Validation of Aeolus Level 2 products by comparison with global NWP and airborne flight data

Gemma Halloran, Mary Forsythe, Franco Marenco and Phil Brown
Met Office, U.K.

Our Cal/Val project combines two well established components of observation validation:

1. **NWP model and observation comparison, under the umbrella of the EUMETSAT NWP SAF, and**
2. **Airborne observation comparison, using the Facility for Airborne Atmospheric Measurement (FAAM) aircraft**

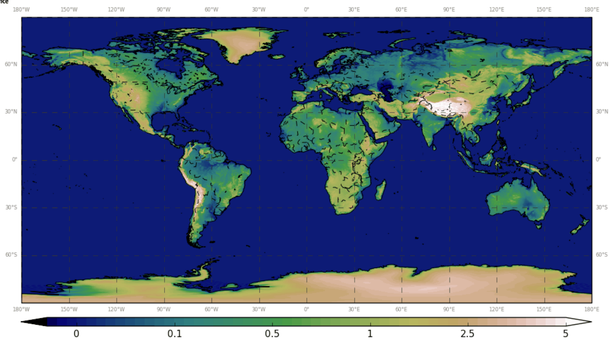
NWP model and observation comparisons

The Met Office (the UK's National Meteorological service) will use our own Numerical Weather Prediction (NWP) Model, the Unified Model, as well as other wind observations to assess the quality of Aeolus HLOS observations.

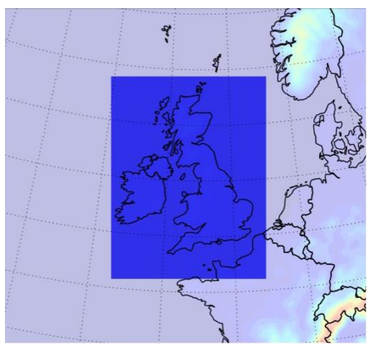
We will use two different versions of our model: the global model, expected to be at 10km horizontal resolution, and the UK model, at 1.5km horizontal resolution.

As well as airborne validation (see below), we will be able to compare Aeolus winds with those derived from atmospheric motion vectors (AMVs, see typical coverage to the right) and scatterometers.

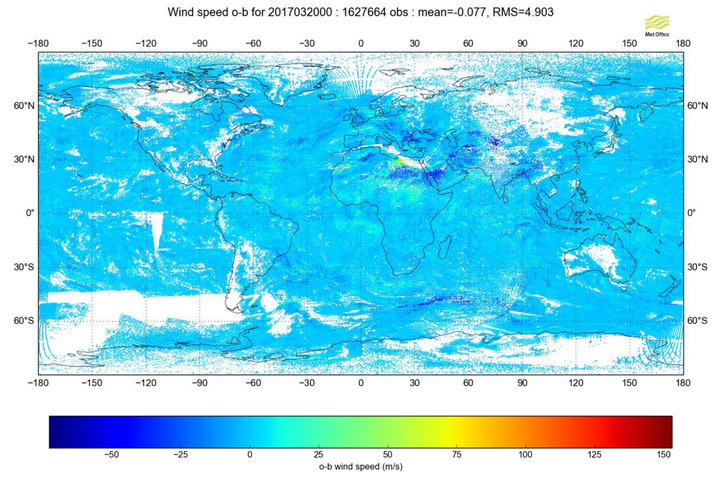
By comparing Aeolus HLOS winds to our model background fields (T+3 (UK) or T+6 (global) forecasts) we can compare all HLOS observations at all levels and locations and build up useful observation quality information and help to understand observation biases.



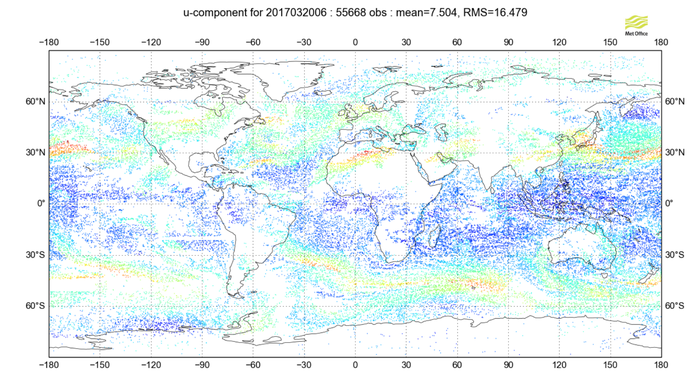
Global Model:
N1280 (~10km by end 2018)
70 vertical levels up to 80km



