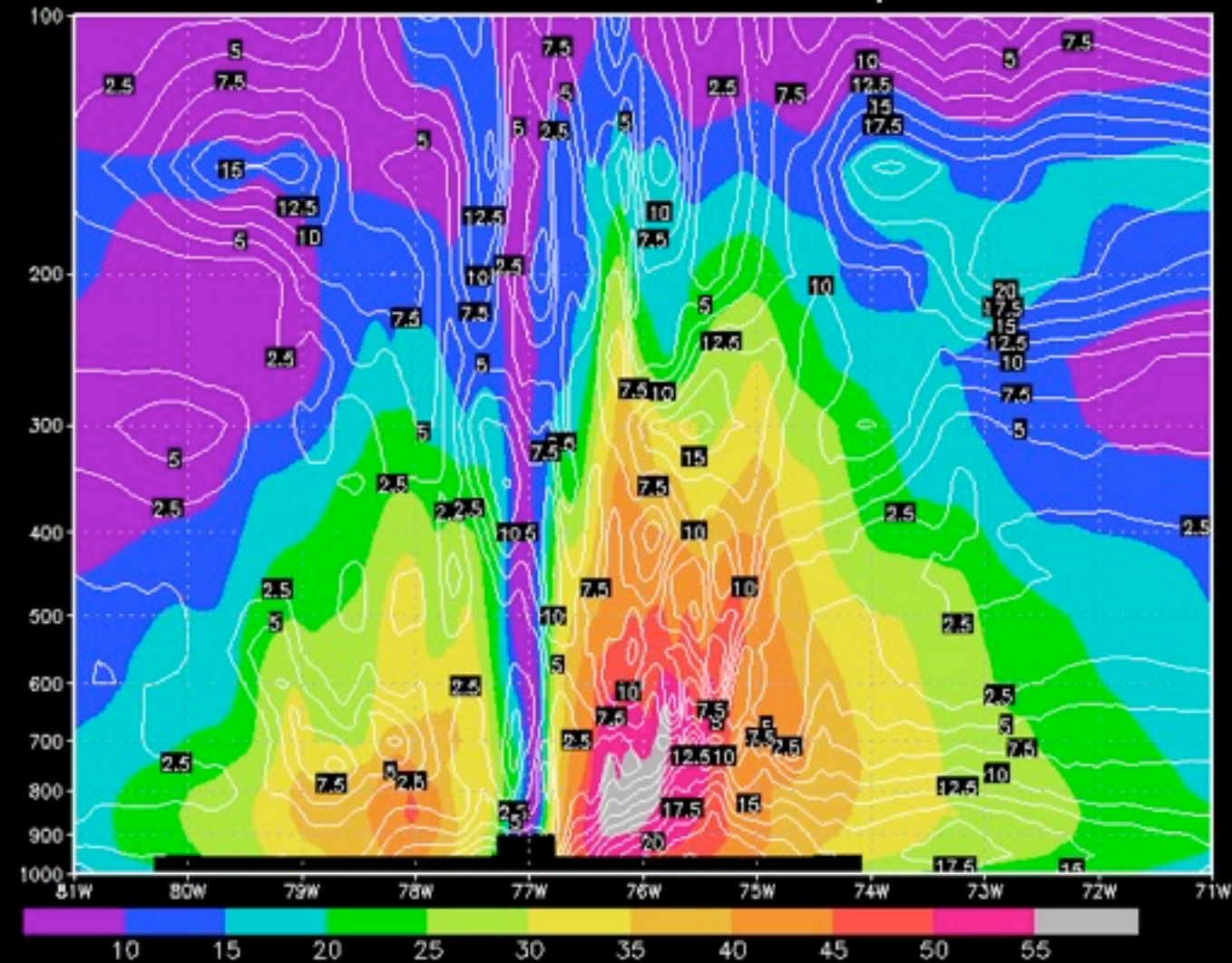


Pressure-coordinate cross sections

N-S total and radial wind speeds



E-W total and radial wind speeds



HEDAS height-level output

DSET hedasheight.dat ← File name
TITLE height-level data on standard latlon grid
OPTIONS sequential big_endian ← Type of file
UNDEF -9.99e+08 ← Undefined (missing) values in file
PDEF 463 451 ETA.U -82.20000 32.50000 0.02000 0.02000
XDEF 463 LINEAR -81.11450 0.02000
YDEF 371 LINEAR 25.40460 0.02000
ZDEF 39 LEVELS
35.00000 100.0000 200.0000 400.0000
600.0000 800.0000 1000.000 1200.000
1500.000 1800.000 2100.000 2400.000
2700.000 3000.000 3400.000 3800.000
4200.000 4600.000 5000.000 5500.000
6000.000 6500.000 7000.000 7500.000
8000.000 8500.000 9000.000 9750.000
10500.00 11250.00 12000.00 13000.00
14000.00 15000.00 16000.00 17000.00
18000.00 19000.00 20000.00
TDEF 1 LINEAR 14:00Z26AUG2011 1yr
VAR 9
xx 0 0 Earth longitude (deg)
yy 0 0 Earth latitude (deg)
uu 39 0 zonal wind comp (m/s)
vv 39 0 meridional wind (m/s)
tt 39 0 air temperature (K)
qq 39 0 specific humidity (kg/kg)
pp 39 0 air pressure (mb)
rh 39 0 relative humidity (%)
cw 39 0 total condensate (kg/kg)
ENDVARS

