Construction of Submerged Aquatic Vegetation Index through Global Sensitivity Analysis of Radiative Transfer Model

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Abstract : Submerged aquatic vegetation (SAV) in wetlands can absorb nitrogen and phosphorus effectively to prevent the eutrophication of water. It is feasible to monitor the distribution of SAV through remote sensing, but for the reason of weak vegetation signals affected by water body, traditional terrestrial vegetation indices are not applicable. This paper aims at constructing SAV index to enhance the vegetation signals and distinguish SAV from water body. The methodology is as follows: (1) select the bands sensitive to the vegetation parameters based on global sensitivity analysis of SAV canopy radiative transfer model; (2) take the soil line concept as reference, analyze the distribution of SAV and water reflectance simulated by SAV canopy model and semi-analytical water model in the two-dimensional space built by different sensitive bands; (3)select the band combinations which have better separation performance between SAV and water, and use them to build the SAVI indices in the form of normalized difference vegetation index(NDVI); (4)analyze the sensitivity of indices to the water and vegetation parameters, choose the one more sensitive to vegetation parameters. It is proved that index formed of the bands with central wavelengths in 705nm and 842nm has high sensitivity to chlorophyll content in leaves while it is less affected by water constituents. The model simulation shows a general negative, little correlation of SAV index with increasing water depth. Moreover, the index enhances capabilities in separating SAV from water compared to NDVI. The SAV index is expected to have potential in parameter inversion of wetland remote sensing.

Keywords : global sensitivity analysis, radiative transfer model, submerged aquatic vegetation, vegetation indices