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Drought index driven by L-band microwave soil moisture data

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Drought is considered in many areas across the globe as one of the major extreme events. Studies do not all agree on the increase of the frequency of drought events over the past 60 years [1], but they all agree that the impact of droughts has increased and the need for efficient global monitoring tools has become most than ever urgent. Droughts are monitored through drought indexes, many of which are based on precipitation (Palmer index(s), PDI...), on vegetation status (VDI) or on surface temperatures. They can also be derived from climate prediction models outputs. The GMO has selected the (SPI) Standardized Precipitation Index as the reference index for the monitoring of drought at global scale. The drawback of this index is that it is directly dependent on global precipitation products that are not accurate over global scale. On the other hand, Vegetation based indexes show the a posteriori effect of drought, since they are based on NDVI. In this study, we choose to combine the surface soil moisture from microwave sensor with climate data to access a drought index. The microwave data are considered from the SMOS (Soil Moisture and Ocean Salinity) mission at L-Band (1.4 Ghz) interferometric radiometer from ESA (European Space Agency) [2]. Global surface soil moisture maps with 3 days coverage for ascending 6AM and descending 6PM orbits SMOS have been delivered since January 2010 at a 40 km nominal resolution. We use in this study the daily L3 global soil moisture maps from CATDS (Centre Aval de Traitement des Données SMOS) [3,4]. We present a drought index computed by a double bucket hydrological model driven by operational remote sensing data and ancillary datasets. The SPI is also compared to other drought indicators like vegetation indexes and Palmer drought index. Comparison of drought index to vegetation indexes from AVHRR and MODIS over continental United States show that the drought index can be used as an early warning system for drought monitoring as the water shortage can be sensed several weeks before the vegetation dryness occures.

Keywords: SMOS, microwave, level 4, soil moisture, drought, precipitation, hydrological model, vegetation index