Information on rotated lat/lon grid

Height levels

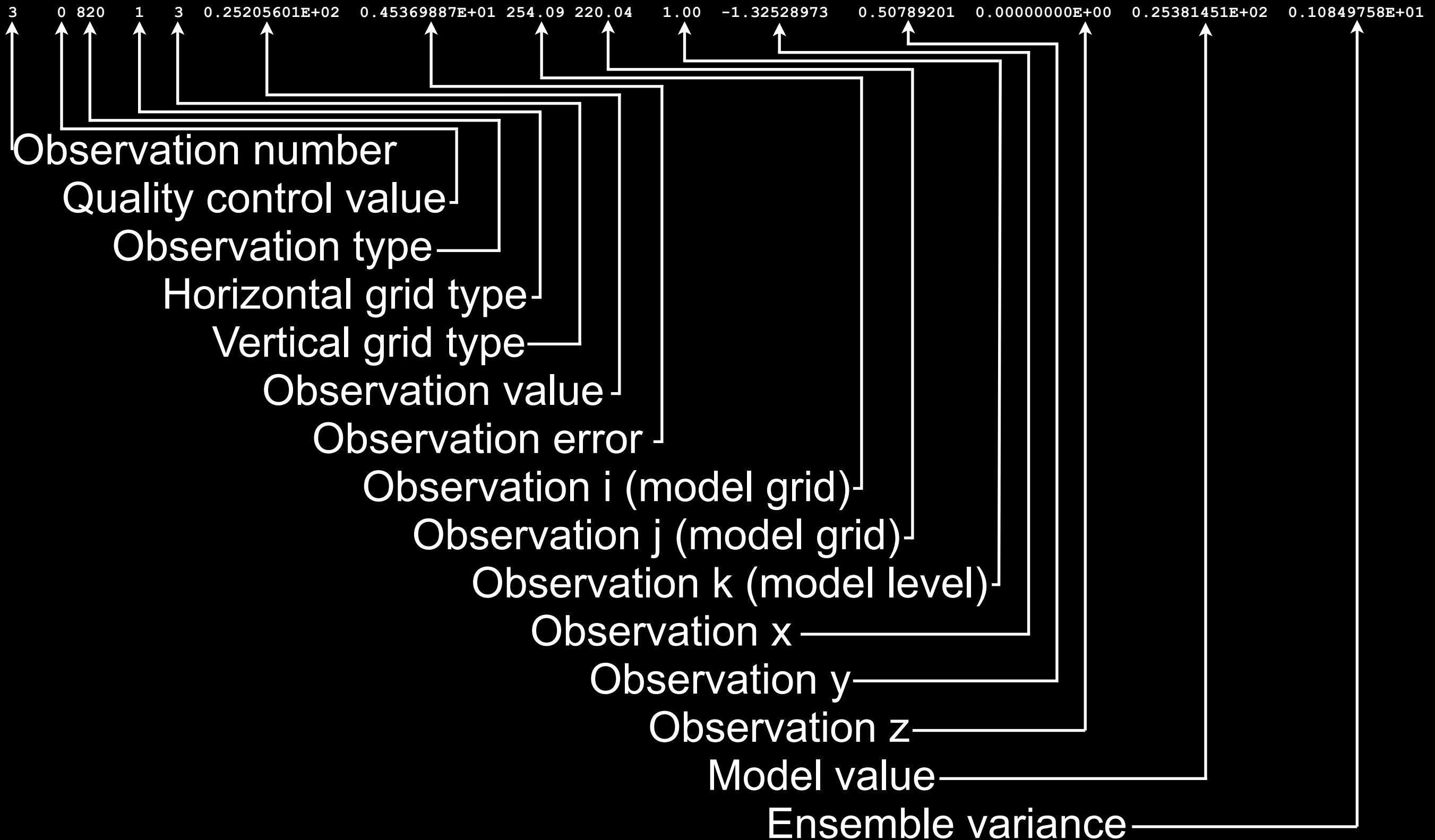
Analysis time

Variables

created by diapost

Diagnostics files

ASCII, One for each analysis cycle



Observation number

Simply a counter to keep track of observations

Quality control value

- 0 Observation was assimilated successfully
- 1 Observation was evaluated but not assimilated
- 2 Observation was skipped
- 3 The EnKF update step was skipped
- 4 Observation time format error
- 5 Observation time was outside of assimilation window
- 6 Bad observation value for log computation
- 7 Bad observation error value for log computation
- 11 Error in lat/lon i/j conversion
- 12 Bad observation (horizontal grid type value)
- 13 Observation horizontal coordinate outside of assimilation domain
- 15 Error in height to k conversion
- 16 Error in pressure to k conversion
- 17 Bad observation (vertical grid type value)
- 21 Error in prior-diagnostic-loop forward operator: ensemble mean
- 22 Error in prior-diagnostic-loop forward operator: ensemble member
- 23 Error in prior-diagnostic-loop forward operator: ensemble mean log computation
- 24 Error in prior-diagnostic-loop forward operator: ensemble member log computation
- 25 Error in prior-diagnostic-loop forward operator: not enough good members (NE/2) for variance computation
- 31 Error in update-loop forward operator: ensemble mean
- 32 Error in update-loop forward operator: ensemble member
- 33 Error in update-loop forward operator: ensemble mean log computation
- 34 Error in update-loop forward operator: ensemble member log computation
- 35 Error in update-loop forward operator: not enough good members (NE/2) for variance computation
- 40 Error in update-loop forward operator: no model grid points to update
- 41 Error in posterior-diagnostic-loop forward operator: ensemble mean
- 42 Error in posterior-diagnostic-loop forward operator: ensemble member
- 43 Error in posterior-diagnostic-loop forward operator: ensemble mean log computation
- 44 Error in posterior-diagnostic-loop forward operator: ensemble member log computation
- 45 Error in posterior-diagnostic-loop forward operator: not enough good members (NE/2) for variance computation

Observation type

Basic variables:

- 1 temperature (K)
- 2 specific humidity (kg/kg)
- 6 u-component of the wind (m/s)
- 7 v-component of the wind (m/s)
- 8 pressure (Pa)

+0 for dropwindsonde

+40 for flight-level

+80 for dropwindsonde surface values

Other variables:

- 820 SFMR surface wind speed (m/s)
- 840 Doppler wind radial (m/s)

Horizontal and vertical grid types

For horizontal grid type:

0 - Model grid

1 - Lat/lon (radians)

For vertical grid type:

