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The Central European floods in June 2013: the role of "preconditioning" and warm conveyor belts

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In June 2013 Central Europe was hit by a century flood affecting the Danube and Elbe catchments after a 4-day period of heavy precipitation and causing severe human and economic loss. In this study model analysis and observational data are investigated to reveal the key atmospheric processes that caused the heavy precipitation event. The period preceding the flood was characterised by a weather regime associated with cool and unusual wet conditions resulting from repeated Rossby wave breaking (RWB) in Europe at the downstream side of an Atlantic blocking ridge and the upstream side of a Scandinavian blocking ridge. The RWB events lead to unusually high accumulated rainfall amounts in many parts of Europe in the two weeks prior to the event. During the event a single RWB established a reversed baroclinicity in the low to mid troposphere in Central Europe with cool air trapped over the Alps and warmer air to the North. The upper-level cut-off resulting from the RWB instigated three consecutive cyclones in eastern Europe that unusually tracked westward during the days of heavy precipitation. Continuous large-scale slantwise ascent in warm conveyor belts (WCBs) associated with these cyclones is found as the key process that caused the 4-day heavy precipitation period. Fed by moisture sources from continental evapotranspiration, these WCBs unusually ascended equatorward along the southward sloping moist isentropes. Although such equatorward ascending WCBs are climatologically rare events in Europe, they have great potential for causing high impact weather.

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