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Conference Paper · September 2013

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Wetland habitat mapping by applying advanced classification to very high spatial resolution satellite images

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Wetland mapping based on Earth Observation data has proved a challenging task for practitioners due to the complexity in their spatial structure and composition, the wide within-class spectral variability and the lack of concrete boundaries between habitat types. Furthermore, the inherent temporal water variability of these landscapes poses an obstacle for integrating field and remote sensing data, which regularly are not acquired simultaneously.

To overcome these limitations we test the applicability of the Kernel-based reclassification (KRC) algorithm on a dual-date composite image over a wetland. A composite image consisting of bands and spectral indices from two images stresses seasonal differences of the habitat under investigation in response to the changes occurring between the two image acquisitions, mainly flooding. Thus it encloses information about the phenological differences occurring and determines specific classes of interest. Indices such as the difference of the NDVI index derived from pre- and post-summer images of the same year for instance, when flooding is dissimilar, provide ad-hoc information in wetland specific studies.

In this study we employed dual-date high-spatial resolution WorldView-2 (WV-2) imagery in July and September 2011 to map Aliakmonas river delta in Northern Greece. Aliakmonas delta is a specially protected area by the Ramsar Convention and site of conservation interest of NATURA 2000 network encompassing mainly the habitats 1420 (*Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)*), 1310 (*Salicornia and other annuals colonizing mud and sand)* and 1420 (Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea 1420 fruticosi)).

The classification is applied on a combined image of bands and extracted indices of the dual-date composite imagery and more specifically individual bands with lowest correlation (i.e. Blue, Near Infrared and Red edge channels), the first principal component of each image and the NDVI difference between them. The classification is carried out with the KRC algorithm. KRC is a supervised classification scheme applied on an unsupervised classified product accounting for the spatial texture of the image by estimating the spatial arrangement and frequency of the labels within a predefined square kernel which scans the adjacent pixels. The process was implemented in the ANAX software environment (Advanced classification methods for inventorying and mapping protected areas using satellite imagery), developed at the Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing, National Observatory of Athens. The results reveal an overall accuracy of 86% and a satisfactory user's accuracy (82%, 94% and 89%) for the three main classes of the littoral zone.