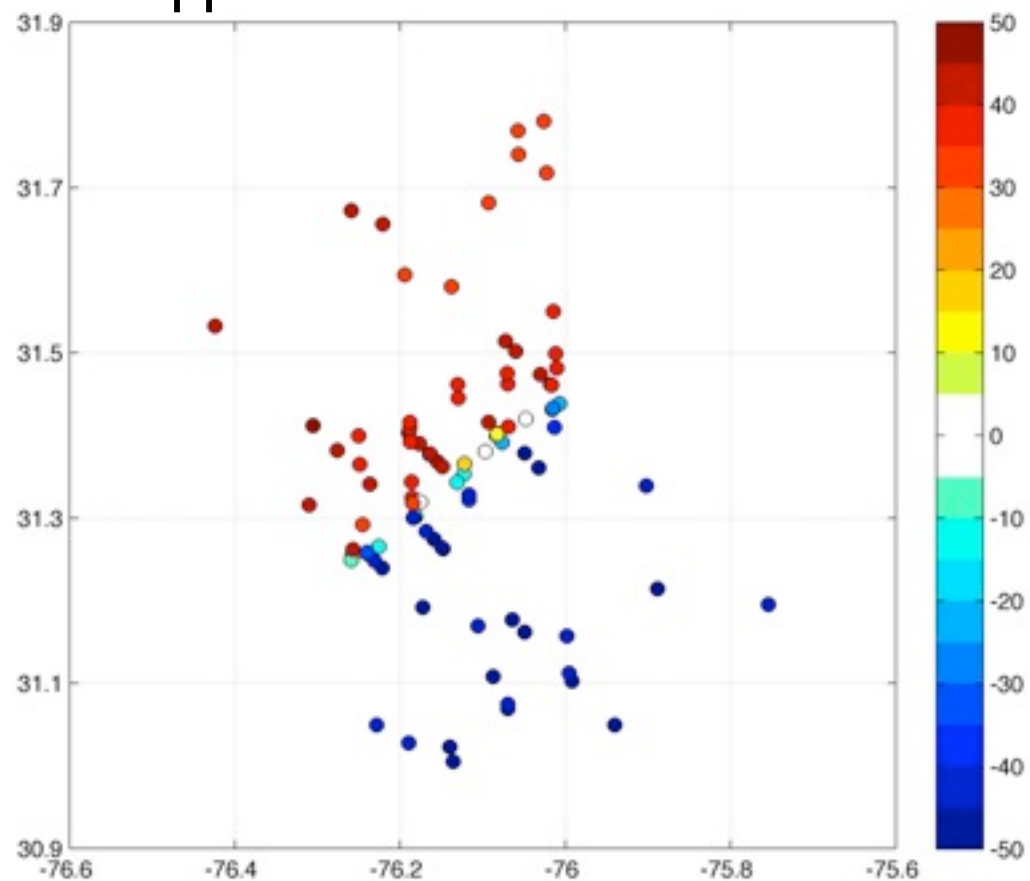
0 - Model level

1 - Height (m)

2 - Pressure (Pa)

