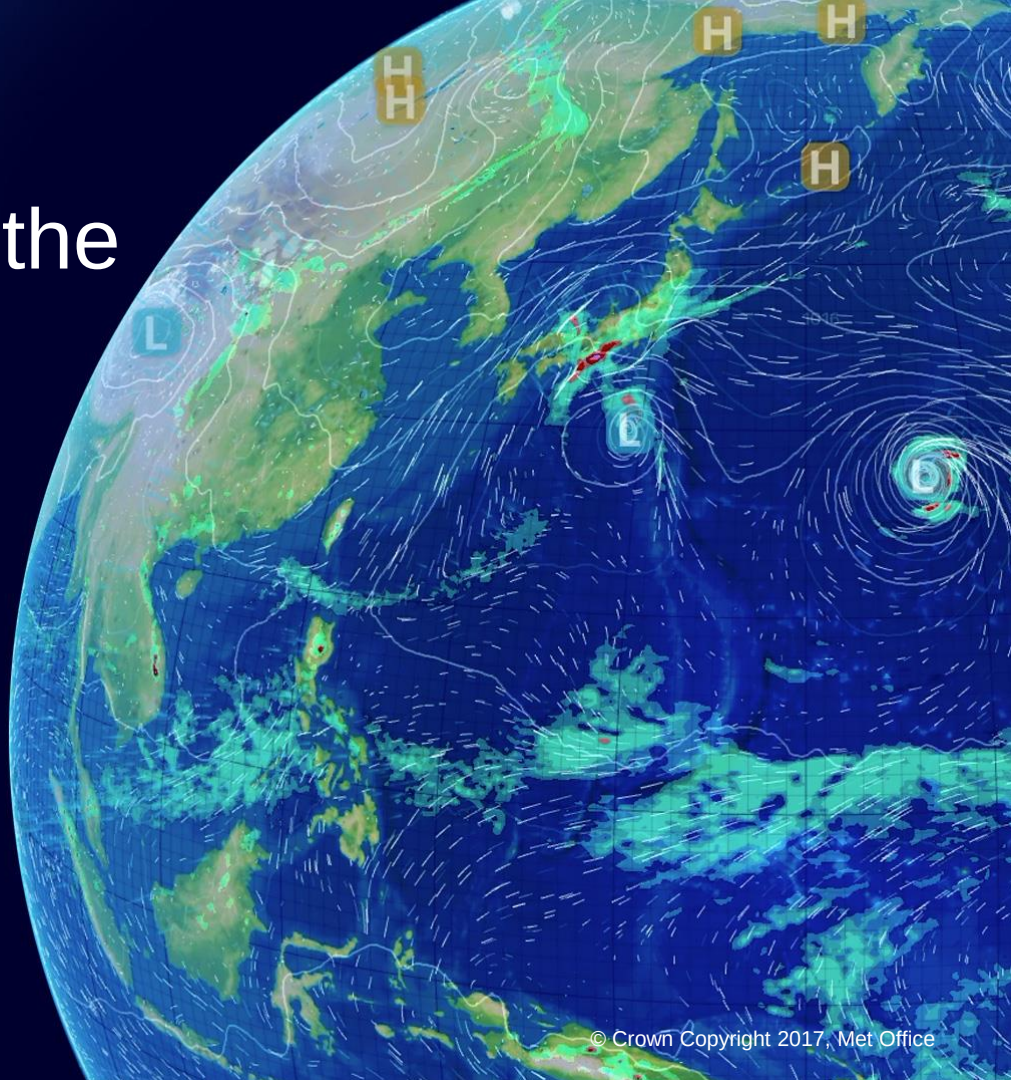
Assimilation Status at the Met Office

Owen Lewis and Gemma Halloran

E-GVAP Experts meeting, 28-29th November 2017, De Bilt



PS39

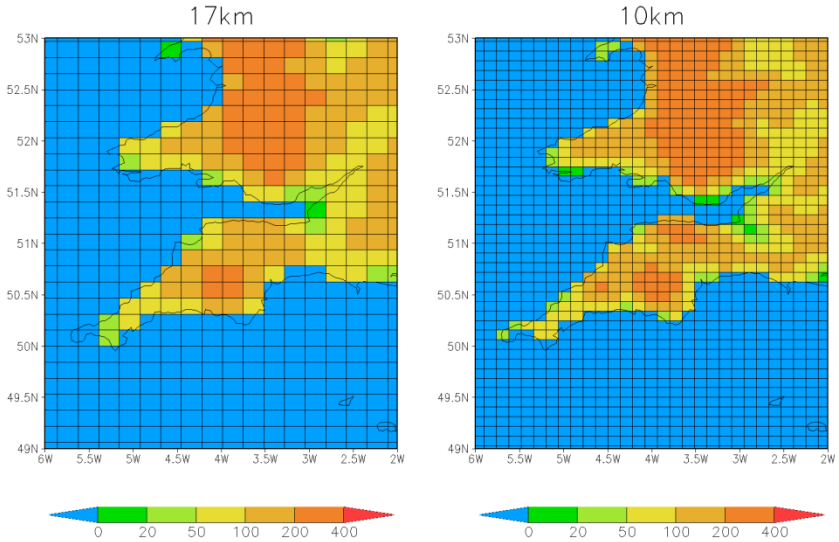
- PS39 was made operational in July 2017
- Many significant changes to the Global, UK and Ensemble models
- Resolution changes, changes to cycling schedule and updates to use of satellite data.

