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The following title was submitted:

USE OF A SPECTRAL LIBRARY AND OF MIVIS DATA TO THE DEFINITION AND MAPPING OF A SPECTRAL SOIL DEGRADATION INDICATOR IN AN AGRICULTURAL AREA OF THE SOUTHERN APPENINES (ITALY)

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Abstract (497 words):

It is widely agreed that accelerated water erosion is one of the most important sources of soil degradation, which together with the destruction of vegetation cover and structure, contributes to the potential increase of land degradation in Mediterranean Europe.

In this context the paper describes an experiment, performed in the Fortore beneventano mountain community (Italy), to test and enhance methods for mapping soil conditions from spectroradiometric ground measurements and hyperspectral images. This required as a prerequisite the validation of MIVIS data characteristics and the correction of atmospheric and illumination effects resulting into the conversion of radiances to relative reflectance values. After radiometric rectification of the image data and the collection of a field/laboratory spectral library, principal component analysis was used to identify the relationship between soil mineral spectral absorption features and the known degradation levels of the soils in the test areas. As a result the relation of hematite versus goethite and of carbonate versus clay features appeared to be most significantly related to soil degradation.

Linear spectral mixture analysis (SMA) was then used to decompose ground measured and image soil spectra into fractions of the above mentioned spectrally distinct mineralogical components. In this context a so-called multiple endmember approach was applied, which allows to automatically select the best matching endmember combination by applying a number of criteria aiming at minimising the RMS error, the band residuals and negative fractions of endmembers.

Comparing finally spectra with high clay abundance with those showing both increased carbonate and clay fractions the major difference found is the different relationship between the clay mineral and the carbonate absorption features between 2000 and 2500 nm. This indicates that the relative abundance values are indeed directly related to varying soil mineralogy. A comparison of these abundance values with percentage values for clay and calcite contents obtained in pedological laboratory analyses showed, that the differences of percent carbonate and clay abundance fall in the same range of soil mineralogical/chemical variation as observed between degraded and not degraded field samples. The results for hematite and goethite abundance were less significant.

Against this background a soil degradation index based upon the ratio of carbonate/clay abundance was defined, where increasing values of carbonate content are positively correlated with soil degradation states as observed in the field survey. This relation could be found both in laboratory and MIVIS derived soil spectra and was applied to MIVIS imagery. Thus the potential of MIVIS is demonstrated to semi-quantitatively map soil degradation as function of soil mineralogical components such as carbonate and clay minerals in the soil surface layer. The methodology, however, has to be adapted to a wider range of lithological backgrounds and soil mineralogical conditions if it is to be applied in a wider regional framework.

In this context the use of the MIVIS thermal channels, converted to apparent relative emissivity units through a combined principal component and flat-field technique (PC-ratio-FF technique), will be tested to obtain better discrimination of soils according to the presence of non-layered primary silicates.