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Aerosol direct radiative effect at the top of the atmosphere over cloud free ocean derived from four years of MODIS data

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Abstract. A four year record of MODIS spaceborne data provides a new measurement tool to assess the aerosol direct radiative effect at the top of the atmosphere. MODIS derives the aerosol optical thickness and microphysical properties from the scattered sunlight at 0.55–2.1 μm. The monthly MODIS data used here are accumulated measurements across a wide range of view and scattering angles and represent the aerosol's spectrally resolved angular properties. We use these data consistently to compute with estimated accuracy of ±0.6 Wm^{-2} the reflected sunlight by the aerosol over global oceans in cloud free conditions. The MODIS high spatial resolution (0.5 km) allows observation of the aerosol impact between clouds that can be missed by other sensors with larger footprints. We found that over the clear-sky global ocean the aerosol reflected 5.3±0.6 Wm^{-2} with an average radiative efficiency of −49±2 Wm^{-2} per unit optical thickness. The seasonal and regional distribution of the aerosol radiative effects are discussed. The analysis adds a new measurement perspective to a climate change problem dominated so far by models.

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