3 - Surface

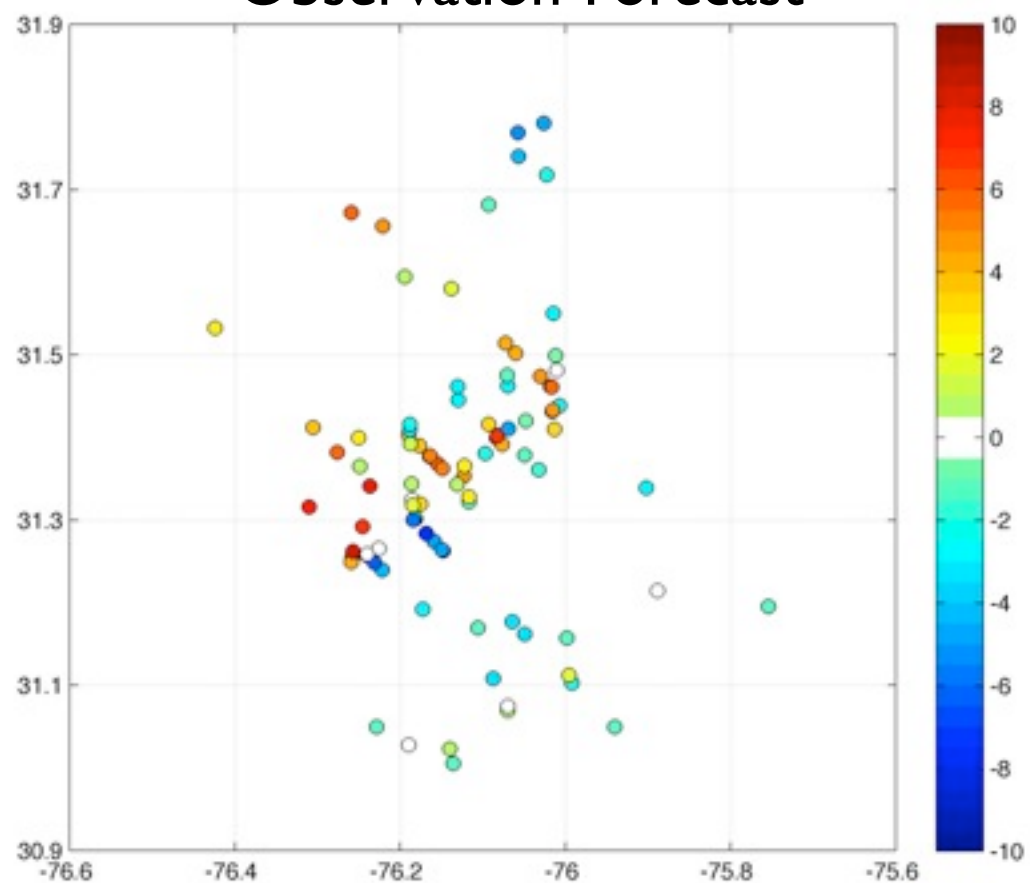
Doppler radial wind observations



