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Recurrent synoptic-scale Rossby wave patterns and their effect on the persistence of cold and hot spells

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Abstract

The persistence of surface weather during several recent high-impact weather events has been pivotal in generating their societal impact. In the study that I will present during this talk we examined Hovmöller diagrams of the 250hPa meridional wind during several periods with particularly persistent surface weather and found a common pattern in these Hovmöller diagrams. This pattern can be characterized as a „recurrent Rossby wave pattern“ (RRWP), arising from multiple transient synoptic-scale wave packets, each amplifying in the same geographical region and then covering several wavelengths in the same phase.

I will discuss the synoptic evolution of two such RRWP periods, in February-March 1987 and July-August 1994, and illustrate how the recurrence of the transient wave packets led to unusually long-lasting cold and hot spells, which occurred simultaneously in several regions, each separated by roughly one synoptic wavelength. Furthermore, a simple index to identify RRWPs termed R will be proposed, which is based on both a time and wavenumber filter applied to conventional Hovmöller diagrams. A Weibull regression analysis then shows that large values of R are statistically significantly linked to increased durations of winter cold and summer hot spells in large areas of the Northern Hemisphere mid-latitudes. Traditionally, persistent high-impact surface weather has often been linked to the occurrence of proximate atmospheric blocking. In contrast to blocking, RRWPs affect persistent surface temperature anomalies over multiple synoptic wavelengths. We therefore argue that, in addition to blocking, RRWPs should be considered as an important flow feature leading to persistent high-impact surface weather.