USE OF NEW HIGH RESOLUTION DEIMOS-1 SATELLITE IMAGERY TO STUDY
COASTAL PROCESSES IN THE GUADALquivir ESTUARY

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ABSTRACT
Estuarine environments are characterized by very complex morphodynamics and represent one of the most critical coastal regions for the exchange of sediment and nutrients. The fertilization of the continental shelf of the Gulf of Cádiz (SW Iberian Peninsula), in which the Guadalquivir and other rivers play an influential role, constitutes the major factor determining the productivity of the basin, from phytoplankton to fisheries resources as anchovy. Moreover, the input of nutrients and suspended particulate matter (TSS) from the rivers has a relevant impact on several socio-economic strategic activities (aquaculture, tourism, navigation). This work was undertaken to analyze the spatial and temporal variability of the Guadalquivir river plume and develop an approach for successfully monitoring water quality parameters as diagnostic tool in the coastal management. The incorporation of DEIMOS-1 novel satellite images of high spatial resolution (22 m) will improve our ability to map turbidity and to assess and predict the plume behavior. To achieve this goal, remote sensing images have been processed and updated against TSS in-situ measurements from several cruises to check the quality and precision of satellite data in this coastal region. The high spatial resolution of these images will allow us to study spatial features related to the dynamics of the turbidity plume in the river mouth and connect these patterns with the meteorological and oceanographic process controlling it.

STUDY AREA

Location of the Gulf of Cádiz coastal region and the Guadalquivir estuary (SW Iberian Peninsula). Right: Sampling sites for the field campaigns in the mouth of the river.

DEIMOS-1 SATELLITE

- **NEW** system based on an automatic spatial platform of small size (only 100 kg weight) with a multi-polarized optical instrument.
- **Very advanced technology** allowing to achieve the following characteristics:
  - 8 cameras in red, green and near infrared bands, equivalent to Landsat
  - **High Spatial Resolution** (22 m)
  - Wide field of view (600 km swath)
  - **High capacity for repeated imaging**
- The arrows on the sensor bands include: Band 3 (555-618 nm), Band 2 (634-698 nm), and Band 1 (755-906 nm).

IN-SITU DATA

- Data on Total Suspended Solids (TSS) collected during several oceanographic field cruises conducted last two years (2010-2011) have been analyzed.
- At each sampling site, water was collected from depths of 0 and 0.5 m below the water surface.
- Total concentrations of suspended solids were measured by filtering a 100 mL aliquot gravimetrically on pre-weighted Whatman GF/F filters after rinsing with distilled water.

VALIDATION

Scatter plot of measured TSS concentration versus DEIMOS-1 satellite images. Bottom: DEIMOS-1 reflectance data for scene 3 March, 2011.”

TSS MAPPING: SPATIAL VARIABILITY

RGB image created from DEIMOS-1 satellite images (AZTA 120 m). RGR composite from DEIMOS-1 sensor and maps of TSS concentrations at the river mouth defined by Band 3 and DEIMOS-1 radiances for scene 3 March, 2011.”

CONCLUDING REMARKS

- This study has demonstrated the potential, accuracy and effectiveness of DEIMOS-1 novel imagery to provide reliable information for the efficient management of the Guadalquivir region.
- The high resolution and the spatial coverage in combination with the sensing ability of the collects bands are attractive tools for detecting and mapping the spatial distribution of suspended solids, turbidity, plume movements and water circulation in a relatively complex system such as the Guadalquivir estuary (SW Iberian Peninsula).
- Using validated optical remote sensing observations and supporting environmental data sets, we have developed a robust satellite-derived approach improving the representation of TSS concentration across the region (Band 3, Green reflectance).
- The DEIMOS-1 satellite products will also present challenges in a wide variety of applications, particularly in coastal research, to supply useful and critical information such as frontal systems, vegetation coverage and shoreline changes.
- Future work will be focused on analyzing the role of different meteorological and oceanographic forcing factors responsible of the plume pattern to check the controlling mechanisms in order to convert this monitoring capacity into operational applications.

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