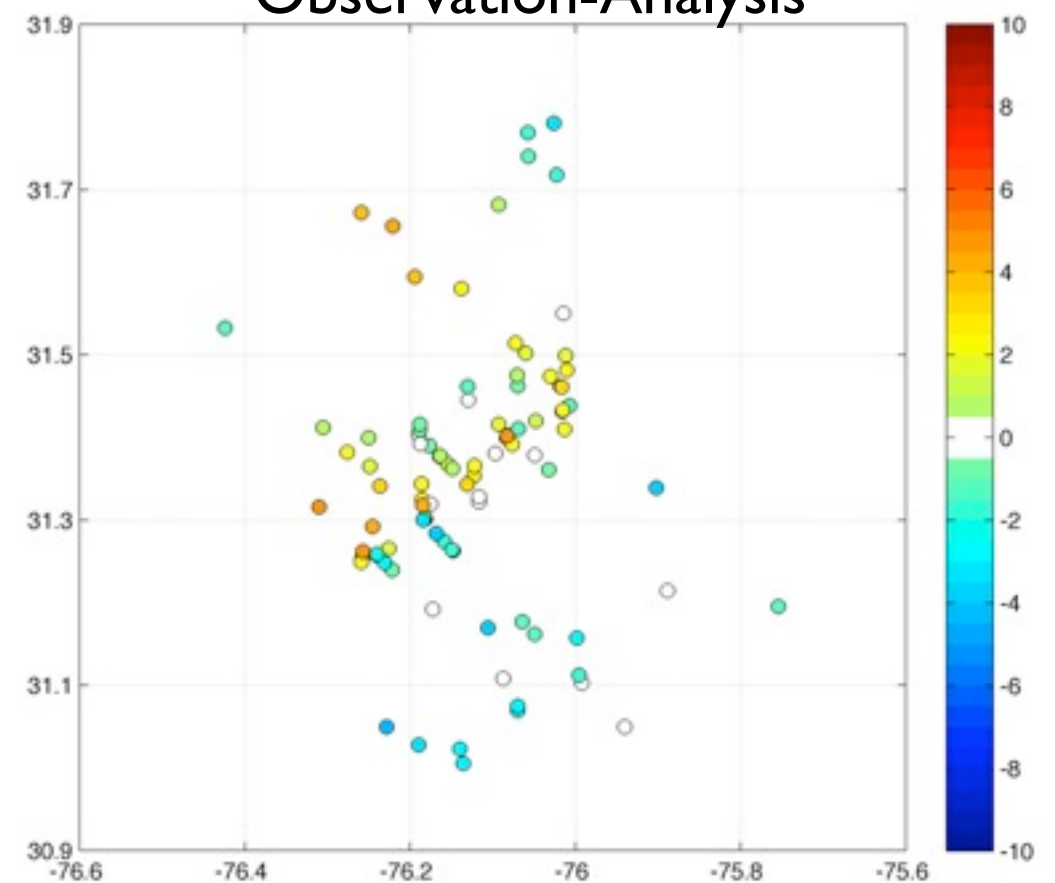
Examples

Fit of analysis to
observations

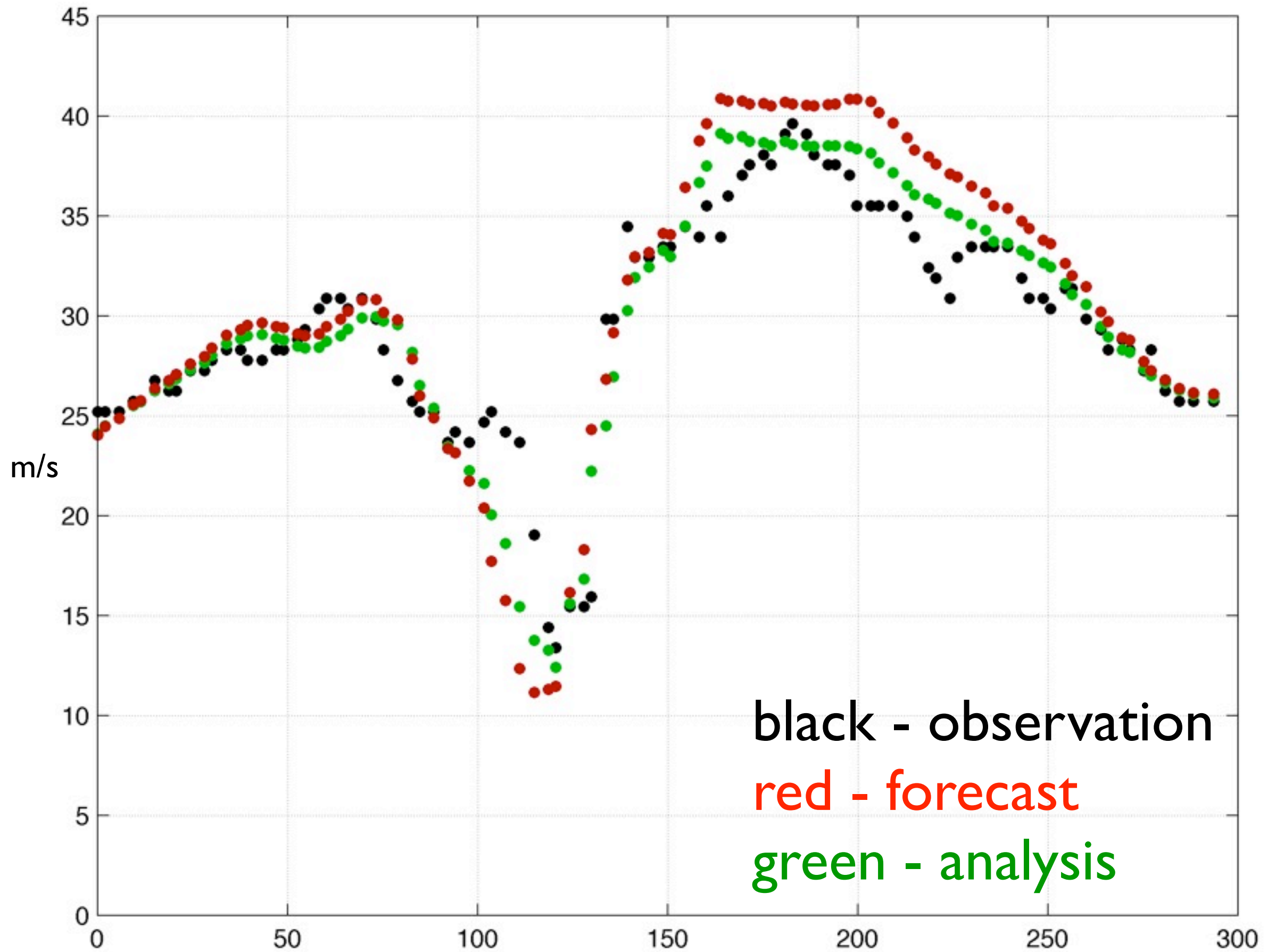
