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Remote sensing of salt-marsh biodiversity

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This contribution aims at studying salt-marsh biodiversity in space and time, together with the physical factors influencing it, with applications to the Lagoon of Venice (Italy). Lagoons and estuaries are very important environments, both from an ecological and a socio-economic point of view, and require proper monitoring methods to describe their spatial complexity and high dynamism. Remote sensing observations are potentially suitable for this purpose as they allow repeatable and spatially distributed observations of many ecological and morphological parameters, provided that sufficient field ancillary data are collected.

The remote sensing data used here were acquired, both from satellite and aerial platforms, during the period 2000-2004 within the European Project TIDE (Tidal Inlets Dynamics and Environment, EVK3-CT-2001-00064). The dataset comprises several acquisitions of the CASI, MIVIS, IKONOS, QUICKBIRD and ROSIS sensors from several study salt marshes in the northern part of the Venice Lagoon. The application of several unsupervised (e.g. K-means and Isodata) and supervised (e.g. Spectral Angle Mapper and Maximum Likelihood) classification algorithms is shown to allow the accurate identification of vegetation species in these areas. In order to assess the classification results both visual and quantitative validations have been applied yielding satisfactory results. In particular, the confusion matrices computed on validation reference areas which were accurately surveyed in the field, exhibit diagonal values greater than 75% for most species, showing that less than 25% of the validation pixels were affected by commission or omission errors. A further field validation was also performed to evaluate whether actual vegetation patches were correctly captured by

remote-sensing vegetation maps, by surveying a subset of the study areas after the application of classification algorithms. On this basis we conclude that remote sensing observations provide quantitative, accurate and repeatable descriptions of salt-marsh vegetation distribution. Finally, on the basis of the most accurate classification results determined above, a diversity analysis has been performed by computing biodiversity indices. In particular, Shannon-Weaver entropy and Beta-diversity are used to characterize the temporal and spatial variability of biodiversity and its relationship with various geomorphic characteristics.