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Comparison of Sentinel-2 and Landsat 8 OLI satellite imagery for vegetation cover and land surface moisture monitoring

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Abstract: The availability of new generation multispectral sensors of the Landsat 8 and Sentinel-2 satellite platforms provides opportunities for certain time intervals and at certain frequencies vegetation and land surface moisture monitoring. In this study, success of Landsat 8 and Sentinel-2 satellite images are evaluated for determining the vegetation cover and land surface moisture in areas where the vegetation cover is dense and less dense. Sentinel-2 satellite carries a single multi-spectral instrument (MSI), which provides 13 bands in the visible, near infra-red, and short wave infra-red part of the spectrum, at different ground resolution.

On the other hand, Landsat 8 carries two push-broom instruments: The Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS). The Operational Land Imager (OLI) measures in the visible, near-infrared and shortwave infrared portions of the spectrum. Its images have 15-meter panchromatic and 30-meter multi-spectral spatial resolutions. In our S2 data assessment, vegetation cover and land surface moisture were produced at 10 m spatial resolution by pansharpening the low resolution Sentinel 2 spectral channels with 10 m pixel size. On the other hand, in our Landsat 8 assessment, vegetation cover and land surface moisture were produced at 15 m spatial resolution by pansharpening low resolution Landsat OLI spectral channels with 15 m pixel size. In the study vegetation cover is extracted from near-infrared and red spectral bands of Landsat OLI and Sentinel 2 satellites by using Normalized Difference Vegetation Index (NDVI). High NDVI values correspond to areas that reflect more in the near-infrared spectrum. Higher reflectance in the near-infrared corresponds to denser and healthier vegetation. On the other hand, land surface moisture extracted from the near infrared and short wave infrared spectral bands of Landsat OLI and Sentinel 2 satellites by using Normalized Difference Moisture Index (NDMI). NDMI is used in combination with other vegetation indexes, which is associated with vegetation moisture. The resulted NDVI and NDMI that are extracted from Landsat 8 and Sentinel-2 are compared at randomly selected points. The results of the study reveals that, although spectral signatures similar to each other's, the spatial accuracy of Sentinel 2 derived indices is slightly higher than Landsat 8 OLI derived indices.

Keywords: Normalized difference moisture index (NDMI), Normalized difference moisture index (NDMI), Sentinel-2, Landsat 8 OLI