Geophysical Research Abstracts
Vol. 15, EGU2013-1109, 2013
EGU General Assembly 2013
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Use of satellite-derived soil moisture to improve drought monitoring

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From all natural disasters droughts rank first regarding the number of people affected, severity, length of event, spatial extent, loss of life and economic consequences. Drought impacts depend not only on the severity of the impact. Regional exposure and vulnerability play a crucial role that is often hard to assess. Industrialized countries, such as the United States, have measures to mitigate consequences. In contrast, developing countries often suffer from long-term impacts on people's livelihoods due to recurring events. Decreasing uncertainties in decision-making by state-of-the-art technologies seems to be the most promising approach. Several drought indices were developed during the last decades for different applications. However, there is an obvious lack of indices that consider drought creating factors and actual user requirements in data-scarce regions.

FAO SWALIM (The Somalia Water and Land Information Management Group of the UN Food and Agriculture Organization) developed the Combined Drought Index (CDI) in 2011. It originally consisted of three weighted sub-indices: rainfall and temperature (both from point measurements) and NDVI as a substitute for soil moisture. At least ten years of data are required for each sub-index to detect anomalies reliably. The CDI is calculated as a decadal or monthly product, whereas drought levels range from values >1 (no drought) to <4 (extreme drought).

In order to improve operational decision-making in the long run the CDI was revised to substitute point measurements by spatial data. Precipitation and temperature were obtained from modelled (and gauge-corrected) data as well as from satellite-derived datasets. The MODIS instrument onboard Terra provided NDVI data. Soil moisture was integrated from a merged active and passive microwave remote sensing dataset that had been created within the Climate Change Initiative (CCI) of the European Space Agency (ESA)

This study aims at illustrating the performance of a satellite-based soil moisture dataset in a user-friendly drought index. Therefore, different variations of the CDI were tested over the highly drought-prone Horn of Africa. The CDI was either fed with soil moisture (surface and profile) as a substitute for NDVI or with an equally weighted combination of NDVI and soil moisture. Future work will focus on automated calculations and improved temporal resolution.