Observation-Forecast



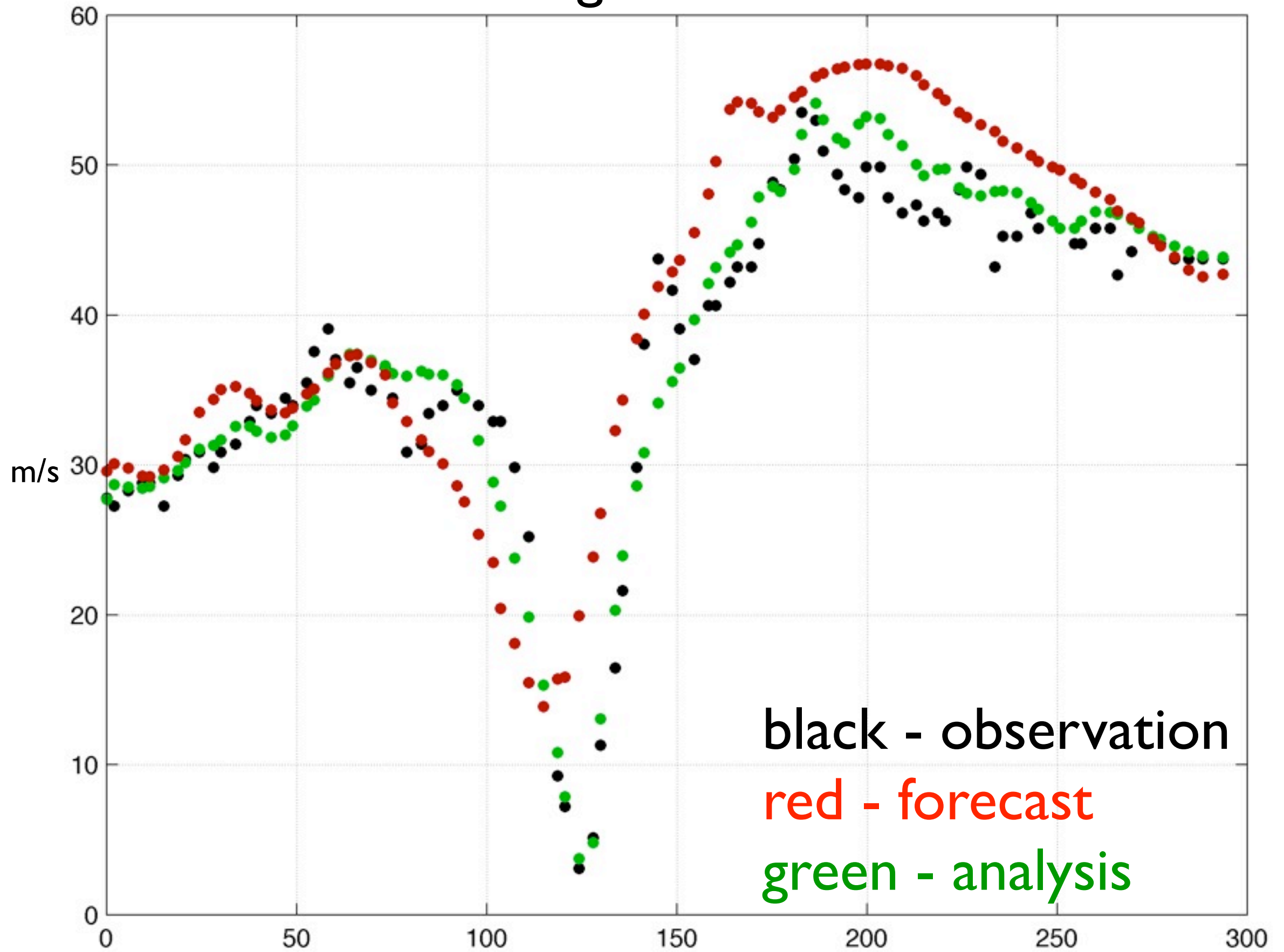
Observation-Analysis



SFMR