PS39 Global

- Resolution increase from 17 km to 10 km, 220 million extra grid points.
- Gives better representation of coastlines and topography.

- MOGREPS-G (Ensemble) resolution increase 33 km to 20 km in mid latitudes.

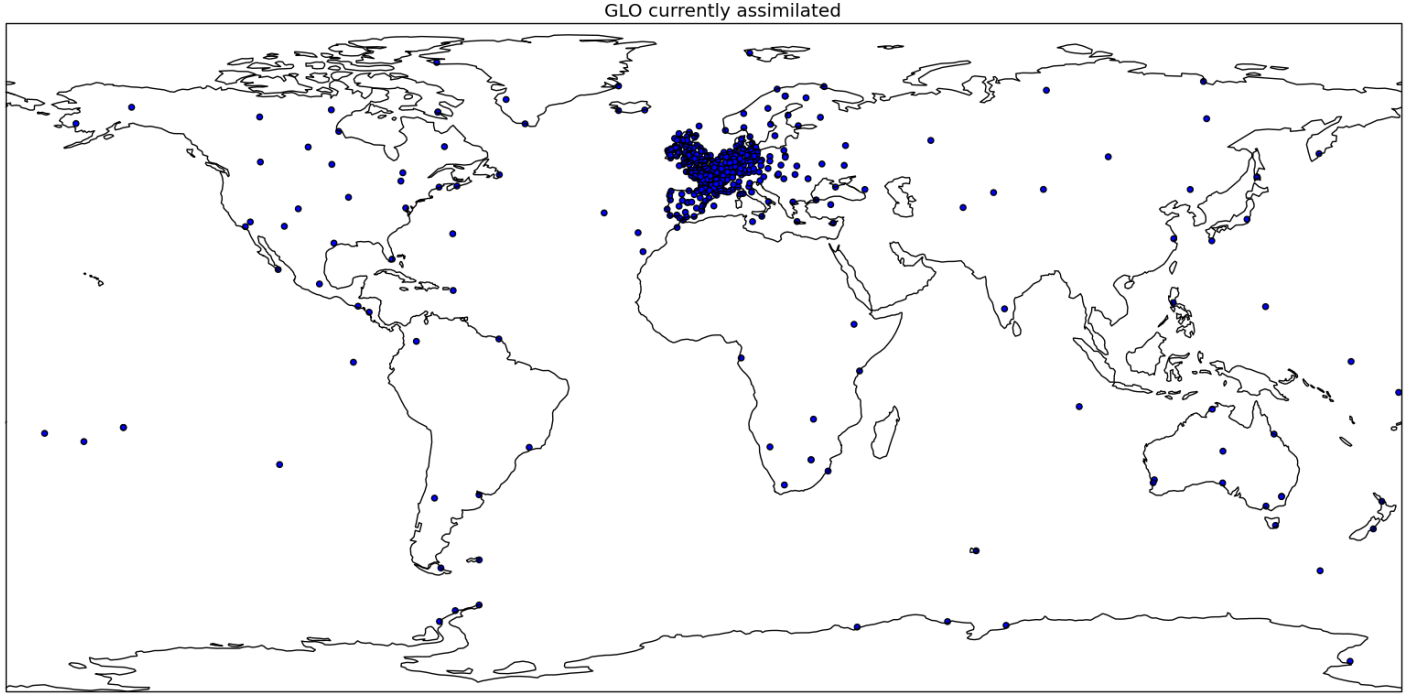
- Increase the members from 12 to 18 every 6 hours



