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TELLUS

Foreword

Special issue with manuscripts related to ESA's Atmospheric Dynamics Mission/Aeolus

Within the Earth Explorer programme ESA will launch a new satellite mission devoted to wind observations, the Atmospheric Dynamics Mission (ADM/Aeolus). Measurements of atmospheric winds are inadequate in the present global observing system, wind profiles have been stated as the most urgently needed observation type for climate studies as well as numerical weather prediction (WMO, 2004). The ADM/Aeolus mission will provide line-of-sight wind profiles using a Doppler lidar measurement technique. A space borne lidar with an intermittent pulsing will provide wind profiles of high quality with a spatial along track resolution of 200 km. The vertical resolution is about 1 km and the measurements cover the troposphere and also extend into the lower stratosphere. Both Rayleigh scattering from molecules and Mie scattering from aerosols is used as detection principles in the Doppler lidar receiving equipment. An overview of the mission can be found in Stoffelen et al. (2005).

The main purpose of the mission is to measure winds. In particular. In tropical regions there is a serious lack of wind information. Also aerosol and cloud information will be obtained as secondary products. In the tropics atmospheric variability is governed by the winds, with only temperature and pressure information present day weather prediction systems have difficulties in properly representing some aspects of tropical weather. One example of this is given by Kistler et al. (2001) when they compare zonally averaged wind fields from two separate re-analysis systems. It is clear that the two different re-analyses differ markedly in the tropical regions while they are quite similar in mid-latitude and polar regions. This is not due to any deficiency in any of the re-analysis models used, but can be argued to result from a lack of wind information in the tropics.

In this special issue of Tellus A contributions from a workshop held in Noordwijk, the Netherlands in September 2006 are published. The purpose of the workshop was to review the current status of the ADM/Aeolus mission and to discuss scientific aspects of the utilization of ADM/Aeolus data. As the wind profiles only give line-of-sight wind information it will be necessary to assimilate the information in a meteorological data assimilation system. Several papers discuss assimilation issues, a basic description of the assimilation procedure that will be used at ECMWF is described by Tan et al. (2008). One particular feature of the Rayleigh Doppler lidar receiver is that winds as well as temperature and pressure affect the Doppler frequency shift. A description of this effect and how to handle it in an assimilation system is given in the paper by Dabas et al. (2008). The potential impact of the new wind data in an assimilation system is investigated using some novel analysis techniques in a series of papers by Marseille et al. (2008a,b,c). Körnich and Källén (2008) describe how a new technique for assimilation of tropical winds originally proposed by Zagar (2004) can be combined with traditional variational assimilation technique focusing on mid-latitudes. In addition to the wind data the ADM/Aeolus mission will also measure atmospheric aerosol properties and clouds, Flamant et al. (2008) describe how well ADM/Aeolus will be able to detect these phenomena. The mission is originally designed to measure wind profiles but it has been realised that with the very powerful laser transmitters used the mission will also provide a potential contributing to our knowledge of aerosols and clouds.

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