Geophysical Research Abstracts
Vol. 13, EGU2011-3855-3, 2011
EGU General Assembly 2011

Retrospective drought analysis over Germany during the last 60 yrs

Luis Samaniego, Rohini Kumar, Matthias Zink, and Sabine Attinger

Helmholtz-Centre for Environmental Research - UFZ, Computational Hydrosystems, Leipzig, Germany
(luis.samaniego@ufz.de, +49 (0)341 235451971)

Droughts are among the most costly natural disasters because they impact heavily on the economy of a region as well as on its social and cultural activities. Ultimately they may also lead to unprecedented environmental disasters that contribute to a further decline of the already precarious conditions. In the past, droughts have been associated with the turning points and the decline of human societies. Droughts do not only occur in arid or semiarid regions but also in humid ones. The year 2007, for example, was the sunniest, hottest and driest in Germany in the last two centuries. In this case, it was too dry too early. As a result, the harvest was cut by half leading to enormous losses in the primary sector. Consumer prices of some agricultural products went up 26 percent. The hydro-meteorologic mechanisms originating droughts are relatively well understood. It is difficult, however to predict their occurrence. Consequently, the development of improved prediction methods is key for implementing adaptation strategies. Droughts have been classified as meteorological, agricultural, and hydrological, depending on whether they deal with shortages of water in the atmosphere, in the soil, or in the streams, respectively. To characterize these kinds of droughts, a number of indices have been proposed, for instance, the standardized precipitation (SPI), soil moisture (SSMI), and runoff (SRI) indices, which can be estimated for 1, 3, 6, and 12 month accumulation periods. The purpose of this study is to identify the major drought events in Germany since 1950 based on their severity, duration and areal extend. To achieve this goal, a 60-yr retrospective hydrological simulation of the land surface water budget over Germany was carried out with the process based distributed hydrological model mHM (Samaniego et al. 2010, WRR) forced with grided daily precipitation and temperature data at 4×4 km. Point measurement data from more than 5600 rain gauges and about 1120 meteorological stations (German Meteorological Service) were interpolated with external drift Kriging to produce highly consistent fields of meteorological variables. Land cover change was also considered during this period. Principal component analysis using these three drought indices was used to identify homogeneous climatic regions whereas canonical correlation analysis has been employed to identify extreme events and their relationship with macro-circulation patterns and other potential predictors. The high spatial and temporal resolution of the mHM simulations ensured that the drought indices take into account the short-term changes in the meteorological variables as well as the long-term effects of the climatic variations. Processes such as snow accumulation and melting as well as infiltration in partially frozen ground were also considered. These considerations alone make this study more reliable than standard approaches.