PS39 Global Ground based GNSS

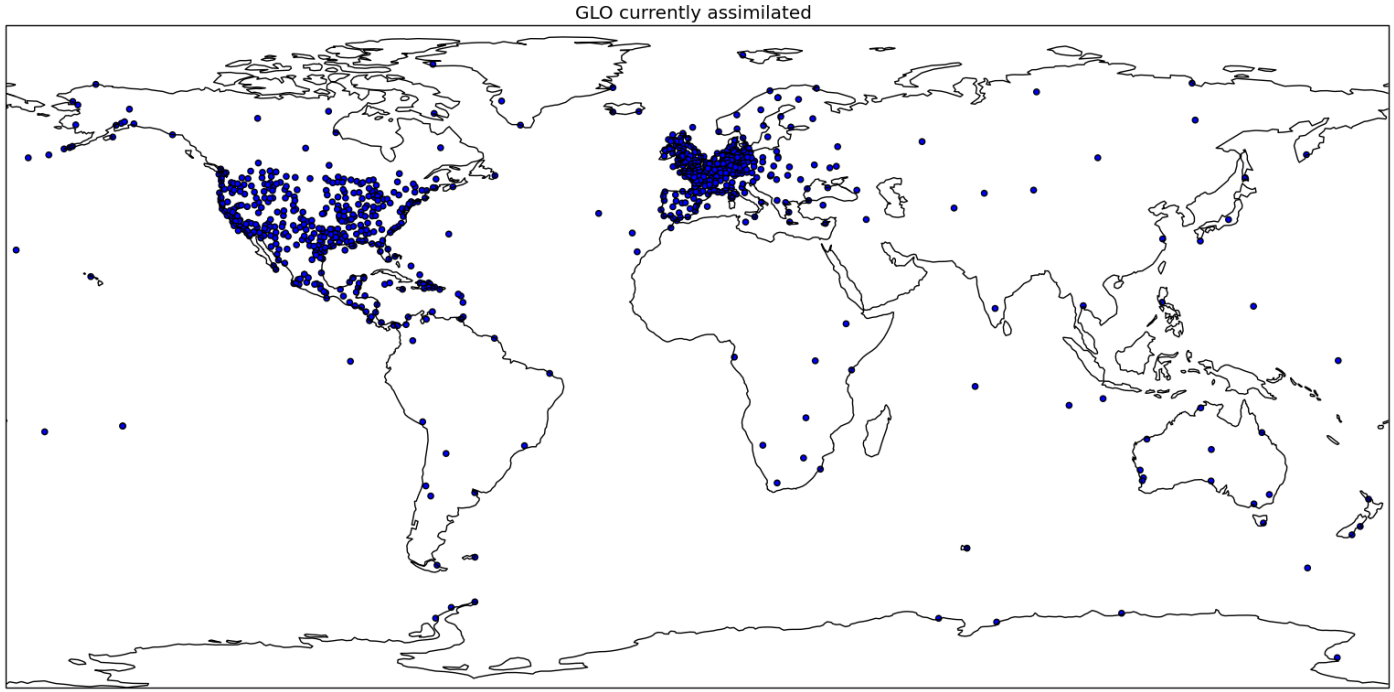
- Inclusion of the UCAR stations, which are spread across North America and the Caribbean.
- This has approximately doubled the number of observations assimilated, 15/11/17 this was 794 stations
- Reduction in ZTD observation error from 15 mm to 10 mm
- New Ground Based GNSS observation operator

