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Toward a combined high-temporal resolution aerosol product from MODIS and METEOSAT SEVIRI

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Aerosols are an important but poorly understood part of the climate system. They significantly influence the radiation balance of the atmosphere both indirectly through their influence on cloud formation and development, and directly through reflection and absorption of shortwave radiation. The direct effects strongly depend on size and composition of the individual aerosol particles, as well as the wavelength under consideration.
Passive satellite imagers are well-suited for studying aerosol and their properties at global scale. The MODIS instrument onboard the polar-orbiting Terra and Aqua instrument is unique in its instrumental capabilities in terms of calibration accuracy and its large range of wavelengths, which enable an accurate retrieval of aerosol optical depth, size and type over ocean. MODIS aerosol products represent a significant improvement over those from other satellite imagers, which are generally only based on single or dual channel reflectances. Polar-orbiting satellites such as MODIS are, however, restricted to overpasses at a fixed local time, and thus cannot resolve the diurnal cycle and temporal evolution of aerosols. To address this shortcoming, we plan to utilize the MODIS aerosol products in combination with reflectances from the geostationary METEOSAT Spinning Enhanced Visible and Infrared Imager (SEVIRI) to obtain a merged aerosol product at SEVIRI's 15 minute temporal resolution.
Here, a feasibility study on the combination of MODIS and SEVIRI measurements over ocean is presented. As a prerequisite for a successful combination, we evaluate the consistency of the MODIS retrievals with SEVIRI reflectances and ground-based observation. For this purpose, the diurnal cycle of SEVIRI reflectances is simulated with the LibRadtran radiative transfer model using the MODIS aerosol properties and models as input. The sensitivity of the aerosol retrievals to assumptions about wind speed and aerosol type is studied, and the accuracy of the single scattering assumption is investigated as simple method for obtaining aerosol optical depth. Our simulations are then compared to SEVIRI observations for selected case studies for an ocean region centered around the Cape Verde islands. Additional information about the temporal changes in aerosol properties are obtained from ground-based instruments from the Aerosol Robotic Network (AERONET).