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Drought assessment by evapotranspiration mapping in Twente

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Drought is a reoccurring worldwide problem with impacts ranging from food production to infrastructure. Droughts are different from other natural hazards (floods, hurricanes, and earthquakes) because the effects can only be witnessed slowly and with a time delay. Effects of droughts are diverse, like famine and migration of people. Droughts are caused by natural causes but also by interaction between the natural events and water demand. Not only typical dry regions, like the Horn of Africa, are affected, but even semi-humid environments, like Europe. Temperature rise and precipitation deficit in the summers of 2003 and 2006 caused substantial crop losses in the agricultural sector in the Netherlands. In addition increased river water temperatures and low water levels caused cooling problems for power plants. Heat waves and prolonged absence of precipitation is expected to increase due to climate change. Therefore assessing and monitoring drought in the Netherlands is thus very important.
Various drought indices are available to assess the severity, duration and spatial extend of the drought. Some of the commonly indices used are Standardized precipitation index (SPI) and the Palmer Drought Severity Index (PDSI). However each of these indices do not take into account the actual state of the land surface in respect to the dryness. By analysing drought through actual evapotranspiration (ET) estimations from remote sensing this can be circumvented.

The severity of the droughts was quantified by ET-mapping from 2003-2010. The assessment was based on the spatial and temporal distribution of ET using the Evapotranspiration Deficit Index (ETDI) drought index. Surface energy fluxes, like ET, were estimated using WACMOS methodology. The input data consisted of remote sensing products like land surface temperature, LAI, and albedo from MODIS; and meteorological data like air-temperature, humidity and wind speed from the European Centre for Medium weather forecast (ECMWF). ETDI was then calculated using the estimated actual ET in combination with reference ET from Penman-Moneith. Investigations on temperature and precipitation anomalies, using SPI, are also included because of their contribution to the droughts. For this precipitation data from ground measurements were used to calculate the SPI for comparison with ETDI.

Preliminary results show that SEBS ET from MODIS 1km resolution and ECMWF can be used for estimating ET for Twente region. The ET maps show that evapotranspiration in all years follow a seasonal trend with higher ET during the growing season as compared to other seasons. Investigation into ET shows small spatial variability, and investigation into SPI shows large temporal variability with 2003 and 2006 being very dry years.