OS38



The map of assimilated station before PS39

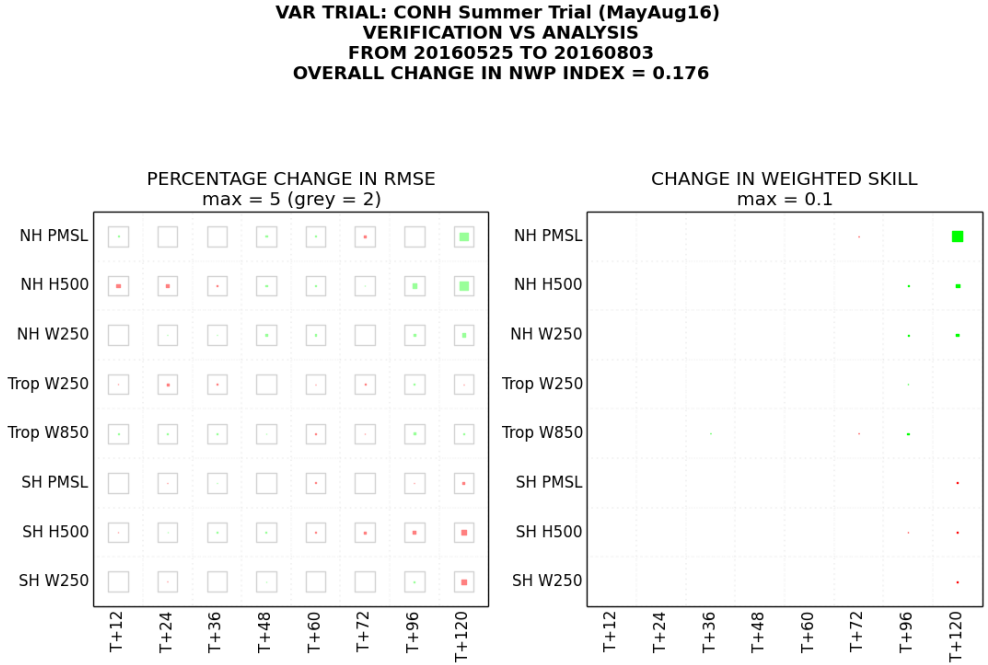
PS39



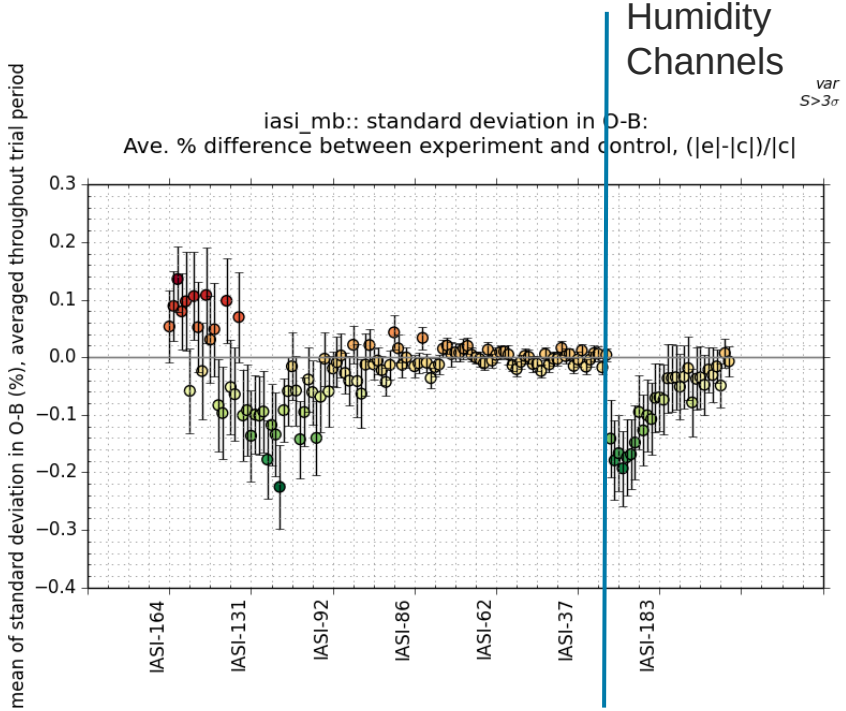
The map of assimilated stations as of 15/11/17

Trial Results

- Trials were run for periods
  - June – August 2015 Summer
  - November 2015 – January 2016 Winter
- During trialling results were not significant and deemed neutral



Trial Varstats

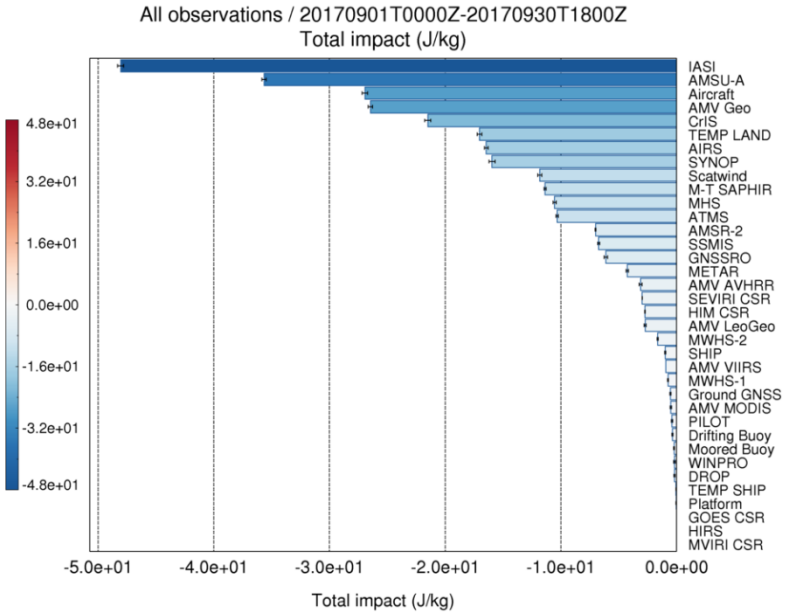


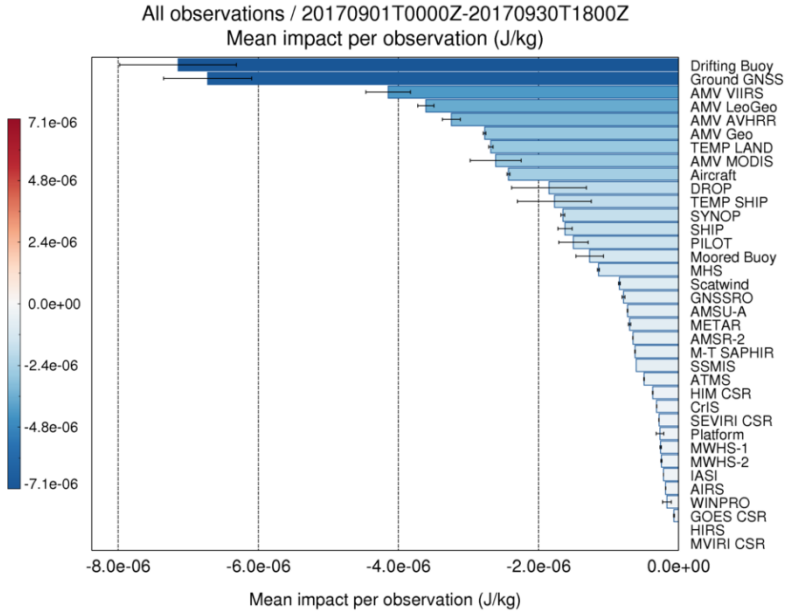
- Winter trial with reduced observation error and the UCAR data
- Improvement in the lower level humidity channels
- Reduction in standard deviation not quite large enough to be deemed significant

