The goal of project “Mesoscale wind profile and data assimilation for NWP” which started in 2012 within the PECs (Plan for European Cooperation in Science) is to address the potential of assimilation of the horizontal line of sight (HLOS) wind observations provided by ADM-Aeolus in a limited area model (LAM) for Europe.

Motivation

Several studies addressed the potential impact of Doppler wind lidar (DWL) measurements provided by ADM-Aeolus. They have dealt exclusively with the impact in a global model based on the variational assimilation framework.

This poster presents the ongoing work within the project coupling a special high-resolution nature run with a chain of processors E2S, L1B and L2B and a mesoscale data assimilation system.

The ultimate goal is to study the data assimilation potential to extract useful information from the ADM-Aeolus HLOS wind observations at higher resolutions than currently used for averaging of individual measurements (~90 km).

While the ultimate goal is to have a mesoscale data assimilation system tuned for the use of new observations upon the launch of ADM-Aeolus, the ongoing work is to set a special Observing System Simulation Experiment (OSSE) which combines a high resolution nature run prepared by ECMWF run with a mesoscale ensemble Kalman filter data assimilation system.

This is the first OSSE which combines the whole chain of processors (E2S-L1B-L2B) and an NWP data assimilation system.

Data set

Nature run - T3999 ECMWF Forecast for a 10-day period from 1 to 10 April 2007
- Forecast available on 137 model levels with ~5km horizontal resolution
- Performed with NCEM (ECMWF)
- Selected period is 1-10 April 2007 for which CALIPSO measurements are available through KNMI.

Aerosol and cloud properties will be additionally provided using CALIPSO data.

New experiments within the NWP framework confirm results from the earlier idealized model about insufficiency of 3DVAR data assimilation for low wind conditions. A new method, designed within the project at the Faculty of Mathematics and Physics introduces perturbations by perturbing the Davies relaxation scheme used for coupling ECMWF and WRF.

Single HLOS observation experiments

What is the sensitivity of the analysis increment for a single HLOS observation on the azimuth angle?

In other words, what is the relation between analysis increments due to full wind information and HLOS?

Are the background-error covariances capable, supported by other simulations, to extract the missing wind component?

Summary and future work

Main components of the OSSE system for limited-area NWP model and ADM-Aeolus are presented.

High resolution nature run T3999 is used as input for the ADM-Aeolus simulator chain.

Aerosol and cloud properties will be additionally provided using CALIPSO data.

New observation operators related to ADM-Aeolus were added in DART (4 operators: Rayleigh/Mie in combination with clear/cloud scattering).

Several aspects of the ensemble Kalman filter data assimilation system such as inflation are subject of ongoing work.

A new method for the simulation of spread due to LBC has been developed and implemented in WRF/DART.