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Capturing flood-to-drought transitions in regional climate model simulations

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In previous studies atmospheric cyclones have been investigated in terms of related precipitation extremes in Central Europe. Mediterranean (Vb-like) cyclones are of special relevance as they are frequently related to high atmospheric moisture fluxes leading to floods and landslides in the Alpine region. Another focus in this area is on droughts, affecting soil moisture and surface and sub-surface runoff as well. Such events develop differently depending on available pre-saturation of water in the soil.

In a first step we investigated two time periods which encompass a
flood event and a subsequent drought on very different time scales, one long lasting transition (2002/2003) and a rather short one between May and August 2013. In a second step we extended the investigation to the long time period 1950-2016. We focused on high spatial and temporal scales and assessed the currently achievable accuracy in the simulation of the Vb-events on one hand and following drought events on the other hand.

The state-of-the-art regional climate model CCLM is applied in hindcast-mode simulating the single events described above, but also the time from 1948 to 2016 to evaluate the results from the short runs to be valid for the long time period. Besides the conventional forcing of the regional climate model at its lateral boundaries, a spectral nudging technique is applied. The simulations covering the European domain have been varied systematically
different model parameters. The resulting precipitation amounts have been compared to E-OBS gridded European precipitation data set and a recent high spatially resolved precipitation data set for Austria (GPARD-6). For the drought events the Standardized Precipitation Evapotranspiration Index (SPEI), soil moisture and runoff has been investigated.

Varying the spectral nudging setup helps us to understand the 3D-processes during these events, but also to identify model deficiencies. To improve the simulation of such events in the past, improves also the ability to assess a climate change signal in the recent and far future.