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Identification of groundwater dependent vegetation via remote sensing and geodata integration

Abstract

Groundwater resources are biodiversity hotspots, and provide crucial ecosystems services. Yet, groundwater dependent ecosystems (GDEs) are exposed to several anthropogenic threats, including climate change. Tackling these threats requires improving the on-the-ground identification of GDEs at the global scale. In order to identify the location of groundwater dependent vegetation (GDV) in the landscape and create a harmonized global map of GDV a novel multi-instrument and multi-scale approach was developed. The approach combines a geodata-based GDV-index as well as vegetative, hydrogeological, topographic and climatic remote sensing parameters. The mapping concept implements different criteria aiming at: 1) high vitality and wetness during dry periods (e.g., EVI, NDVI, NDWI), 2) low seasonal changes in vitality and leaf area (LAI), 3) low interannual changes in vitality, 4) high topographic potential of water accumulation and low water table depth and 5) high potential inflow dependency. Processing of different remote sensing data (e.g., Sentinel 1;2, MODIS) is performed using the Google Earth Engine. Botanical mapping as well as integration of several geodata is used for validation and calibration of derived GDV-likelihoods. Furthermore, the integration of vegetation plots from sPlot, the global vegetation database introduces a novel methodology to validate GDV locations derived from remote sensing. After successfully testing the mapping approach at local scale in the Mediterranean biome, a two-step upscaling methodology is currently designed to implement the concept on regional (county) and global (biome) scale.