



Spatially-explicit modelling of the salt marsh wave attenuation using pressure measurements and UAV imagery.

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Among the consequences of global changes, an increase of coastal risks is widely expected. Indeed, the sea-level rise conjugated with spring tides and hazardous storms, can lead to extreme sea-levels, in worldwide coastal areas subject to unprecedented demographic exposure, thus risks.

In this context, many methods, using conventional engineering or soft management, are used or experimented to reduce the coastal risk of marine flooding, thus protecting the human stakes.

Coastal wetlands and especially salt marsh areas, can play a major role into the risk mitigation by acting as a natural buffer zone. Indeed, the various plant communities, which composed the salt marshes, have the potential to alleviate hazards by reducing the significant wave height and reducing the wave energy. Therefore, the quantification of this attenuation capability, through pressure gauges, is an essential element for the understanding of coastal territories and their dynamics. The mapping of the wave attenuation induced by the several plant communities is an efficient tool for coastal managers to take account of this natural buffer zone into urban spatial planning. However, the very high spatial resolution (VHR) quantification and mapping of this wave attenuation remains confined to numerical modellers unfortunately correlated with a poor level of stakeholders' outreach.

We propose here a simple but robust solution to quantify and map the VHR wave attenuation service offered by a coastal salt marsh using an easy-to-implement combination of in situ pressure measurements and in silico optical imagery.

The methodology, applied to a salt marsh in the western part of Mont-Saint-Michel bay (France), consists in several steps: 1) wave height and energy data acquisition using 10 pressure sensors distributed along two different cross-shore transect (approximately 15 million data for each tide cycle) at a 2 Hz frequency; 2) identification and mapping of species composition of the salt marsh, using in situ and UAV imageries through three optical bands (blue, green, red); 3) quantification of attenuation values along the two cross-shore transects using ad hoc signal processing; 4) spatially-explicit modelling of the discretely-measured attenuation values to the entire salt marsh by means of the continuously-acquired UAV optical imagery deprived of, and provided with, the digital elevation model derived from the photogrammetry of the UAV imagery, so as to integrate the attenuation of the structural complexity.