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Advances in European drought research efforts and related research networks

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Drought is a complex phenomenon with wide-ranging socio-economic and environmental impacts; still drought research and operational applications like drought monitoring and forecasting, have been lagging behind the development in flood-related research. However, recently several drought research projects and networks have emerged in Europe, partly in response to the occurrence of a series of dry and hot summers in the 21st century, notable the record breaking 2003 event covering large part of central Europe. These events were a strong reminder of Europe's vulnerability to drought and neither were forecasted.

Meteorological drought is caused by regional or meso- (synoptic) scale spatial and temporal anomalies in the climatic system, which control the natural short- and long term variability in drought occurrence. However, climate forcing by synoptic scale conditions is not the only cause of drought, also various regional land-surface feedbacks through soil moisture and vegetation, concur to amplify dry weather and high summer temperatures. A deficit in the climatic water balance may affect all components of the hydrological cycle through a reduction in soil moisture, groundwater and surface water and subsequently, reduced water availability. Understanding how a climate water deficiency propagates through the hydrological system and its feedbacks to the atmosphere is crucial to develop drought mitigation and adaptation plans. Moreover, it is the basis for early warning and forecasting of hydrological drought (groundwater and surface water).

A review of drought studies from the 20th century suggests that drought in Europe has occurred more frequently in the latter part of the century, partly enhanced by higher temperatures. However, the scientific understanding of the driving forces behind large-scale droughts is incomplete and further complicated by insufficient knowledge about long-term (decadal and millennial) natural variability. Moreover, the role of the physical catchment structure (i.e. presence of stores) in drought development is still limited. Climate change projections for Europe further indicate that drought is likely to become more frequent and more severe due to warmer northern winters and a warmer and dryer Mediterranean region.

This presentation reviews current knowledge on the main climate drivers of drought in Europe, important land-surface feedback processes, drought propagation (meteorological to hydrological droughts), major historical events, spatial and temporal characteristics of drought, and methodologies for monitoring and forecasting. Recent and ongoing European drought research projects and networks are presented, focusing on their role in advancing our knowledge on drought within different research areas and hydroclimatological regions. Finally, some recommendations for further research are given, including the need for access to updated data across national boundaries. A joint interdisciplinary effort is suggested to advance our knowledge through a comprehensive assessment of recent major large-scale droughts in Europe.