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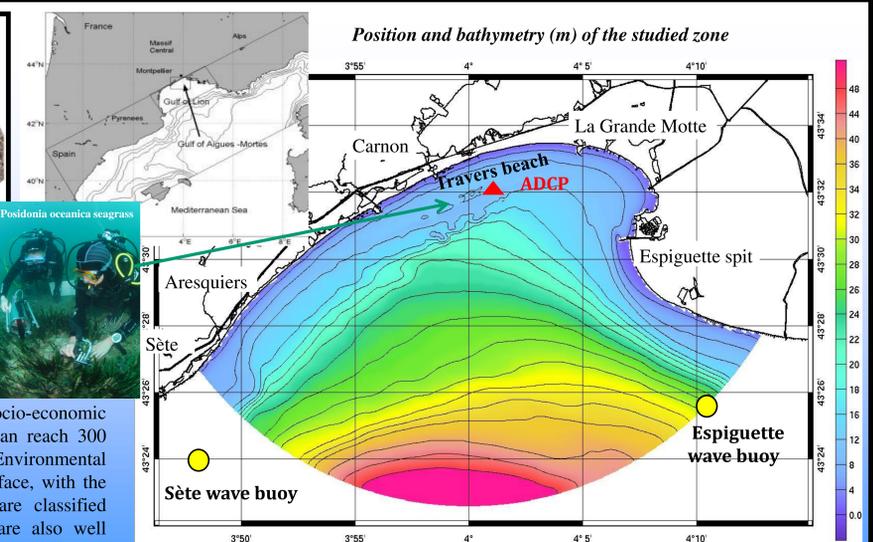
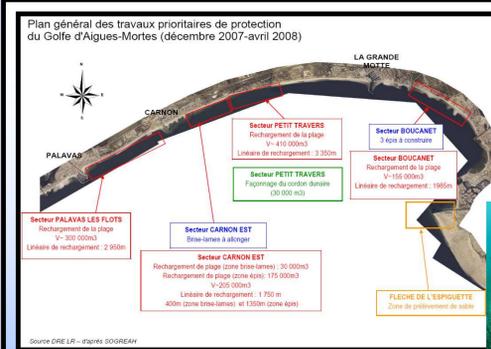
BEACH NOURISHMENT AND SEDIMENTARY PLUMES IN THE BAY OF AIGUES-MORTES (LANGUEDOC-ROUSSILLON, FRANCE). STORM IMPACTS ON SEDIMENTARY HYDRODYNAMICS.

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Abstract
In the bay of Aigues-Mortes, the managers of the coastal cities try to preserve the socio-economic and patrimonial stakes against the coastal hazards, such as contamination, storm surge and erosion. In this context, a massive beach nourishment of sand (1 million of m³ for 10km of coastline) was made at the beginning of year 2008 to reduce erosion. The REPBAM project (REchargements et Panaches sédimentaires dans la Baie d'Aigues-Mortes) aims to qualify and quantify by in-situ measurements and numerical modelling: 1. the geomorphological evolution of this modified coast and 2. the impact of the sediment's resuspension on the coastal ecosystems, in particular the one of the *Posidonia oceanica* seagrass. A numerical modelling "wave/current/sediment" is first implemented for December 2008. Nested and curvilinear grids allow a very high resolution for the beach area but also include the inner shelf where the seagrasses are located. Hydrodynamic and topo-bathymetric measurements were acquired from January to May 2012. Model and measurements results show the same trends during storms: strong currents, seaward migration of the inner bar, sediment resuspension and turbid on the inner shelf.