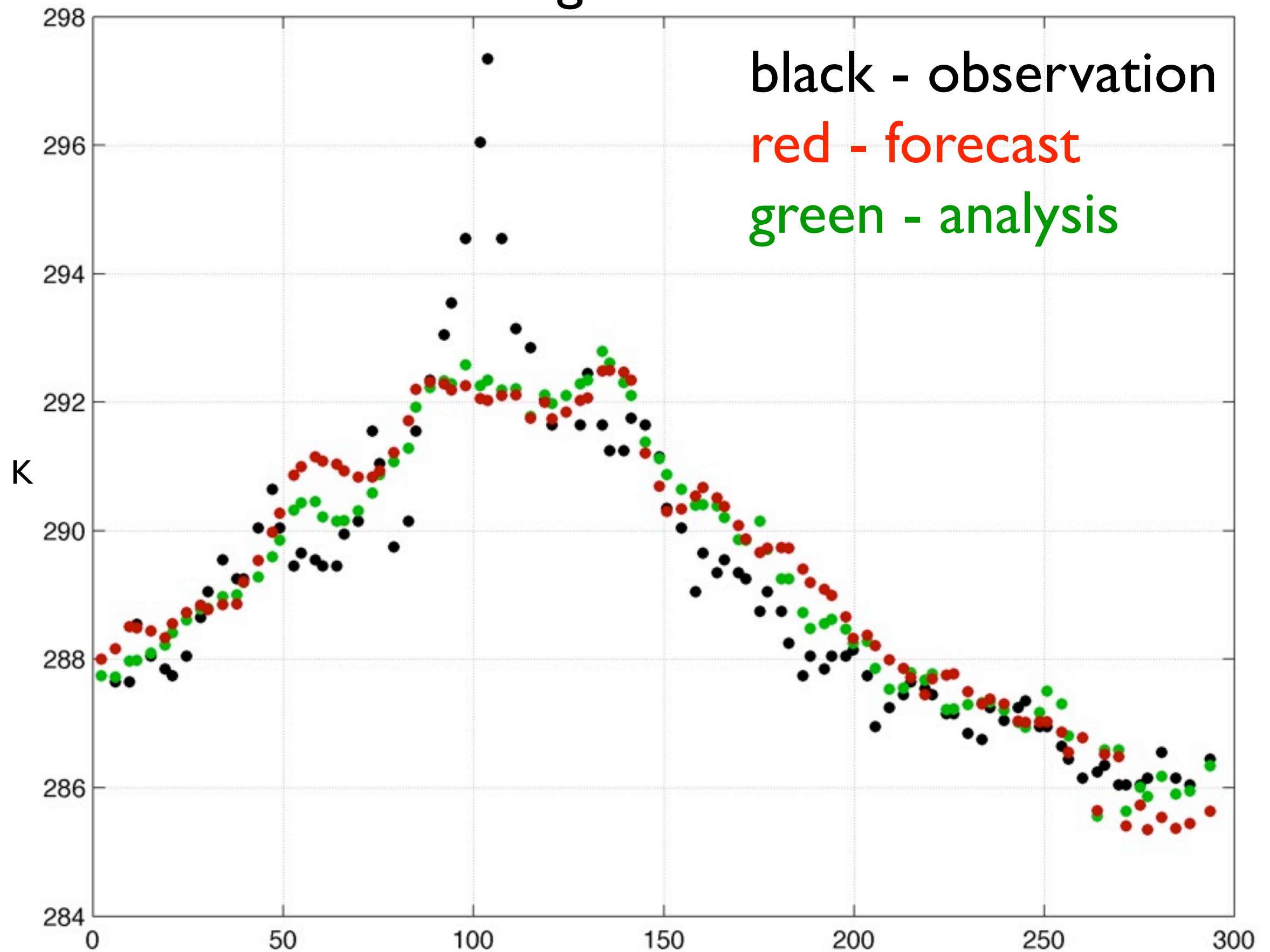


Flight level

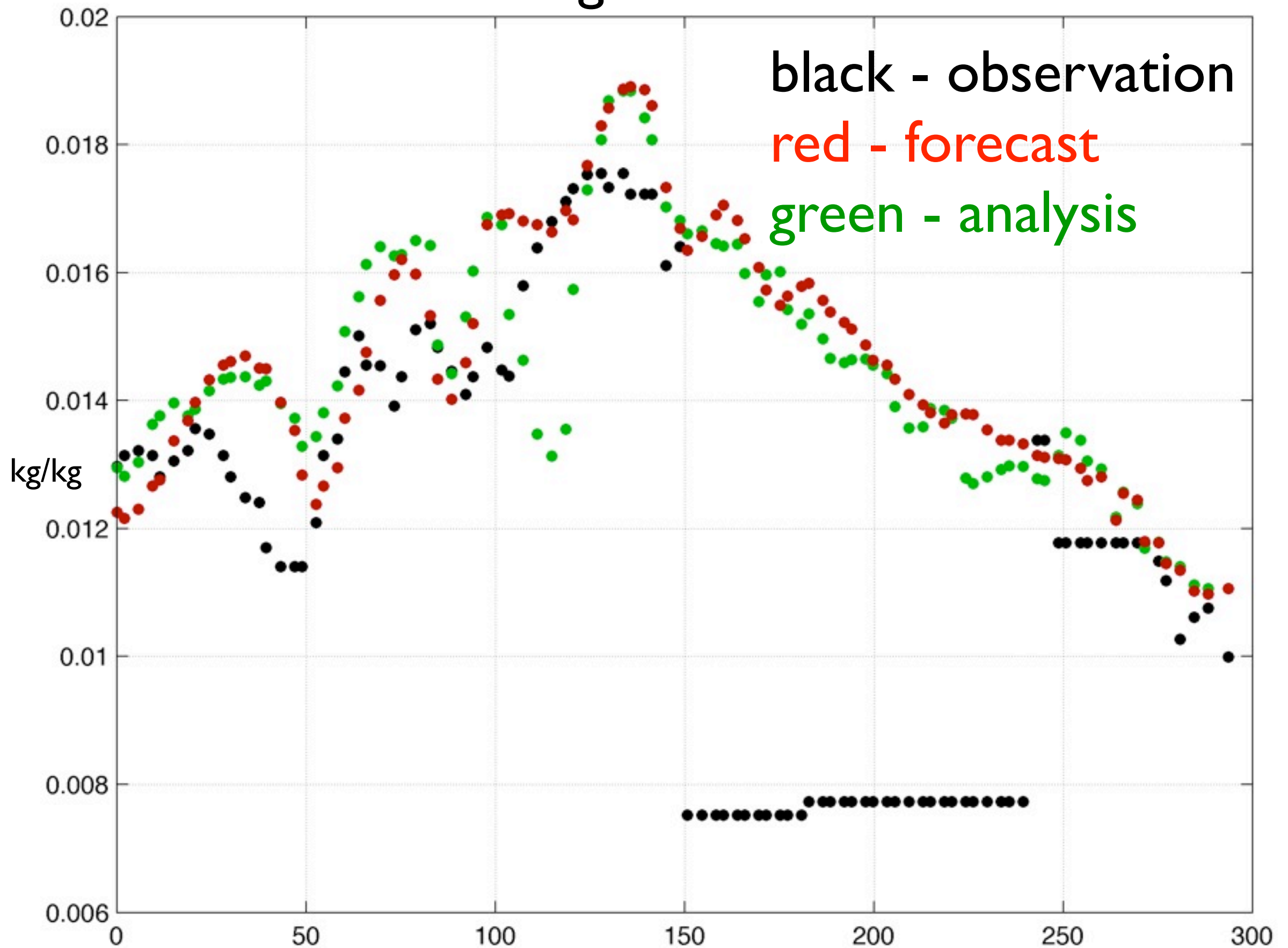


black - observation
red - forecast
green - analysis

flight-level



flight-level



**Thoughts?
Questions?
Concerns?
How to proceed?**