SUSPENDED SOLID MATERIAL (SSM) MONITORING IN COASTAL AREAS BY SATELLITE DATA

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1. INTRODUCTION

Suspended Solid Materials (SSM) affect seawater turbidity and more generally its quality because they have a crucial role in nutrients transport and in the reduction of light penetration (Miranda et al., 2011). Thanks to the variation of water spectral signatures at grazing of SSM concentration (Fig. 1), SSM can be retrieved by different satellite sensors.

![Image of satellite data analysis](image)

2. THE STUDY AREA

The investigated area is the Sea Ionian coastal area of Basilicata Region (southern Italy). It is a typical transitional environment and has a high historical, cultural, and economic value for the region. Five rivers have their mouths in this area (from N-E to S-W): Basento, Barano, Cavone, Agri and Sinni.

![Map of study area](image)

3. METHOD AND DATA

The Robotic Satellite Techniques (RST) are a multi-temporal methodology of satellite data analysis which allows the identification of different signals anomalies, in terms of ALICE index (Eq. 1), as a statistically significant deviation from the expected value of the investigated signal for a specific condition of observation. Such an expected value is preliminarily identified by analyzing multi-year homogeneous (e.g. same area, same spectral channel) A/A month and acquisition time) series of satellite records (Fig. 3).

![Graph showing ALICE index changes](image)

The ALICE index described by eq. 2 and 3, where historical temporal minimum values have been used as reference for the uncorrelated conditions, both for the VIS and the NIE signals, allow to reduce the contribution of sea bottom to the measured reflectance (Fig. 4), especially important in presence of shallow clear waters.

River flow data

Because no direct SSM measurements were available for the study area, information about rivers water levels have been considered to discriminate SSM events of different magnitude. Three events (Fig. 3) characterized by an increase in river discharge (i.e. Basento river), which hit with a different level of intensity the Basilicata region in the past, were studied in this work.

Satellite Data

MODIS (Moderate Resolution Imaging Spectroradiometer), among the sensors currently operational at global scale, is the one with the best trade-off between spectral, spatial and temporal resolution for SSM retrieval. Being on board of Terra and Aqua satellites, it allows to acquire data per day mostly all over the world. The ones in the VNIR spectral region (VIS, 410 – 670 nm, NIR, 841 – 870 nm) is at 250 meters of spatial resolution. A total of about 2,000 NDVI/ModisQQM (Level 1B Calibrated Radiances = 250m) products (Table 1) acquired in the period 2003–2012 during the months of February and March over the investigated site have been processed.

![Table of satellite data](image)

5. RESULTS

Results achieved by implementing the proposed MODIS-RST based approach (easy exportable on whatever geographic location) for SSM identification and monitoring confirm its potential in providing a reliable and accurate description of sea water status after extreme hydrological events. In detail, the index based on VIS data (Eq 2) shows good sensitivity to the presence of SSM at different levels of concentration, while the one implemented on NIR data can be used only when high levels of SSM concentration are present.

![Graph showing VIS and NIR data](image)

5. CONCLUSIONS

Combining the potential of a robust and exportable approach for SSM classification, like the one here presented, with the high temporal capability of the EOS satellites constellation, allows for an effective monitoring of the evolution of SSM in the spatial-temporal domain.

The analysis carried out for the February 2012 event (mid intensity) clearly highlights such a capability, showing first, at the beginning of the event, a sort of time delay between the response of the northern rivers (i.e. Basento and Barano) respect in the southern ones. Afterwards, a quite fast restoring of almost normal conditions is observable on the following day. Also in this case, the NIE based index (Eq.3) were able to provide information only when high levels of SSM concentration are expected.