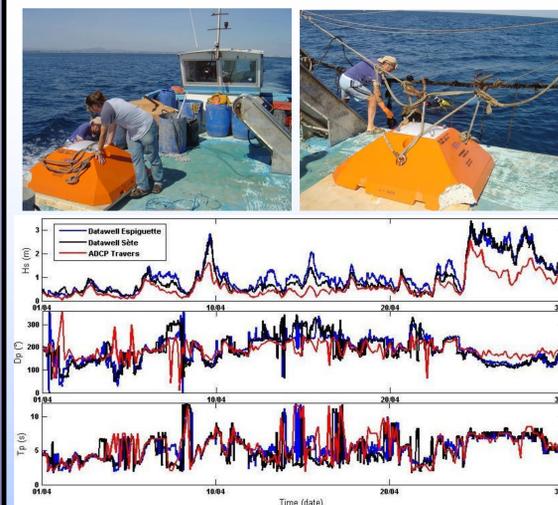


1. Context

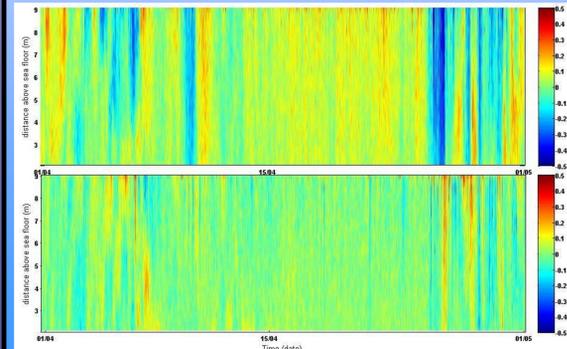
In the bay of Aigues-Mortes (NW Mediterranean sea), the socio-economic implications are strategic. Summer residents population can reach 300 000. Tourism is then the main resource of the region. Environmental issues are also very important. The lagoons and the shoreface, with the presence of vulnerable *Posidonia oceanica* seagrasses, are classified Natura 2000 (2009). Small trades including fishermen are also well represented in the area.

The concern of coastal managers is to maintain all these practices by fighting against the hazards to which they are submitted, including the hazards of contamination, erosion and flooding. To address the problem of erosion, a massive sand nourishment was carried out in early 2008. The injected volume of sand within the sediment cell was more than one million m³ on a 10km-long coastline.

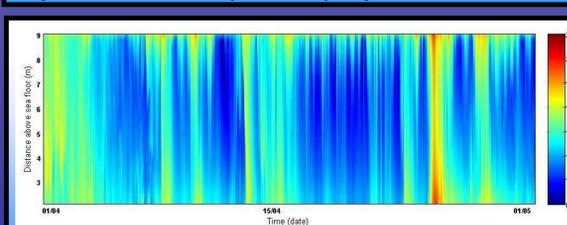
3. ADCP data



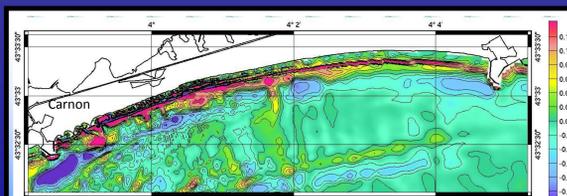
Significant wave height (m), peak direction (°) and period (s) of the wave versus time measured at buoys Datawell Sète (black), Espiguette (blue) and at the ADCP (red) for the period of April 2012.



Current components eastward (top) and northward (bottom) versus depth and time measured by the ADCP for April 2012

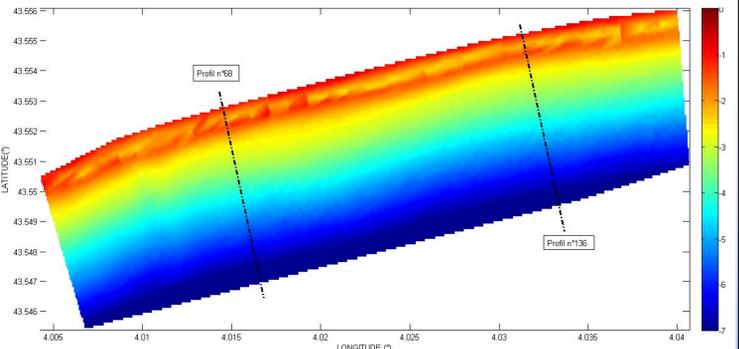


Intensity of the backscattered echo of the ADCP (count unit) versus time and depth for April 2012.

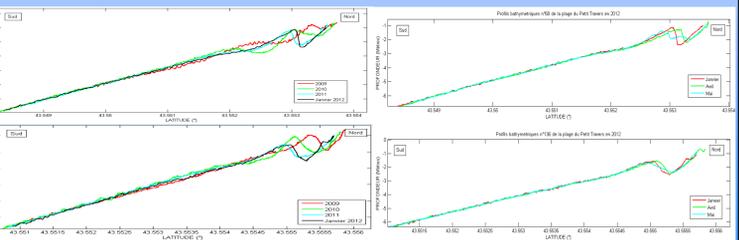


Balance of erosion (negative values) vs. deposition (positive values) (m) between December 21st 2008 and January 01st 2009

4. Bathymetric data of the Travers beach



Bathymetry from survey on January 15th 2012



Bathymetric profiles n° 68 (up) and 136 (bottom) between 2009 and 2012 (left) and between January and May 2012 (right)

5. Conclusion

For both periods, simulated for December 2008 or observed at the beginning of 2012, we note the same storm impacts on sediment transport of the nourished beach. This beach, nourished during 2008, has then largely evolved with the successive storms. The sand at the beach top tended to move seaward. Even if the total sediment stock does not seem to decrease, it is now located on sedimentary bars on the shoreface. These bars tend to be reconstructed near the coast during fine weather and to migrate seaward at each storm. Simulated and observed data clearly show this trend. The results are less conclusive for the sediment plumes. It is still difficult to separate the local resuspension in the seagrass zone and the transport from the resuspension zone in the wave breaking zone. The 2008 and 2012 storms were dry, which means without river plumes. In case of flood, these plumes can bring much more turbidity than the one from the resuspended sediment, leading to a more complex situation, with several sources of turbidity. Whatever the source is, the *Posidonia* seagrasses are however affected by these sedimentary plumes, which diminish the light intensity.

