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Soil moisture estimation from high-resolution UASs imagery based on machine learning approaches for land cover classification

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Soil moisture (SM) is an essential variable in the earth system as it influences water, energy and, carbon fluxes between the land surface and the atmosphere. The SM spatio-temporal variability requires detailed analyses, high-definition optics and fast computing approaches for near real-time SM estimation at different spatial scales. Remote Sensing-based Unmanned Aerial Systems (UASs) represents the actual solution providing low-cost approaches to meet the requirements of spatial, spectral and temporal resolutions [1; 3; 4]. In this context, a proper land use classification is crucial in order to discriminate the behaviors of vegetation and bare soil in such high-resolution imagery. Therefore, high-resolution UASs-based imagery requires a specific images classification approach also considering the illumination conditions. In this work, the land use classification was carried out using a methodology based on a combined machine learning approaches: k-means clustering algorithm for removing shadow pixels from UASs images and, binary classifier for vegetation filtering. This approach led to identifying the bare soil on which SM estimation was computed using the Apparent Thermal Inertia (ATI) method [2]. The estimated SM values were compared with field measurements obtaining a good correlation (R^2 = 0.80). The accuracy of the results shows good reliability of the procedure and allows extending the use of UASs also in unclassified areas and ungauged basins, where the monitoring of the SM is very complex.

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