Monitoring of Aquatic Plants Proliferation

Executive Summary

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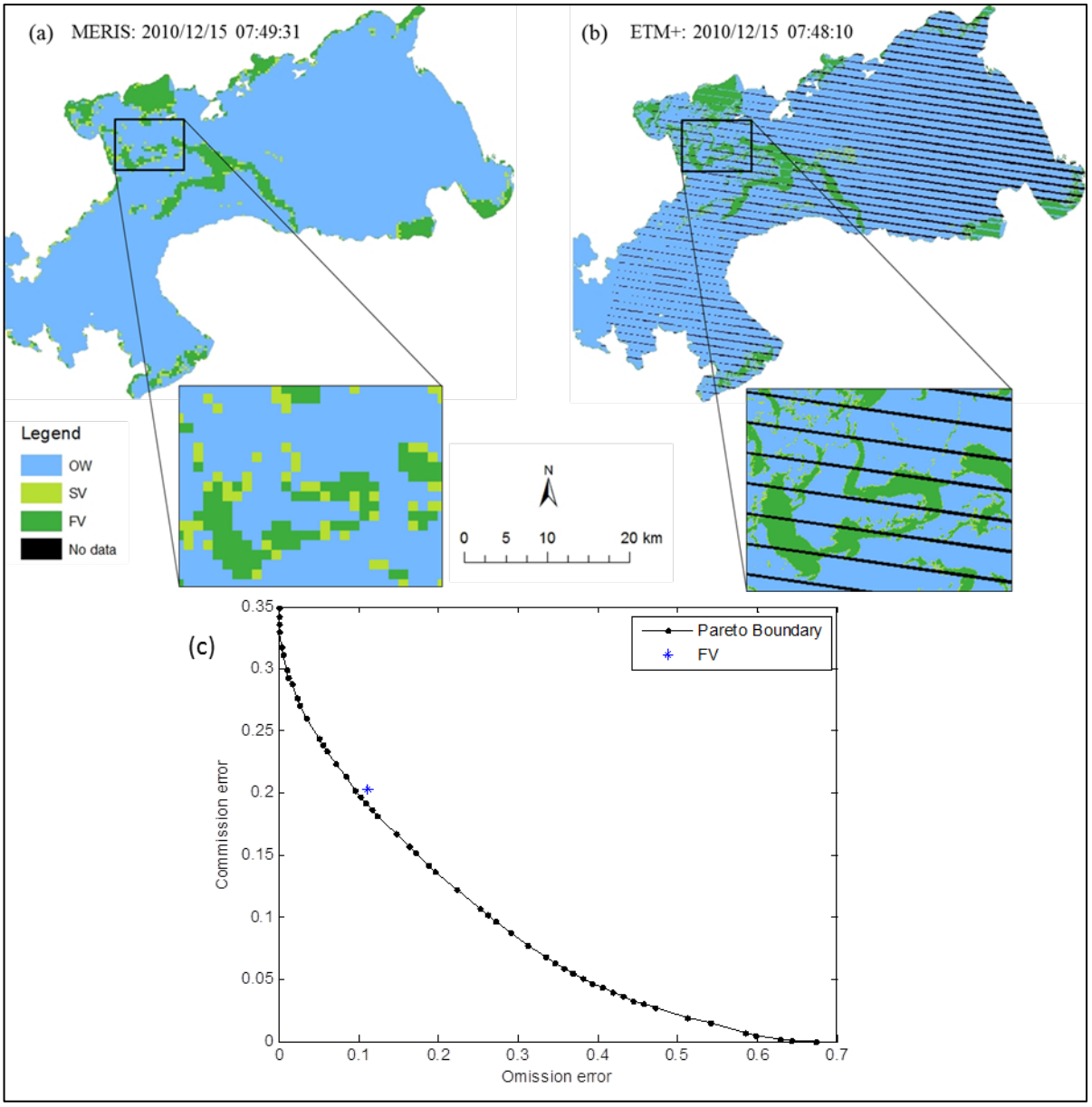
Figure 1. NDVI sliced to 3 levels: open water (OW), sparse vegetation (SV) and floating vegetation (FV), showing the distribution of vegetation as derived from **(a)** MERIS and **(b)** ETM+. The central image acquisition time is indicated for each image. **(c)** An analysis of the trade-off between commission and omission errors in the classification of FV using NDVI slicing. Pareto Boundary shows the optimal classification that can be achieved with low resolution MERIS data and reference from higher resolution ETM+. Position of the omission and commission errors in the classification of FV is shown in the error space.



Motivation:

Evaluate alternate methods to determine the extent of the area covered by aquatic plants in view of automatic analysis of a very large amount of data covering the entire lake for extended periods of time.

Methodology:

The approach involves the following steps:
1. The core observational objective of the project is to construct time series of the lake area covered by water plants. The basic observable is at-surface spectral reflectance, from which two different measures of the area covered by water plants are derived:
a. areal extent, estimated using classification techniques;
b. fractional vegetation cover in the lake;
2. With method (a) the spectral reflectance is applied as attribute to discriminate aquatic plants from other land cover types. Spectral end-members extracted from the satellite image data (MERIS FR) are used to define classes and evaluated against in-situ measurements of spectral reflectance.
3. With method (b) different methods can be applied to retrieve the fractional vegetation cover of aquatic plants. Spectral un-mixing has been applied using refined end-members in combination with observations of fractional abundance of land cover types obtained with higher resolution multi-spectral satellite images.

Results:

Please list here a brief description of the most significant results obtained during the study (max: 4 items).

- Vegetation density results obtained with 30 m resolution ETM+ data are suitable classification reference for 300 m resolution MERIS data. Due to the dynamic nature of floating aquatic vegetation, it is necessary to use for accuracy assessment an image pair acquired almost simultaneously.
- Slicing of NDVI reduces its sensitivity to vegetation density variations.
- There is a highly consistent non-linear relationship between NDVI and vegetation densities obtained with sub-pixel spectral mixture model

Publications:

E. K. Cheruiyot, C. Mito, M. Menenti, B. Gorte, R. Koenders, N. Akdim, (2014?). Assessing the accuracy of algorithms to determine the extent of aquatic plants: NDVI slicing vs. Spectral unmixing, *Submitted to Remote Sensing Special Issue*.

Highlights:

Remote sensing data with large swath and high observation frequency, such as SEVIRI (15 minutes), are useful in monitoring the highly dynamic aquatic vegetation. Such data are associated with low spectral resolution and use of spectral mixture models is not suitable. NDVI is less sensitive at high vegetation densities. Relationship between NDVI and fractional vegetation densities can be used to retrieve vegetation densities from such low resolution data, to allow frequent observation of aquatic vegetation.