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Aerosol seasonal variability over the Mediterranean region and relative impact of maritime, continental and Saharan dust particles over the basin from MODIS data in the year 2001

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Abstract. The one-year (2001) record of aerosol data from the space borne Moderate Resolution Imaging Spectroradiometer (MODIS) is analyzed focusing on the Mediterranean region. The MODIS aerosol optical thickness standard product (AOT at 550nm) provided over both land and ocean is employed to evaluate the seasonal and spatial variability of the atmospheric particulate over the region. Expected accuracy of the MODIS AOT is ($\pm 0.05 \pm 0.2 \times \text{AOT}$) over land and ($\pm 0.03 \pm 0.05 \times \text{AOT}$) over ocean. The seasonal analysis reveals a significant AOT variability all over the region, with minimum values in Winter ($\text{AOT} < 0.15$) and maximum in Summer ($\text{AOT} > 0.2$). The spatial variability is also found to be considerable, particularly over land. The impact of some major urban sites and industrialized areas is detectable. For the sole Mediterranean basin, a method (aerosol mask) was implemented to separate the contribution of maritime, continental and desert dust aerosol to the total AOT. Input of both continental and desert dust particles is well captured, showing North-to-South and South-to-North AOT gradients, respectively. A quantitative summary of the AOT seasonal and regional variability is given for different sectors of the Mediterranean basin. Results of this summary were also used to test the aerosol mask assumptions and indicate the method adopted to be suitable for the aerosol type selection. Estimates of the atmospheric aerosol mass load were performed employing specifically-derived mass-to-extinction efficiencies (α). For each aerosol type, a reliable mean α value was determined on the basis of both lidar measurements of extinction and aerosol models. These estimates indicate a total of 43Mtons of desert dust suspended over the basin during 2001. A comparable value is derived for maritime aerosol. Opposite to the dust case, a minor seasonal variability (within 15%) of maritime aerosol mass is found. This latter result is considered a further check of the suitability of the methodology adopted to separate, on the basis of MODIS data, the three aerosol types which dominate the Mediterranean region.

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