



Regional hydrological droughts and weather types in north-western Europe

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This study explores associations between severe hydrological droughts and weather types to improve understanding of development and hydroclimatological controls of regional hydrological droughts in north-western Europe. Daily series (1964-2001) of a Regional Drought Area Index (RDAI) were derived from river flow records for two homogeneous regions in Denmark and four regions in Great Britain. Due to their different hydrogeological characteristics these six regions vary in hydrological response from relatively flashy (fast responding) basins in Scotland to well-buffered (slowly responding) basins in the central part of southern England underlain by major groundwater aquifers. Weather types (WT) were characterised using an objective version of the Hess-Brezowsky Grosswetterlagen (James, 2007) that defines 29 different weather types. In an ongoing comparative study, we have found the objective Grosswetterlagen well suited to identifying links between climate drivers and hydrological drought in this area of Europe. Correlation analysis of daily RDAI and potentially drought supporting WT revealed that the duration of the time over which WTs influence drought development varies systematically between the regions (30 - 180 days), according to basin hydrogeology. WTs related to the development of the five most severe drought events within each region were then identified. This analysis was based on investigating frequency anomalies of the WTs prior to, and during the onset, of the drought events. The analysis showed several WTs to be associated with individual severe droughts and the dominant WTs to differ between drought events even within the same region. Only two WTs were associated with drought in all six regions. These two WTs represent high pressure areas over the British Isles and Island respectively. In addition, all other anticyclonic WTs except for the Anticyclonic South-Easterly occurred frequently in connection with drought in four or five of the regions. Overall, this research identified that severe hydrological droughts are caused by a complex set of hydroclimatological processes that vary between regions and also between events within the same region. The overall hydrological response time of a region or basin is important to consider when relating regional scale climatic drivers such as weather types to hydrological drought. Relations between larger scale ocean and atmosphere patterns and hydrological drought in north-western Europe and the usability of WTs as a connecting link remain to be investigated.

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