Geophysical Research Abstracts
Vol. 19, EGU2017-15398, 2017
EGU General Assembly 2017

Anticipation of drought impacts in the Ebro basin using remote sensing data

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For an effective mitigation of drought impacts, managers should be able to detect drought processes that will lead to impacts with enough anticipation to allow the necessary measures to be undertaken. Drought indicators and thresholds are commonly used to detect and classify drought conditions and trigger mitigation actions. However, the indicators and thresholds selected as triggers are only rarely connected to the specific impacts that need to be avoided.

The aim of this research is to identify global earth observation data sets that can anticipate drought impacts at basin scale and therefore be used as indicators of early stages of drought. The performance of a broad range of parameters was assessed in the Ebro basin for the period 2000-2012. These were the Standard Precipitation Index (SPI), the Normalized Difference Vegetation Index (NDVI), Evapotranspiration (ET), Soil Moisture (SM), Land Surface Temperature (LST), Gross Primary Production (GPP) and the in situ hydrologic indicators currently used in the basin. Since impact data at a suitable temporal and spatial scale was not available to be used as benchmark for the tests, a data set of drought and impact occurrence was compiled by a comprehensive review of local news records. In addition annual crop yield data was used as alternative benchmark data.

Early signs of drought impact were detected up to 6 months in advance with respect to the impacts reported in the newspaper, with SPI, NDVI and ET showing the best correlation-anticipation relationships. SM and LST offer also good anticipation, but with weaker correlations, while GPP presents moderate positive correlations only for some of the rainfed areas. Although water levels and flows from in situ stations provided better anticipation than remote sensing indicators in most of the areas, correlations were found to be weaker. The indicators show a consistent behaviour with respect to the different levels of crop yield in rainfed areas among the analysed years, with SPI, NDVI and ET providing again the stronger correlations. Overall, the results confirm global remote sensing products' ability to anticipate reported drought impacts and therefore appear as a useful source of information to support drought management decisions at basin scale.