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Extreme precipitation events in the eastern Mediterranean and their relation to dynamical forcing factors under recent and anthropogenic climate conditions

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Extreme precipitation events in the eastern Mediterranean are often linked to so called "Red-Sea-Trough" (RST) situations in combination with a mid-tropospheric, mid-latitude trough approaching from the Mediterranean Sea to the cost of the Middle-East region. E.g. about 40% of the extreme flash floods in the Negev Desert (southern Israel) and surrounding deserts are caused by these specific meteorological conditions.

In this study RST situations accompanied with extreme rainfall based on data from 6 Israely stations and ECMWF-reanalysis (ERA40) are investigated. Special focus is laid on the assessment of the statistics and dynamics envolved in the development of these extreme events, thus different parameter and atmospheric conditions favourable for extreme precipitation events are analysed. By means of a multiple linear regression the location of the RST itself, the deepness of the trough in 500hPa, and the steepness of the RST are identified as the dominant factors responsible for the development of extreme precipitations.

In order to estimate potential, anthropogenic future climate change signals, simulations with the AOGCM ECHAM5-OM1 following the IPCC SRES A1B and A2 scenarios are investigated. The model simulations for the actual climate period are validated against ERA40. Under climate change conditions an increased potential for the occurrence of RST situations itself is identified, mainly in December and January, accompanied by a significant incease in the number of troughs in 500hPa, which exist simultaneously. Parallel, a significant weakening of these troughs in 500hPa may occure, mainly in Nov. and Dec., whereas in January a slight deepening is seen. Additionally, a significant decreased moisture flux convergence over the eastern Mediterranean and the Middle-East has to be noted. Thus, although a decreasing potential for RST induced extreme events are mainly identified in the months November and December, the risk of extreme events increases in January, leading to a potential shift in the seasonality of the occurrence of extreme precipitation events in consequence of combined RST and Trough-500hPa conditions.