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Identification of atmospheric patterns associated with severe regional drought in North-Western Europe

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Hydrological drought (defined as a deficit in river discharge) is a slowly developing natural hazard. Its development is influenced by various hydroclimatological and hydrogeological characteristics, all varying at different spatial and temporal scales. A hydrological drought becomes important when it persists for a prolonged period of time (several weeks or months) or covers a large area. Such long-lasting and extensive drought events are usually associated with persistent high pressure systems. This study investigates a range of approaches to identify and characterise the atmospheric conditions linked to the occurrence of hydrological drought in North-Western Europe. Both regional-scale weather types as well as more slowly-varying, large-scale atmospheric circulation patterns, such as the North Atlantic Oscillation (NAO), the Scandinavian Pattern (SCAN) and the Arctic Oscillation (AO) are considered. Weather types are defined according to an objective classification method for the Hess and Brezowsky Grosswetterlagen (GWL) developed by James (2007). The GWL classification system distinguishes between 29 different weather types for an area covering the whole of Europe and the North-East Atlantic. Time-series of hydrological drought characteristics are defined using the threshold level method for 59 daily discharge series from Denmark and Great Britain. The discharge series are selected to represent regional flow conditions over the last 50 years. Natural or naturalized discharge time-series from Denmark and Great Britain are chosen, including basins of varying size and catchment characteristics. Drought events are quantified in terms of their duration and deficit volume, and daily drought indices are derived. Based on the drought series, homogeneous regions within the wider study area are identified, and for each region a set of regional drought series is derived. The spatial coverage of the drought is accounted

for by considering the catchment size of the at-site series. Finally, the relations between the preceding and concurrent atmospheric patterns and regional droughts are studied. Special attention is given to the analysis of the time series of atmospheric patterns leading up to the most severe historical hydrological drought events.

References

James, P. M. (2007) An objective classification method for Hess and Brezowsky Grosswetterlagen over Europe. *Theor. Appl. Climatol.* **88**, 17–42.