Observation Operator

- New Observation operator used.
- This uses a generic refractivity routine and calculates ZTD gradients with respect to both pressure and specific humidity.
- Previously had only been relative humidity.
- Impact of trialling was again very minimal

Latest FSOI


All observations / 20170901T0000Z-20170930T1800Z
Total impact (J/kg)
IASI
AMSU-A
Aircraft
AMV Geo
CrIS
TEMP LAND
AIRS
SYNOP
Scatwind
M-T SAPHIR
MHS
ATMS
AMSR-2
SSMIS
GNSSRO
METAR
AMV AVHRR
SEVIRI CSR
HIM CSR
AMV LeoGeo
MWHS-2
SHIP
AMV VIIRS
MWHS-1
Ground GNSS
AMV MODIS
PILOT
Drifting Buoy
Moored Buoy
WINPRO
DROP
TEMP SHIP
Platform
GOES CSR
HIRS
MVIRI CSR
4.8e+01
3.2e+01
1.6e+01
0.0e+00
-1.6e+01
-3.2e+01
-4.8e+01
-5.0e+01
-4.0e+01
-3.0e+01
-2.0e+01
-1.0e+01
0.0e+00
Total impact (J/kg)


All observations / 20170901T0000Z-20170930T1800Z
Mean impact per observation (J/kg)
Drifting Buoy
Ground GNSS
AMV VIIRS
AMV LeoGeo
AMV AVHRR
AMV Geo
TEMP LAND
AMV MODIS
Aircraft
DROP
TEMP SHIP
SYNOP
SHIP
PILOT
Moored Buoy
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SEVIRI CSR
Platform
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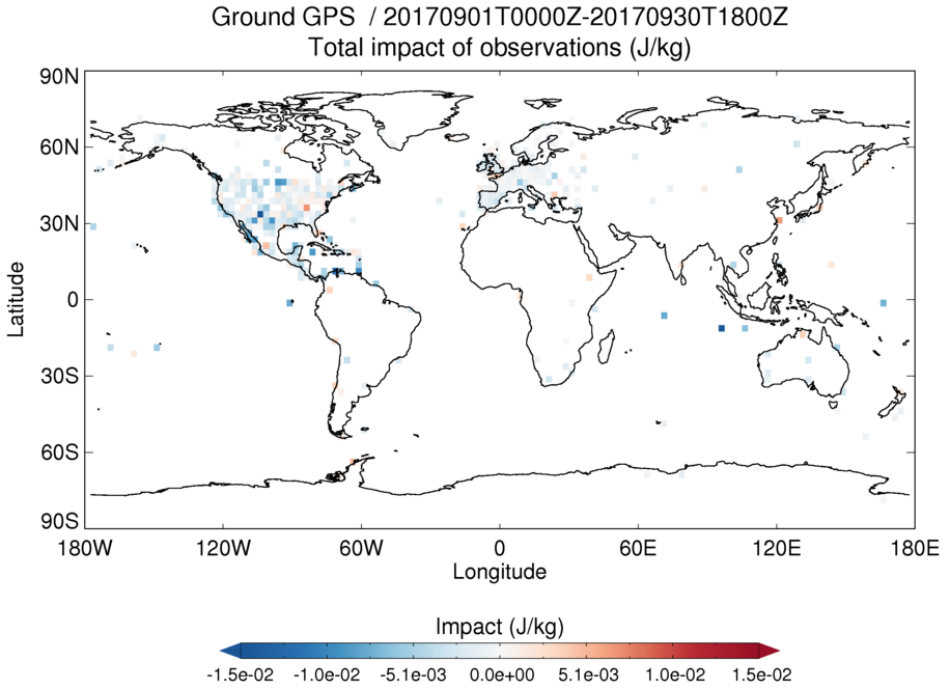
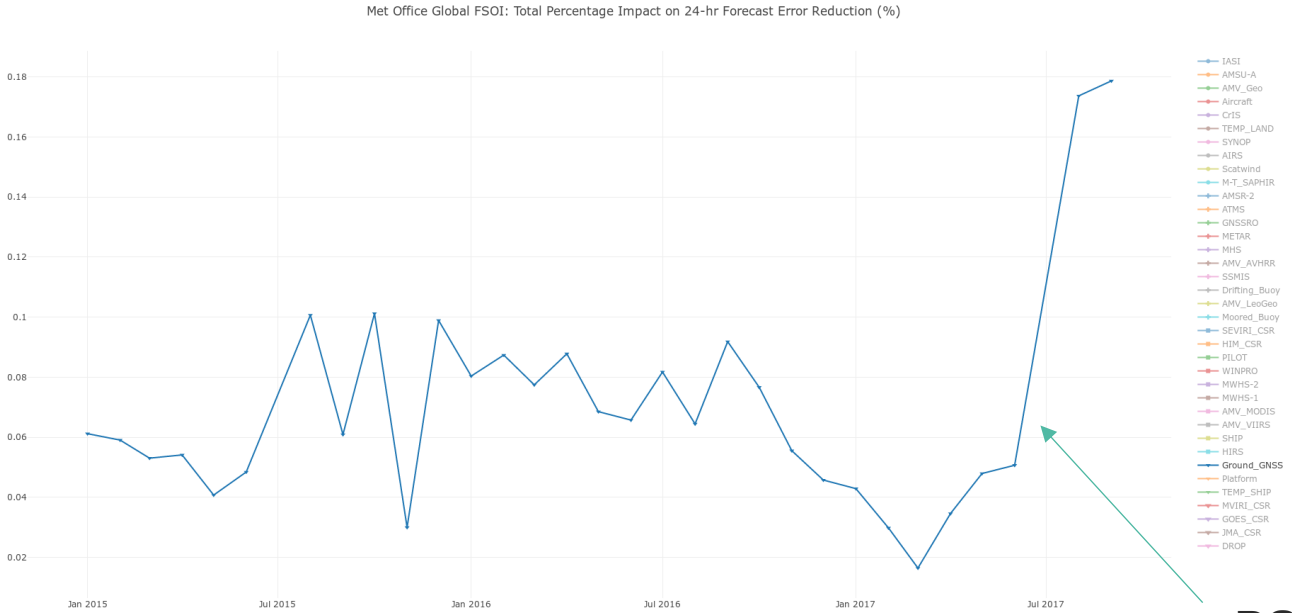
MWHS-2
IASI
AIRS
WINPRO
GOES CSR
HIRS
MVIRI CSR
7.1e-06
4.8e-06
2.4e-06
0.0e+00
-2.4e-06
-4.8e-06
-7.1e-06
-8.0e-06
-6.0e-06
-4.0e-06
-2.0e-06
0.0e+00
Mean impact per observation (J/kg)

