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Article

Optimal Exploitation of the Sentinel-2 Spectral Capabilities for Crop Leaf Area Index Mapping

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Abstract: The continuously increasing demand of accurate quantitative high quality information on land surface properties will be faced by a new generation of environmental Earth observation (EO) missions. One current example, associated with a high potential to contribute to those demands, is the multi-spectral ESA Sentinel-2 (S2) system. The present study focuses on the evaluation of spectral information content needed for crop leaf area index (LAI) mapping in view of the future sensors. Data from a field campaign were used to determine the optimal spectral sampling from available S2 bands applying inversion of a radiative transfer model (PROSAIL) with look-up table (LUT) and artificial neural network (ANN) approaches. Overall LAI estimation performance of the proposed LUT approach (LUT_{N50}) was comparable in terms of retrieval performances with a tested and approved ANN method. Employing seven- and eight-band combinations, the LUT_{N50} approach obtained LAI RMSE of 0.53 and normalized LAI RMSE of 0.12, which was comparable to the results of the ANN. However, the LUT_{N50} method showed a higher robustness and insensitivity to different band settings. Most frequently selected wavebands were located in near infrared and red edge spectral regions. In conclusion, our results emphasize the potential benefits of the Sentinel-2 mission for agricultural applications.