



The role of soil moisture in monitoring drought events over Europe

Carmelo Cammalleri, Fabio Micale, and Jürgen Vogt

European Commission, Joint Research Centre (JRC), Institute for Environment and Sustainability (IES), Climate Risk Management Unit

Drought is a complex phenomenon that manifests at different spatial and temporal scales. Within the European Drought Observatory (EDO, <http://edo.jrc.ec.europa.eu>) an integrated monitoring approach is embraced, attempting at combining various sources of drought information at European level in order to provide a set of drought monitoring tools that encompasses continental, national, regional and local scales. Each tool, ranging from precipitation-based to remotely sensed greenness indicators, aims at capturing different aspect of the heterogeneous nature of drought events.

An accurate measure of the effects of drought on vegetated lands can be achieved by exploiting the capability of soil moisture to quantify plant water stress. This is commonly accomplished by either accounting for the level of the current soil moisture compared to the past history or by computing a water deficit index, based on the on the critical values of the soil water retention curve.

Under the definition that a vegetated area can be considered affected by drought condition only when the soil moisture status in the root zone is simultaneously: i) unusually dry compared to the “normal” state and ii) causing severe water stress to the vegetation, it is an obvious consequence that a soil moisture-based drought indicator should capture both features.

Here we describe a novel drought severity index. DSI, that accounts for the mutual occurrence of these two conditions by means of a weighted average of a water deficit factor and a dryness probability factor. The former quantifies the actual plant water stress level, whereas the latter verifies that the current water deficit condition is unusual for the specific site and period.

The reliability of the estimates made by DSI is evaluated by analyzing the performance during some well-known drought events that occurred over Europe between 1995 and 2012. Overall, DSI seems to correctly distinguish the main drought events recognized in the dedicated literature; according to this index, the largest events during this timespan were the ones in Central Europe in 2003 and in southern Europe in 2011/2012, while the events affecting the Iberian Peninsula in 1995 and 2005 and Eastern Europe in 2000 were among the strongest.