Geophysical Research Abstracts
Vol. 20, EGU2018-2166, 2018
EGU General Assembly 2018
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The 2003 meteorological drought over the Mediterranean region and the associated moisture transport: A Lagrangian analysis

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The aim of this study is to analyse the anomalies in the moisture transport during the meteorological drought episode occurred over the Mediterranean region (MED) in 2003 through a Lagrangian methodology. The episode May - August 2003 was the most severe in the period 1980-2015 according to the one-month Standardized Precipitation Evapotranspiration Index (SPEI-1) analysis. The SPEI-1 was calculated using monthly CRU TS3.24.01 precipitation (PRE) and potential evapotranspiration (PET). The MED region was defined according to the 5th Intergovernmental Panel on Climate Change (IPCC) Assessment Report. The Lagrangian approach is based on the outputs of the FLEXPART dispersion model integrated with data from the ERA-Interim reanalysis at 1° horizontal resolution and 60 vertical levels. The anomalous patterns over the MED during the episode were characterized through PRE, PET, omega at 500hPa, and vertically integrated moisture flux. Analyses of evaporation over the major climatological moisture sources for the MED (OAFLUX and GLEAM data for oceanic and terrestrial areas), as well as of the moisture uptake over these sources and of the moisture supply from these sources towards the MED were also conducted. Results show that anomalous subsidence, increased PET, and reduced PRE predominated over the region during the episode. The most intensive reduction in the moisture supply for the MED was registered from the Mediterranean Sea source. From September 2003 onwards, the weakening of the anomalous subsidence and of the positive anomalies of PET were associated with an increasing of PRE and a higher moisture supply mainly from MED.