Recurrent Rossby wave packets and persistent extreme weather

S. Mubashshir Ali\textsuperscript{1}, Olivia Martius\textsuperscript{1,2}, and Matthias Röthlisberger\textsuperscript{3}

\textsuperscript{1}Oeschger Centre for Climate Change Research and Institute of Geography, University of Bern, Bern, Switzerland (mubashshir.ali@giub.unibe.ch)
\textsuperscript{2}Mobiliar Lab for Natural Risks, University of Bern, Bern, Switzerland
\textsuperscript{3}Institute for Atmospheric and Climate Science, ETH Zürich, Zürich, Switzerland

Upper-level synoptic-scale Rossby wave packets are well-known to affect surface weather. When these Rossby wave packets occur repeatedly in the same phase at a specific location, they can result in persistent hot, cold, dry, and wet conditions. The repeated and in-phase occurrence of Rossby wave packets is termed as recurrent synoptic-scale Rossby wave packets (RRWPs). RRWPs result from multiple transient synoptic-scale wave packets amplifying in the same geographical region over several weeks.

Our climatological analyses using reanalysis data have shown that RRWPs can significantly modulate the persistence of hot, cold, dry, and wet spells in several regions in the Northern and the Southern Hemispheres. RRWPs can both shorten or extend hot, cold, and dry spell durations. The spatial patterns of statistically significant links between RRWPs and spell durations are distinct for the type of the spell (hot, cold, dry, or wet) and the season (MJJASO or NDJFMA). In the Northern Hemisphere, the spatial patterns where RRWPs either extend or shorten the spell durations are wave-like. In the Southern Hemisphere, the spatial patterns are either wave-like (hot and cold spells) or latitudinally banded (dry and wet spells).

Furthermore, we explore the atmospheric drivers behind RRWP events. This includes both the background flow and potential wave-triggers such as the Madden Julian Oscillation or blocking. For 100 events of intense Rossby wave recurrence in the Atlantic, the background flow, the intensity of tropical convection, and the occurrence of blocking are studied using flow composites.