Preparations for Aeolus Doppler Wind Lidar data and the expected NWP Impact

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With the expected launch date of mid 2015 for ESA's Earth Explorer space-based Aeolus Doppler wind lidar mission, the NWP community will soon get an important and novel observing system. The Aeolus L2B/C processing software will provide horizontal line-of-sight (HLOS) wind observations suitable for use in numerical weather prediction (NWP), from the near-surface to 30 km with near-global extent. The processing software has been developed by ECMWF and KNMI (with earlier contributions from Météo-France and DLR). ECMWF will run the L2B/C processing operationally during the mission's three-year lifetime, with the intention of assimilating the winds in the ECMWF analysis. The software is designed to be portable and easy to use. It is freely available, and NWP centers are encouraged to implement it in their own observation processing system.

This presentation will provide an overview of the software and discuss recent changes to accommodate the continuous mode operation of Aeolus, such as a flexible averaging algorithm for the observations. We go on to present the end-to-end testing results from the Aeolus simulator/L1B/L2B processing chain, based on realistic optical properties and atmospheric inputs, using the expected mission launch-time specifications. The verification of these results provides a realistic indication of the quality of Aeolus L2B products, in particular the random and systematic errors of the winds.

The second part of the talk will present studies performed at ECMWF to investigate the expected NWP impact of continuous mode Aeolus wind data. For the impact assessments real, good quality wind observations were used for a number of Observing System Experiments (OSE) and advanced assimilation diagnostics experiments. The denial studies used aircraft and wind profiler observations to investigate the impact of thinning the wind data. In addition the wind observations from radiosondes, aircraft and profilers were used to define single component (HLOS) wind data for various Aeolus related impact studies, where the impact of HLOS data was investigated. Additional experimentation was conducted to investigate the impact of degraded quality observations, representative for the decreased laser pulse energy expected to be used for the first phase of the Aeolus mission.

The NWP impact results confirm that HLOS wind observations are very beneficial. It is shown that wind data is more important than mass (temperature and humidity) data, so new wind observations like Aeolus wind data would be welcome from the global data assimilation and forecast point of view. Particularly, most benefit is expected in the tropics and in the upper troposphere and lower stratosphere. Furthermore it is shown that a slight increase in random observation error does not severely reduce the impact of the Aeolus data. However, even relatively small biases can have very detrimental effect on the impact. All in all the impact studies at ECMWF conclude that Aeolus wind data is expected to provide valuable impact in global numerical weather prediction.