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Extreme Precipitation Events in the Middle East: Climatology of the Active Red Sea Trough

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Extreme precipitation events in the Middle East can cause flash floods with serious societal impacts. For example, in Egypt in November 1994, and in Jeddah (Saudi Arabia) in November 2009, flash floods caused approximately 600 and 120 casualties, respectively. The meteorological phenomenon that was involved with these events is the Active Red Sea Trough (ARST), a tropical-extratropical interaction. Other phenomena that can cause extreme rainfall in the Middle East are Mediterranean cyclones, Sharav cyclones, and tropical plumes.

Recently, a comprehensive description of the synoptic dynamics of ARST events has been presented (De Vries et al., 2013, under revision). This description includes the intrusion of a midlatitude upper-level trough into the subtropics along with Rossby wave breaking, the northward extension of a low-level trough from the tropics (i.e. the Red Sea Trough), and an intensified subtropical jet stream. The study reveals that the involved moisture originates predominantly from the Arabian and Red Seas, while the moisture transport is driven by an intensified subtropical anticyclone at low- to midlevels over the Arabian Peninsula. Also, it is shown that ARSTs affect not only the Levant, as previously assumed, but a much larger part of the Middle East, including the Jeddah region.

Based on ERA-Interim reanalysis and observed precipitation data, we identify ARST events that occurred in the Levant and the Jeddah region during the period 1979-2012. We perform a quantitative analysis that addresses the ARST seasonality, trends, and (interannual) variability. The ultimate objective is to investigate the influence of large-scale circulation patterns on ARST occurrences and how these might be influenced by climate change.

References

De Vries A. J., E. Tyrlis, D. Edry, S.O. Krichak, B. Steil, and J. Lelieveld (2013), “Extreme Precipitation Events in the Middle East: Dynamics of the Active Red Sea Trough”, J. Geophys. Res., under revision.