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# A global drought monitoring system: insights of an approach integrating remote sensing data and vulnerability to food insecurity

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Early Warning Systems (EWS) for drought are currently underdeveloped compared to those related to other natural hazards. Both forecasting and monitoring of drought events are still posing challenges to the scientific community. In fact, the multifaceted nature of drought (i.e. hydrological, meteorological, and agricultural) is source of coexistence for different ways to measure this phenomenon and its effects. Similarly, drought impacts are various and complex thus difficult to be univocally measured.
In the present study an approach for monitoring drought in near-real time and for estimating its impacts is presented. The EWS developed runs on a global extent and is mainly based on the early detection and monitoring of vegetation stress. On the one hand the monitoring of vegetation phenological parameters, whose extraction is based on the analysis of the MODIS-derived NDVI function, allows the fortnightly assessment of the vegetation productivity which could be expected at the end of the growing season. On the other hand, the Standardized Precipitation Index (SPI), calculated adapting TRMM-derived precipitation data in a selected distribution is used, before the growing season start, in order to early detect meteorological conditions which could give rise to vegetation stress events. During the growing season the SPI is used as check information for vegetation conditions. The relationships between rainfall and vegetation dynamics have been statistically analyzed considering different types of vegetation, in order to identify the most suitable rainfall cumulating interval to be used for the proposed monitoring procedures in different areas.
A simplified vulnerability model, coupled with the above-mentioned hazard data, returns food security conditions, i.e. the estimated impacts over an investigated area. The model includes a set of agricultural indicators that accounts for the diversity of cultivated crops, the percentage of irrigated area and the suitability of soils. In addition the people's strategy to supply food is mapped through the use of gravity spatial choice models. This leads to the definition of hazard-specific risk zones, upon which to base the allocation of the calculated alerts.
The performances of the proposed EWS were evaluated, for a selection of national case studies, with comparable ground-truth data derived from local food security assessments. The system is deployed on a WebGIS platform for its use by the widest possible audience.