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Vertical distributions of aerosols and clouds over the greater Mediterranean basin using CALIOP observations

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The vertical distributions of aerosols and clouds are a key requirement in aerosol-cloud-radiation interaction schemes. Obtaining global vertical distribution of aerosols and clouds is necessary for more accurate assessments of the anthropogenic and natural radiative forcings and hence climate change. For example, the position of aerosols relative to clouds is of particular importance since it determines the magnitude or even the sign of the aerosol radiative effect, while also affecting microphysical and optical properties of clouds. Vertical distributions of these key atmospheric constituents have become possible in the last few years due to the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) instrument carried on the CALIPSO satellite, which has been obtaining global profiles since June 2006. The Mediterranean basin is one of the most interesting areas for making assessments of vertical distribution of aerosols and clouds because of the enhanced radiative and climatic effects of aerosols in this region and the vulnerability of the area to climatic change.

In the present study, vertically resolved data from version 3 CALIOP database are used to assess the vertical distribution of aerosols and clouds over the greater Mediterranean basin. The CALIOP data, specifically aerosol and cloud optical depths at 532 and 1064 nm, are analysed and provided at the high resolution of 5 hPa, from surface (1100 hPa) up to 50 hPa. They were originally available at 8 (10) layers for aerosols (clouds) and have been converted to the standard resolution of 5 hPa (210 layers) over the study region extending from 9.5˚W to 38.5˚E and from 29.5˚N to 46.5˚N. The derived data cover the period from December 2006 to November 2010, a period of four complete years. The vertically resolved aerosol optical depth over the study region allows one to examine the contribution of boundary layer and free tropospheric aerosols to the atmospheric columnar aerosol loading. Furthermore, the identification of aerosol types for each grid and for each season offers the possibility to compare with chemistry transport models in terms of aerosol sources. Cloud layered data have been processed to match ISCCP classification (low-medium-high level) and a direct comparison has been made.