



The summertime free tropospheric ozone pool over Eastern Mediterranean/Middle East

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Observational studies show that the Mediterranean troposphere exhibits a marked enhancement in summertime ozone with a maximum over the eastern Mediterranean. This has been linked to enhanced ozone photochemical production and subsidence under cloud-free anticyclonic conditions. The eastern Mediterranean region exhibits among the highest levels of background tropospheric ozone around the globe and it can be considered as a global air pollution hotspot. A 30-year climatological analysis (1979-2009) of free tropospheric ozone was carried out over the region based on ECMWF (European Centre for Medium-Range Weather Forecasts) ERA-interim reanalysis data. A characteristic summertime pool with high ozone concentrations is found in the middle troposphere over the Eastern Mediterranean/Middle East (EMME) by ERA-interim ozone data, which is supported by Tropospheric Emission Spectrometer (TES) satellite ozone data and simulations with EMAC (ECHAM5-MESSy for Atmospheric Chemistry) atmospheric chemistry climate model. EMAC is nudged towards the ECMWF analysis data and includes a stratospheric ozone tracer. The enhanced ozone over the EMME is a robust feature, propagating down to lower free tropospheric levels. The investigation of the ozone links with potential vorticity and water vapour mixing ratios indicates that the dominant mechanism for the free tropospheric ozone pool is the downward transport from the upper troposphere and lower stratosphere associated with the enhanced subsidence that dominates the summertime EMME circulation. The EMAC simulations support the important contribution of stratospheric ozone reservoir to the aforementioned ozone pool. The implications of these summertime high free tropospheric ozone values on the seasonal cycle of near surface ozone over the Mediterranean are discussed.