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Aeolus, the first Doppler wind LIDAR sampling vertical wind profiles from space

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Our ability to observe and analyze winds is far from adequate, both in-situ as well as remote sensing observing systems suffer from being incomplete and in some cases the accuracy of the wind measurements is poor. The World Meteorological Organization (WMO) states in an evaluation of user requirements and satellite capabilities that for global meteorological analyses, measurement of wind profiles remains most challenging and most important (WMO, 1998).

Aeolus will be the first Doppler wind lidar to globally measure vertical wind profiles from space. The instrument is the second ESA Earth Explorer Core Mission, to be launched in 2007. In this presentation, the Aeolus measurement concept will be presented together with the scientific products. Furthermore, and overview of the output from the scientific studies performed to investigate the benefit of the Aeolus measurements for NWP and modeling of climate change will be given.

Observations of temperature and pressure, defining the atmospheric mass distribution, can give us information about the wind field and vice versa. In the extra-tropics the physical coupling between the wind and the mass field is strong. The rotation of the Earth forces the mass and the wind field to be in a so-called geostrophic balance. In the tropics there is no such geostrophic coupling. Instead characteristic atmospheric wave features determine the time dependent coupling between mass and wind. The mass-wind coupling is also scale dependent, large-scale mid-latitude flow features are strongly geostrophically coupled while mid-latitude flow features on a smaller horizontal scale are uncoupled. For features where the coupling is strong, mass field observations can be used to determine the wind field. Mass field observations are more

abundant than wind field observations and NWP has been relying on mass field observations as the basis for atmospheric analyses. It has been shown, however, that the wind field information has a very strong impact on the quality of the atmospheric analyses (Tan and Andersson, 2004). This is particularly true in the tropics as well as for small-scale circulation features in the extra-tropics such as fronts and orographically generated flow features. Additional wind information thus increases the accuracy of atmospheric analyses.

References:

World Meteorological Organisation, 1998: Preliminary Statement of Guidance Regarding How Well Satellite Capabilities Meet WMO User Requirements in Several Application Areas. *WMO Satellite Reports SAT-21. WMO/TD No 913.*

D. Tan and E. Andersson, 2004: Expected Benefit of Wind Profiles from the ADM-Aeolus in a Data Assimilation System. *Final report for ESA contract 15342/01/NL/MM.*