

Biogenic Soil Crust Affecting Satellite Spectral Response

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Abstract

For the last 20 years, a large number of scientific and technical efforts have been conducted in studying the vegetation patterns and dynamics in the desert transition zone, especially in North Africa. This study suggests a new interpretation for the vegetation remote sensing signal in arid and semi-arid zones.

The study is dealing with the effect of biogenic soil crust, which consist of mosses, lichens, algae and cyanobacteria, on satellite spectral reflectance. It was found that:

- Under arid and semi-arid conditions where natural higher vegetation is sparse and covers less than 30% of the surface, the photosynthetic signal in the satellite image is caused mainly by non-vascular plants;

- A slight photosynthetic signal exists when the microphytic crusts are dry but a notable signal occurs when they are wet. When wet, the NDVI value can rise up to 30%, although no photosynthetic activity of higher plants is observed;

- Although the new vegetation indices, such as SAVI and MVI, are supposed to overcome NDVI's limitations, and especially the soil brightness background effect, it was found that all the vegetation indices will be affected similarly by the microphytic crust;

- The microphytes are active mainly after rain and flood events. They are observed at the beginning of the rainy season when the annuals are still dry and the perennials have not yet budded. Furthermore, they are also active in the dry seasons after dew nights. Consequently, microphytes activity can affect the interpretation of the VIs during both wet and dry season.

- The current cloud screening procedures may lead to a misinterpretation of the NDVI since they are based on the highest NDVI value during the entire compositing period;

- The higher spectral signal from microphytes crusts occurs across the desert transition zone. In more humid regions the microphytes are masked by the spectral signal of higher plants and, in more arid regions, the surface is mainly covered by inorganic desert varnish such as patina and;

- The NDVI desert artifacts which have been observed in different parts of the Sahara can be explained by microphytes photosynthetic activities.