Latest FSOI



- Notable improvements in FSOI scores from the implementation of PS39.
- Blue indicates a positive impact
- Clear positive impact over North America

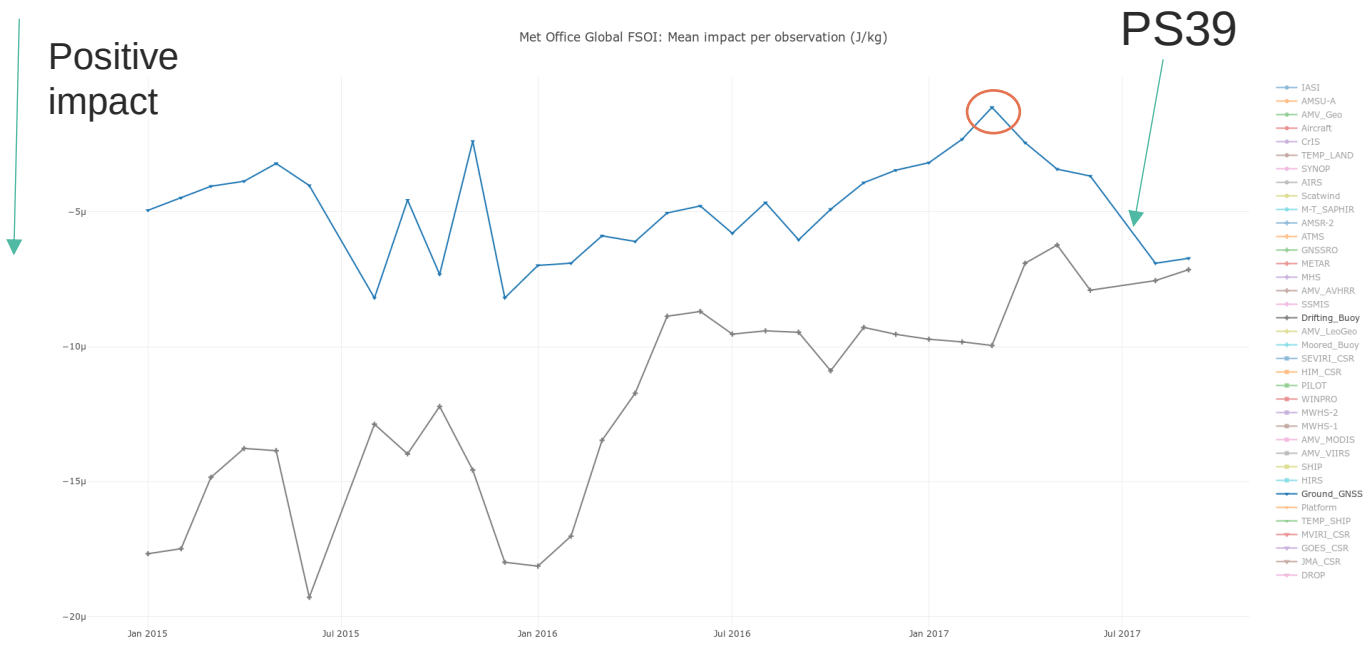
Latest FSOI



- A relative large increase the percentage impact for Ground based GNSS
- This is as a total observation system

