

## Master II Research internship: **Coastal waves from optical satellite using deep learning**

Keywords: Environmental Informatics, Deep Learning, Waves, Coastal area

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Location: UMR5566 LEGOS, Toulouse/France Duration: 6 months

Remuneration: 523.26€/month

Topic: Coastal regions are currently facing environmental and resource problems aggravated by population pressure and overexploitation. The environmental context or extreme events (floods, coastal erosion) combined with demographic pressure are a limiting factor for coastal development. The general objective of this internship is to improve the representation of sea state and subsequent coastal dynamics at the event scale. In practice, direct measurements (wave buoys, CANDHIS network) remain costly and difficult. On the other hand, models have been developed and implemented for both coastal circulation and wave representation but are computationally costly and subject to large uncertainties in coastal areas. The internship will investigate the possibilities to 1) derivate sea states (waves) using optical images from regular basis satellites with global coverage such as Sentinel-2 and 2) replace costly wave models to propagate from offshore deep waters to the coast (incl. extreme sea level/setup). Using deep learning would represent an efficient way to solve computationally costly wave observation and modelling in coastal zones. The training will be conducted on a synthetic dataset of more than 12000 numerical simulations of waves with random conditions and the application on Sentinel-2 images.

### References :

Perugini, E., Soldini, L., Palmsten, M.L., Calantoni, J., Brocchini, M., 2019. Linear depth inversion sensitivity to wave viewing angle using synthetic optical video, *Coastal Engineering*, 152, 2019, 103535, ISSN 0378-3839.

Bergsma, E.W.J., Almar, R. and Maisongrande, P. (2019): Radon-Augmented Sentinel-2 Satellite Imagery to Derive Wave-Patterns and Regional Bathymetry, *Remote Sensing*, vol. 11, p 1918

Required skills: training in deep learning, applied mathematics, experience in image processing geosciences would be a plus, knowledge of a programming language (C, Matlab, Python, Fortran...), knowledge of the Unix environment.

