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Satellite-based retrieval of desert dust deposition into the Atlantic Ocean

Malte Jaeger, Luca Lelli, Marco Vountas, and John P. Burrows
Institute of Environmental Physics, University of Bremen, Bremen, Germany, mjaeger@iup.physik.uni-bremen.de

Desert dust plays a prominent role in climate as it influences the radiation budget in the atmosphere and, if being transported to the ocean, affects the ecosystem, e.g. by acting as fertilizer.
Measurements of dust deposition are usually performed using collectors on land and on buoys as well as sediment traps deployed across the Atlantic Ocean. However, regional to continental coverage can be only achieved with satellites. We present a new methodology for the assessment of desert dust deposition from top-of-atmosphere reflected solar irradiance measured by satellite. This methodology is based on the observation of changes in columnar aerosol optical thickness (AOT) along the transport path of dust outflows from the Sahara. The guiding idea is that, if transport orientation is correctly estimated, a decrease in AOT across the Atlantic can be linked to the deposition of aerosols onto the ocean surface.
The Bremen Aerosol Retrieval (BAER), developed at the Institute of Environmental Physics of University of Bremen (IUP/U-Bre), serves as primary AOT retrieval algorithm. It uses multispectral measurements by the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and MEdium Resolution Imaging Spectrometer (MERIS).
Especially the correct implementation of the wind fields for trajectory prediction and the choice of comparison sites are of critical importance for deposition estimation. Therefore a two-step wind correction, including a simple implementation of vertical dust layer structure and wind variation, is performed, using ECMWF reanalysis data.
First tests show that seasonal patterns of AOT are correctly reproduced, both in space and time. For example the largest peak in AOT mass loss is observed at summer. Moreover, intercomparisons with in-situ sedimentation measurements at various sites show good correlations.