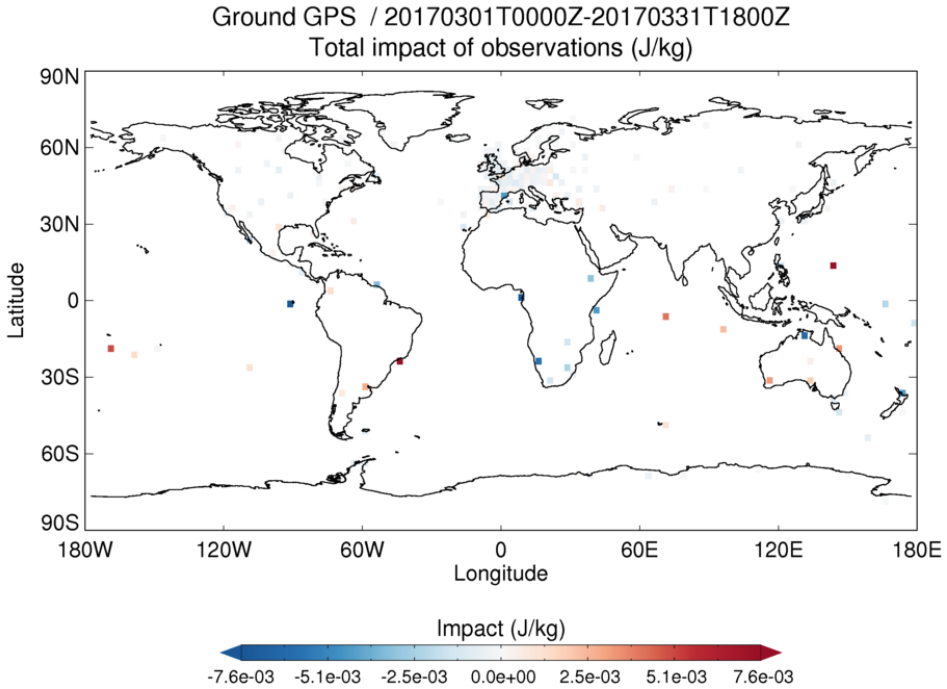
PS39

Latest FSOI



- Again see the increase in mean impact per observation at PS39, closer to the Drifting Buoys.

FSOI March 2017

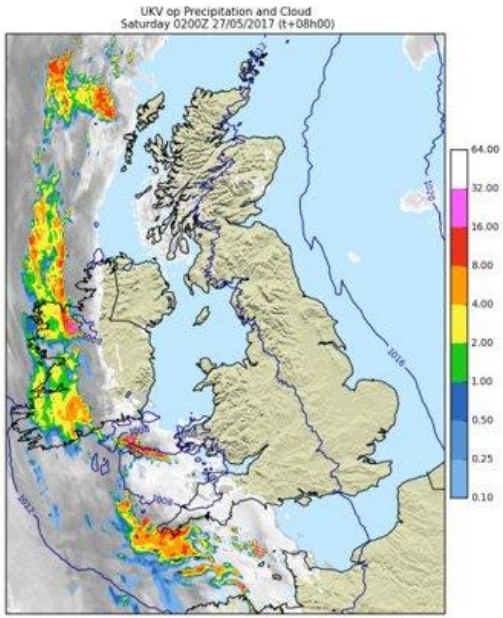


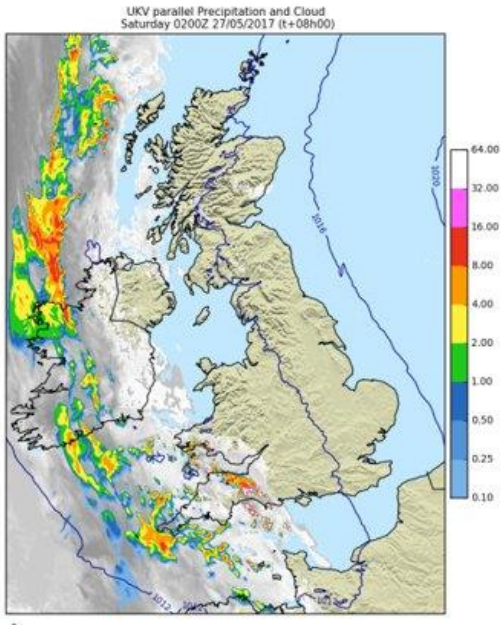
- Would like to investigate why this time had such a drop in impact.
- Many of the red dots appear to confined to island stations

