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Aerosol and Precipitable Water Characterization over the Central Mediterranean by MODIS products

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The importance of aerosols in controlling the Earth's climate has been demonstrated by several models and quantifying how aerosols impact the Earth's climate system is crucial to understanding climate change over the industrial period and to improving predictions of future climate change. The great spatial and temporal variability of both aerosol sources and aerosol properties is responsible for the uncertainties in assessing climatic and environmental effects of aerosols. Long-term continuous observations from flying-satellites offer tremendous benefits to aerosol science as the worldwide use of MODIS aerosol products reveals. MODIS has been launched onboard the EOS Terra and Aqua polar-orbiting satellites since December 1999 and May 2002, respectively. The aerosol optical depth (AOD) that is the most practical measure of aerosol amount for global assessments, the fine-mode fraction F, that is, the fraction of AOD caused by particles smaller than about 1-micron diameter, which is strictly related to the anthropogenic aerosol fraction, and the precipitable water vapour PW represent the main Terra- and Aqua-MODIS products used in this study. In particular, AOD, F, and PW have been retrieved in square boxes of variable size (from 10 km x 10 km up to 300 km x 300 km) centered at Mediterranean sites (Rome, Lecce, Lampedusa, and Crete) differently affected by pollution. The main goal of this study is both to investigate the AOD, F, and PW spatial and temporal variability over the Mediterranean basin and to infer main aerosol source regions and sinks. The effects of long range transported air masses on AOD, F, and PW values and the dependence of AOD and F on PW have also been investigated. We have found that AOD, F, and PW mean values and corresponding seasonal dependences are quite dependent on latitude. In addition, the analysis of 10-km-box averaged values has revealed that all tested parameters also depend on site location. Conversely, we have found that the differences between 300-km-box averaged values of AOD, F, and PW are smaller than corresponding standard deviations. Correlation studies as a function of the data-point spatial distance have provided significant results on the spatial variability of all tested parameters and hence, have allowed inferring to what extent local data can be representative of larger areas. The correlation analysis of Aqua-MODIS and Terra-MOSIS data has instead allowed assessing the variability within few hours of all studied parameters. We believe that paper's results besides contributing to the characterization of water vapor and main aerosol properties over the Mediterranean basin, are of interest to feed Chemical Transport Models (CTMs) which operate at different spatial and temporal resolutions.