6. Perspectives

In the REPBAM project, biological measurements on the *Posidonia* seagrasses concerning their health and photosynthetic activity allowed to evaluate the adaptation of these organisms to these stresses. This subject will be developed in a future communication. The next work is to implement a numerical modelling for January to May 2012, using the same method than the one developed here: nested grids with a high resolution



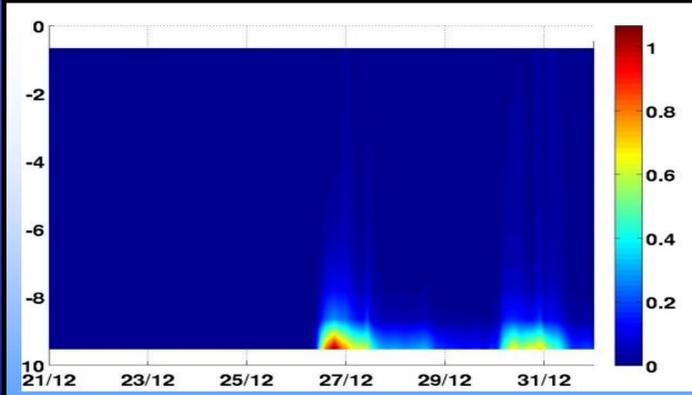
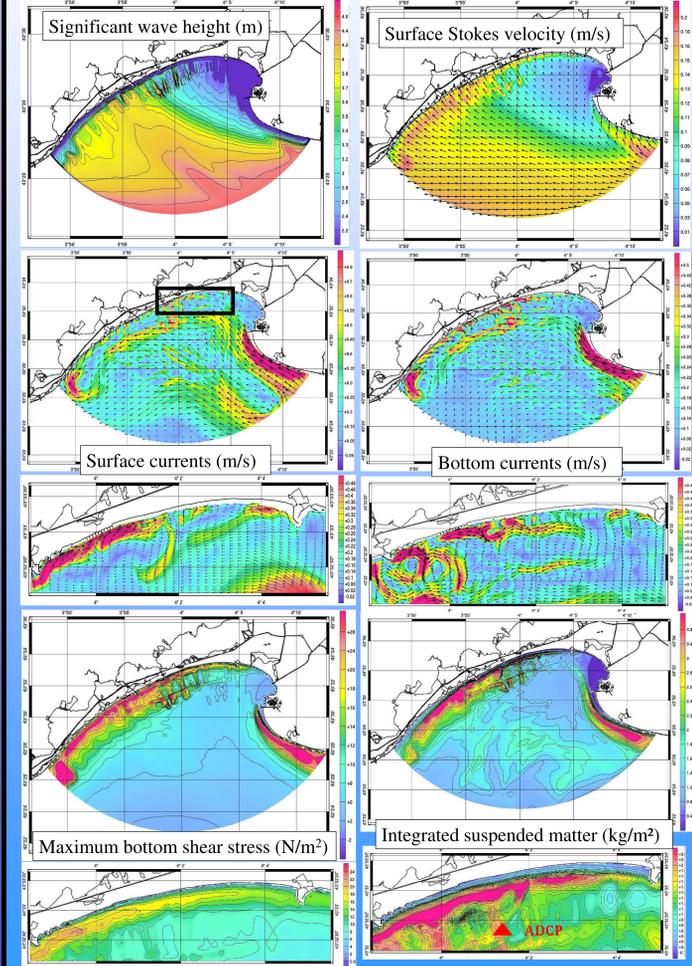
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2. Numerical simulation

The wave/current/sediment multi-scale numerical modelling (Michaud et al., 2012; Ulses et al., 2008) is based on the coastal circulation model Symphonie (Marsaleix et al., 2008) and the wave model WaveWatch3 v4 (Tolman, 2008; Arduin et al., 2010). The Symphonie model validity in the coastal domain (e.g. Leredde et al., 2007) is extended to the surf zone (Michaud et al., 2012) following Arduin et al. (2008) and Bennis et al. (2011) formulations. The Symphonie model is coupled with a sediment transport model through an advection-diffusion equation and a module of bottom boundary layer that calculates the average and maximum bottom stresses over a wave period. The sediment transport model is described in Ulses et al. (2008). We focused on the period of late December 2008. During this period, a storm characterized by a southeast long swell of 12s period and with a 3m significant wave height occurred on December 25th.

Snapshots at the apex of the storm (December 26th 2008 at 7pm)



Simulated suspended matter (kg/m³) at 10m-depth at the position of the ADCP, depending on depth and time (from December 21st 2008 to January 01st 2009)