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An evaluation of hyperspectral vegetation indices for detecting soil salinity in sugarcane fields using EO-1 Hyperion Data

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Sugarcane is the major agricultural crops in the Khuzestan province, in the southwest of Iran. But soil salinity is a major problem affecting the sugarcane yield, and therefore, monitoring and assessment of soil salinity is necessary. This research was carried out to investigate the performance of several hyperspectral vegetation indices to assess salinity stress in sugarcane fields and to determine the suitable indicators and statistical models for detecting various soil salinity levels. For this purpose one Hyperion image was acquired on Sept 2, 2010 and soil salinity was measured in 108 points 5 to 15 days from this date. 60 Samples were used for modeling and 48 samples were used for validation. Values of the soil salinity were linked with the corresponding pixel at the satellite imagery and 16 (hyperspectral) spectral indices were calculated. Then, the potential of these indices for estimating the soil salinity were analyzed and results show that soil salinity can well be estimated by vegetation indices derived from Hyperion data. Indices that are based on the chlorophyll and water absorption bands have medium to high relationship with soil salinity, while indices that only use visible bands or combination of visible and NIR bands don't perform well. From the investigated indices the Optimized Soil-Adjusted Vegetation Index (OSAVI) has the strongest relationship (R2 = 0.69) with soil salinity, because this index minimizes the variations in reflectance characteristics of soil background.