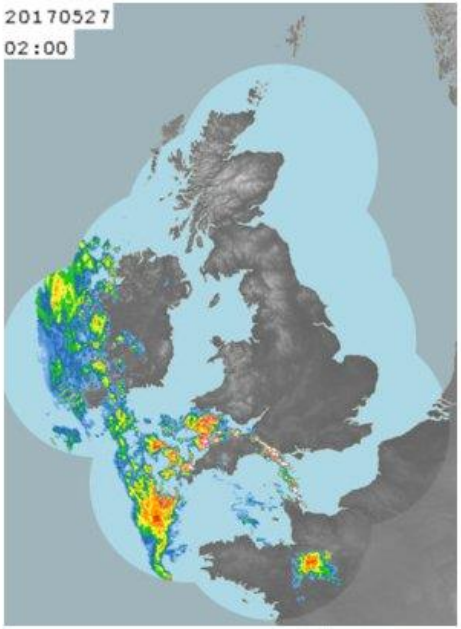
PS39 UKV

- Moved from 3-hourly 3D-VAR to hourly-cycling 4D-VAR
- Up to T+12 for hourly, T+54 3-hourly and T+120 at 03Z and 15Z.
- Cut off is now at 45 minutes, this does cause some data that in the previous model would have been assimilated to not meet the cut off.
- Moisture conservation, unphysically large precipitation rates are less frequent.

An example of improved Rainfall forecast







UKV trials

- Trials of making use of 4D-VAR with Ground based GNSS in the UKV model have not been very successful so far.

- Have tried the new observation operator, different temporal thinning and spatial thinning.

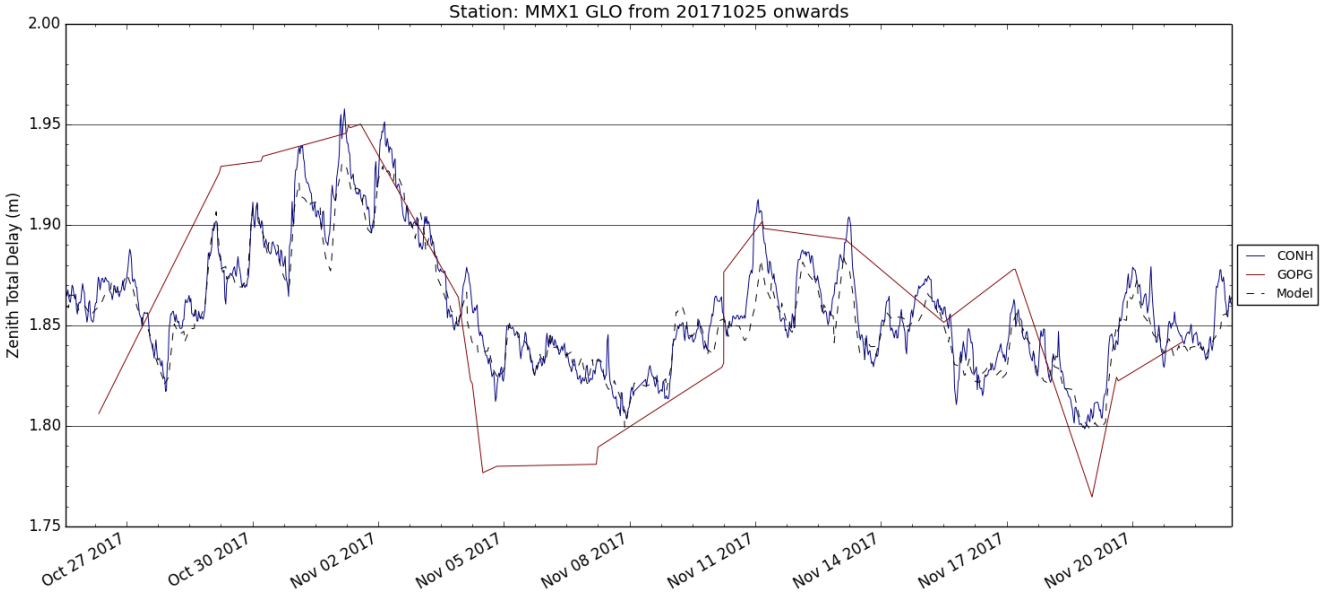
- Waiting on updates to the covariances

Flood Forecasting Centre

- The flood forecasting centre is a partnership between the Environment Agency and the Met Office
- Have started to look at using IWV through GBG to determine maximum hourly rainfall rates.
- Correlated hourly raingauges across England and Wales with IWV to produce a nomogram

Plans

- Move to monitoring the FSOI of the individual stations
- Currently only assimilate one observation per assimilation window, would like to make full use of 4D-Var.
- Single observation experiments
- May make changes to have a more dynamic processing centre selection.


Station: MMX1 GLO from 20171025 onwards
Zenith Total Delay (m)
2.00
1.95
1.90
1.85
1.80
1.75
Oct 27 2017
Oct 30 2017
Nov 02 2017
Nov 05 2017
Nov 08 2017
Nov 11 2017
Nov 14 2017
Nov 17 2017
Nov 20 2017
CONH
GOPG
Model