1. Overall summary of the project

During the NESTS project I focused on the study of sediment transport toward and from the beach at the site of the Sète littoral, along the coast of Gulf of Lion, NW Mediterranean Sea. The study is based on the analysis of three observational datasets from this location.

At the time of my arrival, Dr. Bouchette was already involved in a collaboration with the University of Perpignan, during which they organised and directed a measurement campaign along the Sète littoral. The instruments were deployed on the 15th of December 2008 until the 25th of February 2009. 3 ADV, 1 S4 , 1 ADCP have been deployed on that occasion.

At first, I analysed the original dataset to observe and quantify the hydrodynamics along the beach. Several interactions with Dr. Nicolas Robin and Dr. Raphael Certain at the University of Perpignan took place to discuss about the quality control of the data, the adequate techniques to reduce the data noise and to analyse the results. Several computer codes have been created to optimise the data analysis. The matlab software has been used. The results from the Sète 2008 measurements campaign have been completed with the analysis of two others observational campaigns at the same location. Sète 1999 and Sète 2000 collected by the University of Perpignan in collaboration with Dr. Bouchette.

Secondly, I analysed the data coming from the Greece Coast along the littoral along the Thrace region in the Aegean Sea, Eastern Mediterranean. The data were available thanks to a collaboration with Dr. Sylaios at the Department of Environmental Engineering, School of Engineering, Democritus University of Thrace. The analysis of this second dataset followed the techniques developed in the first part of the NESTS project.

Thirdly, during the NESTS project I participated in the planning and the deployment of the MAGOBS observational station, at the Maguelone site, along the Languedoc-Roussillon coast (South of France, NW Mediterranean Sea). Several instruments, 15 pressiometers, 1 bottom mounted ADCP, 2 ADV, 1 horizontal ADCP, 6 ADV have been deployed in the littoral zone, and the lagoon behind the sandy beach, to be able to obtained real time measurements to monitor that stretch of coast.

2. Overall results

Hydrodynamic measurements (2.5 months of data) and bottom boundary model outputs are used to investigate the sediment transport at the beach of Sète, Gulf of Lions, NW Mediterranean Sea. N-NE and S-SE wind drive S-SE waves, which induce off-shore currents responsible for sediment resuspension and off-shore suspended sediment transport. Oppositely, the bed load transport is directed on-shore, although its magnitude is negligible compared to that of suspended transport. Thus, it is concluded that the suspended transport appears to be the most effective mechanism to displace bottom sediment. Significant suspended sediment transport occurs only during the storm periods.

During the four storms observed, the depth integrated suspended sediment transport vector is strongly variable, both in direction and magnitude. Nonetheless, the cross-shore component is constantly directed off-shore. Its largest magnitude is estimated at the sand bar crest, contributing to an off-shore migration of the inner sand bar; while it is less important at the bar trough and off-shore. The spatial gradient of the cross-shore transport component, from the shore seaward, shows that during medium energy storms, the sediment does not cross the surf-shoaling zone limit.
However, during the strongest storm, in the shoaling zone, suspended sediment transport is still different from zero and directed off-shore. This suggests that the role of the cross-shore component of suspended sediment transport is not limited to a sediment redistribution in the nearshore zone, but it appears to have an important impact on beach erosion, in agreement with recent geological surveys.

3. Potential impact

At the light of the results obtained during NESTS, the importance of reviewing the role of the cross-shore sediment transport component is clearly identified. Moreover, the project shows the importance of collecting detailed long term series of coastal hydrodynamic data to be able to observe all the processes that take place during storms. From this project it is clear that investing on long-term series of coastal data must be the priority of the local scientific community and regional administrators. Such new objective is clear to the Languedoc-Roussillon regional office of DREAL (in english: Regional branch for the Environment, Development, and Housing), which , starting from 2010, is strictly involved in the scientific activity of Géosciences Montpellier.
In particular, the DREAL office, part of the Languedoc-Roussillon regional administration, has joined the host institution with a formal collaboration, that was concretized with the funding of the acquisition and deployment of the scientific and technical equipment of the MAGOBS project.
The main objective of the MAGOBS project is to set up an experimental site along the Languedoc-Roussillon coast (south of France), where a series of hydrodynamics instruments are deployed in the nearshore region to provide real- time measurements of current, wave, suspended sediment concentration, and bottom pressure for a time period longer than 10 years. The MAGOBS long-term data set will be used to observe and investigate a large set of coastal physical oceanographic parameters:
• the seasonal, annual, decadal variability of the hydrodynamics along the coast
• the long-term evolution of the coastal morphodynamics (sand bar, coastal erosion/accretion)
• the interaction between the nearshore and the lagoon, which occurs during storms