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# Application of TREX script for vegetation monitoring in a Oasis Environment using Remote sensed data from ProbaV

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Oases are part of the natural wealth and heritage of Morocco and contribute to the social, economic and touristic development. Morocco has lost more than 2/3 of its oases during the past century creating a huge demand for the implementation of sustainable management practises to preserve the last green areas in the desert. Palm trees are strongly dependent on irrigation or availability of surface water as soon as the water depth falls below the root zone of 9m. Improving management and monitoring of oases ecosystems is strongly encouraged by UNESCO Biosphere Reserve and RAMSAR guidelines.
Oasis are not a big consumer of water but they use groundwater using their roots, so if the piezometric level decrease, the palms are obliged to grow up their roots deeper in order to reach the ground water level. Once the water depth is below 9m, the palm trees rely on the use of surface water (rivers or irrigation) for survival.
The Boudenib and Tafilalet oases are among of the biggest palm groves located in the south-eastern part of Morocco. Those oases belong to catchments of the rivers Guir and Ziz respectively and suffer from a continuous degradation due to a to succession of drought periods, climate change and overexploitation of groundwater resources.
The last few decades of progress in the field of remote sensing created a database of numerous satellite images, that could be used for identifying areas of vegetation degradation. The commonly used Normalised Differential Vegetation Index (NDVI) derived from optical images provides a good estimation of changes in vegetation cover over time.
NDVI images of various spatial resolution (100m, 300m and 1km) obtained with the Belgian, highly frequently revisiting satellite ProbaV and available since 2014, can be successfully used for deriving timeseries of vegetation dynamics, TREX – Tool for Raster data EXploration is a Python-GDAL processing tool of ProbaV NDVI images for analysing vegetation dynamics, developed at the Vrije Universiteit Brussel and available online.
TREX has various applications, but the main functionality is to provide an automating processing of ProbaV satellite images into time series of NDVI and LAI, used in vegetation monitoring of user defined points of interest. This study presents the results of application of TREX in the arid ecosystems of the Tafilalet and Boudenib oases for the period of 2014-2018.

The resulting NDVI and LAI time series are also compared to time series of groundwater depth and dates quantity and quality. Low LAI is observed when water depth is low, and the palm trees lose their greenery. Low LAI is also correlated to low quantity and quality of dates in October 2015 and October 2017. ProbaV images can hence be used for monitoring the health of palm trees in Oases environments.
These results have important implications for water management in the area. The protection of groundwater resources and maintaining the volume of water in the aquifers could save more than 50% of surface water resources.