Synergy between optical and radar images of the ALOS satellite for the recognition of vegetation structures in coastal wetlands

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Wetlands are among the most productive environments in the world and are characterized by exceptional biologic diversity. Despite their indisputable importance, these environments remain among the most endangered ecosystems in the world due to drainage, drying out, pollution or overexploitation of resources. The Danube Delta, a coastal wetland of the Black Sea cannot escape these dangers and, to preserve its resources, it has been declared a Biosphere Reserve (in 1993).

This paper intends to test two instruments of the Japanese ALOS satellite, operational since 2006, namely the AVNIR-2 optical instrument (Advanced Visible and Near Infrared Radiometer type 2), a radiometer conceived to map vegetation in the visible and the near infrared with a 10m resolution and, the PALSAR microwave radar (Phased Array type L-band Synthetic Aperture Radar) with a 15m resolution permitting the discrimination of the vegetation structures dominated by the *Phragmites australis* species in the Danube Delta (it has a very significant reed bed). In optics, the determination of the biophysical parameters of this vegetation blanket relies on the measurement of the sun radiation reflected in the area of the visible and the near infrared (between 0.42 µm and 0.89 µm), whereas the radar observations work in the L band (λ = 24 cm) providing additional information on the structure of the vegetation blanket in terms of roughness, moisture and biomass. The simultaneous acquisition of HH (simple) and HV (crossed) polarizations allowed us to differentiate surfaces according to their response to these diverse polarizations by establishing their polarimetric signatures.

The methodology used in optics relies on the fusion of regions and falls into the category of algorithms based on regions/object and on multi-resolution type segmentation models (good results to discriminate between mixed and aquatic vegetation). The validity and interpretation of these measurements of reflectance depend on the reliability and calibration of the sensors used. This calibration was made by means of field spectrometer acquisitions of spectral measurements over the natural sites identified on images. Other variables and indices were extracted from the microwave radar data as well as the intensity in HH and HV polarizations, and entropy that provided data on the polarimetric quality and the depolarization level of the wave at its interaction with the soil, which is very low when the vegetation density increases (excellent information on different types of exploitation of the reed – cut, burnt).