Geophysical Research Abstracts
Vol. 18, EGU2016-13347-2, 2016
EGU General Assembly 2016

Cryptogamic covers control spectral vegetation indices and their seasonal variation in dryland systems

Emilio Rodriguez-Caballero (1), Tanja Knerr (2), Burkhard Büdel (2), Joachim Hill (3), and Bettina Weber (1)

(1) Max Planck Institute for Chemistry, Multiphase Chemistry department, Mainz, Germany (e.rodriguez-caballer@mpic.de), (2) University of Kaiserslautern, Plant Ecology and Systematics, Kaiserslautern, Germany, (3) University of Trier, Environmental Remote Sensing and Geoinformatics Department, Trier, Germany

Remote sensing data provide spatially continuous information on vegetation dynamics by means of long-term series of vegetation indices (VI). However, most of these indices show problematic results in drylands, as a consequence of the scarce vegetation cover and the strong effect of the open space between plants. Open soil between plants as well as rock surfaces in dryland ecosystems are often covered by complex communities of cyanobacteria, algae, lichens and mosses. These cryptogamic covers show a faster phenological response to water pulses than vascular vegetation, turning green almost immediately after the first rain following a dry period and modifying their spectral response. However, only few studies quantified the effects of cryptogamic covers on VI, and none of them considered them in the analysis of temporal series of satellite images, where differences in physiology and reflectance between cryptogamic covers and vascular vegetation interact. For this reason, we quantified how cryptogamic covers modify the Normalized Difference Vegetation Index (NDVI) and the Enhanced Vegetation Index (EVI), based on field and lab spectral measurements. For two different biocrust-dominated ecosystems within the South African Karoo, we analyzed the effect of biocrusts on spectrally analyzed vegetation dynamics using multi-temporal series of VI obtained from LANDSAT and MODIS images .

Cryptogamic covers exerted a considerable effect on both NDVI and EVI calculated from field and lab spectra. As previously described for vegetation, also increasing cryptogam cover caused an increase of both VI values, and this effect also became apparent at LANDSAT image scale. However, the response of VI extracted from LANDSAT images upon environmental factors differed between pixels dominated by cryptogams and vascular vegetation. Whereas vegetation showed the highest changes in VI values in response to water availability and temperature, cryptogamic covers, which are the main surface components at the study sites, controlled the mean response of both study areas. When the individual response of cryptogamic covers and vascular vegetation (obtained from LANDSAT images; spatial resolution: 30 m) were compared with temporal series of MODIS images (spatial resolution: 250 m), where different surface components interact in one pixel, strong similarities were observed between cryptogam dominated areas and the mean response of the study area obtained from the MODIS images. This illustrates the impact of cryptogamic covers on the spectral response of dryland surfaces, emphasizing the necessity to consider their presence in multi-temporal studies aimed at analyzing dryland water status, phenology, productivity, and energy budgets.