Geophysical Research Abstracts,
Vol. 11, EGU2009-10928, 2009
EGU General Assembly 2009

Deriving atmospheric visibility from satellite retrieved aerosol optical depth

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Atmospheric visibility is a measure that reflects different physical and chemical properties of the atmosphere. In general, poor visibility conditions come along with risks for transportation (e.g. road traffic, aviation) and can negatively impact human health since visibility impairment often implies the presence of atmospheric pollution. Ambient pollutants, particulate matter, and few gaseous species decrease the perceptibility of distant objects. Common estimations of this parameter are usually based on human observations or devices that measure the transmittance of light from an artificial light source over a short distance. Such measurements are mainly performed at airports and some meteorological stations. A major disadvantage of these observations is the gap between the measurements, leaving large areas without any information. As aerosols are one of the most important factors influencing atmospheric visibility in the visible range, the knowledge of their spatial distribution can be used to infer visibility with the so called Koschmieder equation, which relates visibility and atmospheric extinction.

In this study, we evaluate the applicability of satellite aerosol optical depth (AOD) products from the Advanced Very High Resolution Radiometer (AVHRR) and Moderate Resolution Imaging Spectroradiometer (MODIS) to infer atmospheric visibility on large spatial scale. First results applying AOD values scaled with the planetary boundary layer height are promising. For the comparison we use a full automated and objective procedure for the estimation of atmospheric visibility with the help of a digital panorama camera serving as ground truth. To further investigate the relation between the vertical measure of AOD and the horizontal visibility data from the Aerosol Robotic Network (AERONET) site Laegeren (Switzerland), where the digital camera is mounted, are included as well. Finally, the derived visibility maps are compared with synoptical observations in central Europe.