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Quantitative assessment of anthropogenic aerosol radiative effects and their Implication climate in the Mediterranean Basin using 10 years CALIPSO and EARLINET lidar data

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We quantitatively evaluated the seasonal average of the radiative effects, either at the top of the atmosphere (TOA) and at surface (SFC), and the heating rate (HR) of the anthropogenic aerosol emissions in the Po Valley and Sahara desert, two very different regions in the Mediterranean basin which has been identified as one of the climate hotspot regions. The evaluation is based on the use of lidar measurements of aerosol as input for the Fu-Liou-Gu Radiative Transfer Model (RTM). Previous papers have shown that the FLG radiative transfer model can be adapted and used to evaluate the radiative impact of aerosol and clouds along the observed vertical column if lidar extinction atmospheric profiles are used as input into the model. The main objective of the analysis is to assess how much those anthropogenic effects impact the atmospheric column thermodynamics that in turn is linked to meteorological events. The analysis was carried out for different seasons to detect any related cycle. The results obtained with the RTM have been also validated using surface based solar irradiance measurements. Comparison with the LW and SW fluxes provided by ERA5 reanalysis will be used to test the capability of the reanalysis to properly quantify the impact of the aerosol emissions on the radiative budget. The presented analysis may be considered as a pilot study to extend at other lidar regions in the Mediterranean basin in the frame of MPLNET and ACTRIS programs and close to megacities.