UK Model:
1.5km (blue area) and 4km (outer area)
70 vertical levels up to 40km



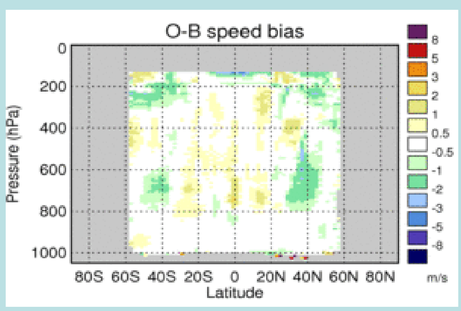
O-B for AMV winds



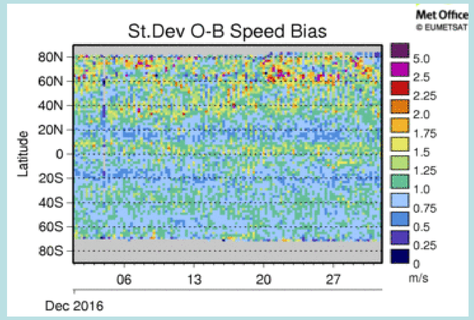
Assimilated AMV u-winds in 6 hours

Example plots

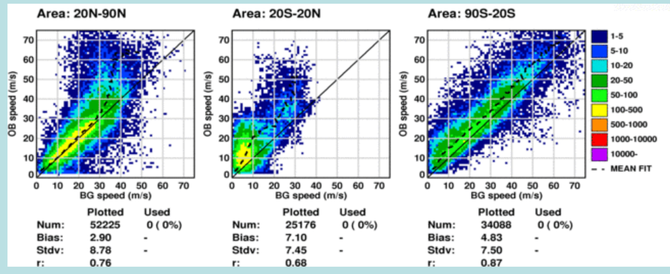
By investigating temporal and spatial features in the observation-background statistics, and comparing with other NWP models, we will help to identify quality control issues and inform any refinements of the derivation



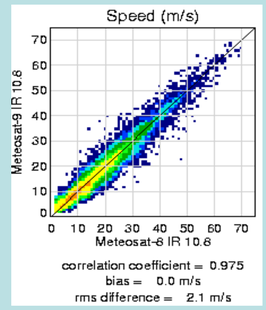
Himawari-8 Zonal mean O-B for February 2017



ASCAT-A standard deviation December 2016



Meteosat-8 WV 6.2 AMV winds February 2017 700-400hPa



Meteosat-9 IR 10.8 vs Meteosat-8 IR 10.8 wind speed

https://nwpsaf.eu/site/

Opportunities for airborne validation

The FAAM BAe 146-301 in flight

The Met Office uses the Facility for Airborne Atmospheric Measurement, a BAe 146-301 aircraft fitted with a wide range of sensors suitable for atmospheric measurements. For Aeolus, we could make use of:

Instrumentation:
- Turbulence probe (32Hz, ±0.3m/s)
- AIMSS probe (20Hz, ±0.5/s)
- Dropsondes
- 3-wavelength nephelometer (1Hz)
- Optical particle counters (0.3-50µm)
- Backscatter lidar

Possible activities:
- Studies on scene classification
- Coordinated flights with DLR Falcon 20
- In situ multi-level flights
- High level flights

Campaign	Funding status	Location	Timing	Objective
PICASSO	Certain	UK	Jan 18	Mixed obj.
MACSSIMIZE/ YOPP	Certain	Alaska	Feb-Mar 18	Snow and BL
YMC	Uncertain	Indonesia	Winter 18/19	Convection
CIRRUS	Uncertain	Sweden	Feb/Mar 19	ICI demo
Begransa	Uncertain	Sweden	Feb/Mar 19	Cloud physics
LIAISE	Uncertain	Spain/ Portugal	Spring 19 or 20	LST bias
COMBLE	Uncertain	Arctic	Early 20	Cold air outbreaks
Trade Winds	Uncertain	Bahamas	Feb 20	
UK flying	Possible (fire cover)	UK	2018-2020	Mixed objectives

Future Met Office airborne campaigns during Aeolus lifetime

Met Office FitzRoy Road, Exeter, Devon, EX1 3PB United Kingdom
Tel: +44 1392 885680 Fax: +44 1392 885681
Email: gemma.halloran@metoffice.gov.uk