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Impacts of a beach nourishment on hydrodynamics and morphodynamics during storms and consequences on the health of Posidonia meadows

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Coastal erosion is a complex phenomenon linked to hydrodynamics, wave and wind climate and sediment transport. In addition, this hazard will become more serious, due to the expected sea level rise and the increase of the frequency and violence of the storms. Given the growing urbanization and socio-economic issues at stake, there is a high demand for protection measures. An alternative to the construction of breakwaters and groins is the frequently used approach of beach nourishment. In the bay of Aigues-Mortes (NW of the Gulf of Lion in the Mediterranean Sea), a large amount of sand (10E6 m3) was imported on the coasts, in early 2008. The purpose of the REPBAM project is to qualify and quantify 1. the effects of beach nourishment on beach morphodynamic and 2. the impact of sediment resuspension on coastal ecosystems, and in particular on Posidonia meadows. The project, funded by FNADT/FEDER., involves the company CREOCEAN and the DREAL Languedoc-Roussillon.

The methodology is to use jointly in-situ measurements and numerical modeling. Two fixed instruments are used: one in shallow water, in an area of sediment resuspension during storms, the other in an adjacent area, where there are Posidonia meadows that may be affected by the plume of suspended sediments. During three months, these two stations collect measurements of hydrodynamics (waves, currents, temperature, and salinity), sediment (turbidity, sedimentation) and photosynthetic performance of Posidonia meadows by a PAM fluorometry. In addition, bathymetric and granulometric surveys are conducted frequently and after storm events.
The numerical circulation model Symphonie (Marsaleix et al. 2008,2009) which takes into account the wave forcing (Michaud et al, 2011) and now represents also the sediment transport thanks to the addition of the module of Ulses et al. (2008), is implemented on this coast, with a multiscale approach using nested grids. This platform is validated during winter storms by comparing its results with in-situ data. We also used this platform in prospective mode to quantify the effects of decadal and centennial storms. The first results will allow assessing the lifetime of the beach nourishment and indicating if the sedimentary turbid plumes of small coastal rivers are more influent on the health of Posidonia meadows than the suspended sediment during storms.

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