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A comparison of classification algorithms for coral reef habitat mapping in South Pacific islands.

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Abstract

During the last decade, interesting comparisons of the performances of classification of satellite and airborne data (SPOT-XS, SPOT-HRV, SPOT-Pan, Landsat TM, Landsat ETM+, Ikonos, CASI, MASTER, aerial photography) have been achieved for coral reef habitat mapping in the Caribbean and more recently in south Pacific reefs. These studies aimed to compare and discuss the respective performances of sensors having very different spatial and spectral resolutions. The Maximum Likelihood statistical classifier is mostly and sometimes only used. Accuracy results seem very dependent of the classification algorithm used with differences up to 20 percents for standard accuracy coefficients like Overall accuracy or Tau coefficient. Taking advantage of both a unique set of data and a previous inter-sensor comparison experience over South Pacific reefs, the present study aims to compare different classification algorithms and discuss their respective advantages.
We use historical SPOT-HRV data and recent acquisition from the Landsat 7/ETM+, ASTER and Ikonos satellites and the airborne MASTER (MODIS-ASTER simulator). We focus on the reef systems of Tahiti Island and extend the results to Moorea Island, two volcanic islands of French Polynesia. The visible wavebands of each sensor are classified independently after a first-order atmospheric correction. Different levels of habitat complexity are defined to map complex zones including lagoon, barrier and fringing structures. Four classifiers (Maximum Likelihood, Mahanalobis distance, Neural Network and Fuzzy logic) are used to map the study zones according to our six levels of habitat complexity. Accuracies (Overall accuracy and Tau coefficient) of classification algorithms are presented and discussed for all levels of mapping complexity and all sensors.

Key words: coral reefs, classification, Maximum likelihood, Mahanalobis distance, Neural network, Fuzzy logic