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Analysis of drought events in a North Africa semi-arid region, Using SPOT-VEGETATION and C band scatterometer satellite Data

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In semi-arid regions, and northern Africa in particular, the scarcity of rainfall and the occurrence of long periods of drought, represent one of the main environmental factors having a negative effect on agricultural productivity. This is the case in Central Tunisia, where the monitoring of agricultural and water resources is of prime importance. Vegetation cover and soil moisture are key parameters in this objective. Remote sensing has shown in the last decades a high potential to estimate these surface parameters.
This study is based on two satellite products: SPOT-VEGETATION NDVI data and ERS and ASCAT/METOP moisture products proposed by Vienna University of Technology (TU Wien) (Wagner et al., 1999). A validation of soil moisture products is realized over the studied site using ground measurements (Thetaprobe continuous measurements), inter-comparison with other satellite products and precipitation levels. Based on long time series of satellite products, two anomaly indices have been proposed.
In order to estimate the state of stress of the vegetation cover, an index referred to as the Vegetation Anomaly Index (VAI) is proposed from SPOT-VGT time series. A positive VAI indicates good vegetation dynamics, whereas a negative VAI indicates the presence of vegetation stress. This index is highly correlated to precipitation, and is found to have a maximum correlation with the 4-month cumulative precipitation (CP3). The VAI index can be operationally applied in order to estimate quantitatively the effect of drought on vegetation cover.
Based on SWI (Soil Water Index) products, representing root-zone soil moisture content in the first meter of the soil, we propose a simple Moisture Anomaly Index, which can provide a quantitative visualization of drought periods. This index is compared with and validated, using the SPI precipitation index. A high degree of correlation is observed between the two indices. The Moisture Anomaly Index could be a very useful tool in regions without precipitation networks. It could be also particularly complementary to precipitation indices in arid and semi-arid regions characterised with limited rainfall events and a high evaporation.