Geophysical Research Abstracts
Vol. 15, EGU2013-5608-1, 2013
EGU General Assembly 2013

Estimation of the spatial validity of local aerosol measurements in Europe using MODIS data

Carlos Marcos (1), J. Luis Gómez-Amo (1,2), Roberto Pedrós (1), M. Pilar Utrillas (1), and J. Antonio Martínez-Lozano (1)

(1) Department of Earth Physics and Thermodynamics, University of Valencia, Burjassot, 46100, Spain, (2) Laboratory for Earth Observations and Analyses, ENEA, Via Anguillarese 301, 00123 Rome, Italy

The actual impact of atmospheric aerosols in the Earth's radiative budget is still associated to large uncertainties [IPCC, 2007]. Global monitoring of the aerosol properties and distribution in the atmosphere is needed to improve our knowledge of climate change. The instrumentation used for this purpose can be divided into two main groups: ground-based and satellite-based. Ground-based instruments, like lidars or Sun-photometers, are usually designed to measure accurate local properties of atmospheric aerosols throughout the day. However, the spatial validity of these measurements is conditioned by the aerosol variability within the atmosphere. Satellite-based sensors offer spatially resolved information about aerosols at a global scale, but generally with a worse temporal resolution and in a less detailed way.

In this work, the aerosol optical depth (AOD) at 550nm from MODIS Aqua, product MYD04 [Remer, 2005], is used to estimate the area of validity of local measurements at different reference points, corresponding to the AERONET [Holben, 1998] stations during the 2011-2012 period in Europe. For each case, the local AOD (AOD_{loc}) at each reference point is calculated as the averaged MODIS data within a radius of 15 km. Then, the AOD_{loc} is compared to the AOD obtained when a larger averaging radius is used (AOD(r)), up to 500 km. Only those cases where more than 50% of the pixels in each averaging area contain valid data are used. Four factors that could affect the spatial variability of aerosols are studied: proximity to the sea, human activity, aerosol load and geographical location (latitude and longitude).

For the 76 reference points studied, which are sited in different regions of Europe, we have determined that the root mean squared difference (RMSD) between AOD_{loc} and AOD(r) , averaged for all cases, increases in a logarithmic way with the averaging radius (RMSD $\propto$ log(r)), while the linear correlation coefficient (R) decreases following a logarithmic trend (R $\propto$ -log(r)). Among all the factors studied, the aerosol load is the most influential one in the aerosol spatial variability: for averaging radii smaller than 40 km, the RMSD increases with AOD_{loc}. Another important factor is the latitude and longitude: the variation of the RMSD in the AOD with regard to the averaging radius can differ up to a 60%, depending on the location. On the contray, the proximity to the sea and the amount of population surrounding each reference point do not have a noticeable influence compared to the above mentioned factors.

Holben, B. N., Eck, T. F., Slutsker, I., Buis, J. P., Setzer, A., Vermote, E., Reagan, J. A., Kaufman, Y., Nakajima, T., Lavenu, F., and Smirnov, A.: AERONET – A federated instrument network and data archive for aerosol characterization, Remote Sens. Environ., 66, 1–16, 1998.

IPCC (2007). S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, H.L. Miller (Eds.), Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK & New York, USA.

Remer, L. A., y co-authors, 2005: The MODIS aerosol algorithm, products, and validation. J. Atmos. Sci., 62, 947–973. doi: http://dx.doi.org/10.1175/JAS3385.1