Scientific motivation for the Aeolus mission

Erland Källén
ECMWF
Aeolus motivation

- Wind profile data is the most urgently needed observation data for NWP
- Climate re-analyses also need wind profile data
- Aerosol information for pollution prediction and climate modelling
Global observing system
Winds

• Radiosondes
• Pilot balloons
• Satellite track winds
  – Water vapour
  – Clouds (visible and IR)
• Aircraft
• Surface observations (incl. profilers)
Radiosondes

ECMWF Data Coverage (All obs DA) - Temp
06/Feb/2015; 12 UTC
Total number of obs = 555
Geo-stationary water vapour winds

ECMWF Data Coverage (All obs DA) - AMV WV
06/Feb/2015; 12 UTC
Total number of obs = 277628
Aircraft data

ECMWF Data Coverage (All obs DA) - Aircraft
06/Feb/2015; 12 UTC
Total number of obs = 111750
Analysis wind differences

Baker et al., 2014
Observation influence on forecast error

Baker et al., 2014
Mid-latitude storms
A poor forecast

200 mb winds on 15 March

Error propagation
Tropical wave
Equatorial Rossby wave

Zagar, 2004
Assimilation using only height observations

Zagar, 2004
Assimilation using height and Aeolus wind observations

Zagar, 2004
NWP impact experiment

Aeolus wind profile impacts

Horanyi et al., 2014
Aerosol assimilation
Optical depth
Climate change

- Greenhouse gases
- Clouds and radiation
- Atmosphere and ocean heat transports
- Ocean heat storage
Re-analysis zonal wind

ERA-Interim

ERA-Interim – ERA-40

Baker et al., 2014
Arctic warming

*Heat transport across 60° N*

Blue and red colour: negative and positive temperature anomalies on March 16 1996

Arrows: energy transport anomalies on March 11 1996

Graversen et al., 2008
Ocean heat storage

Balmaseda et al., 2013
Conclusions

• NWP needs Aeolus winds
• Climate change sensitivity steered by winds
• Aerosol information helpful for forecasting and climate modelling