Geophysical Research Abstracts
Vol. 14, EGU2012-1406, 2012
EGU General Assembly 2012

Assimilation of surface versus lidar observations for PM_{10} forecasting

Y. Wang (1,2), K.N. Sartelet (1), M. Bocquet (1,3), and P. Chazette (2)

(1) CEREA, joint laboratory Ecole des Ponts ParisTech - EDF R&D, Université Paris-Est, 77455 Champs sur Marne, France, (2) LSCE, joint laboratory CEA - CNRS, 91191 Gif-sur-Yvette, France, (3) INRIA, Paris-Rocquencourt Research Center, Le Chesnay, France

Thanks to the new generation of portable lidar systems developed over the past several years, one can now carry out spatially denser observations of aerosol optical properties in the mid and lower troposphere. Data assimilation is an analysis technique which can use these observations to reduce the uncertainties in input data, and improve the forecast. In order to investigate the potential impact of future ground-based lidar network LEONET (http://leo-net.eu/) on analysis and short-term forecasts of PM_{10}, an Observing System Simulation Experiment (OSSE) is built for PM_{10} data assimilation using optimal interpolation over Europe for one month in 2001. Firstly, we estimate the efficiency of the assimilation of lidar network measurements in improving PM_{10} concentration analysis and forecast. It is compared to the efficiency of assimilating concentration measurements from the AirBase ground network, which includes about 500 stations in western Europe. It is found that the assimilation of lidar observations is more efficient at improving PM_{10} concentrations in terms of root mean square error and correlation after 12 hours of assimilation than the assimilation of AirBase measurements. Moreover, the spatial and temporal influence of the assimilation of lidar observations is larger and longer. Secondly, since a lidar is a very costly instrument, a sensitivity study on the number of required lidars is performed to help define an optimal lidar network for PM_{10} forecast. The results suggest 12 lidar stations over western Europe, because a network with 26 lidar stations is more expensive and offers a limited improvement (less than $1\ \mu g\ m^{-3}$ of root mean square error on average) over the 12 lidar network. A comparison of two networks with 12 lidar stations at different locations does not lead to substantial differences. This result gives more freedom in choosing the lidar network configuration.