
Master's internship proposal 2024

Fusion of satellite derived Sargassum velocity and numerical models.

This internship is proposed in the context of an international project called SARGALERT « Integrative Approach for an Operational Forecast of Sargassum Strandings » founded by the ANR (French National Research Agency).

Modeling and forecasting Sargassum strandings in the tropical Atlantic Ocean is essential for designing effective integrated risk management strategies in link with environmental, economic, health, regulatory and decision-making policies. The objectives of the SargAlert proposal are, first, to greatly enhance the performances of the detection, monitoring and prediction of Sargassum strandings from satellite observations and second, to release operational alert bulletins of Sargassum strandings dedicated to end-users. For those purposes, methodologies based on modeling approaches (radiative transfer, ocean dynamics, artificial intelligence), in-situ measurements and remote sensing data analysis will be proposed. A full data processing chain starting from satellite observations up to stranding modelling forecasts will be built.

Satellite observations suggested that errors in the velocity fields from Mercator ocean can significantly limit the forecast performance (Minghelli et al., 2021). These errors are often caused by a spatial offset of the location of mesoscale structures (eddies, jets).

The main goal of the internship is to correct the numerical model velocities based on the Sargassum observations.

The Eulerian velocity field simulated by the numerical model will be corrected using the surface velocity derived from drift estimated from satellite.

A first task will be to estimate the Sargassum drift velocity using successive satellite images for a period of one year. This drift velocity being a linear combination of the background ocean velocity and the direct and the indirect wind effect, the direct windage acting on the surface area exposed to air will be removed (Podlejski et al., 2023). Then a variational data assimilation approach that has been previously applied to drifters and numerical models will be considered (Taillandier et al., 2006).

The student will have the opportunity to work in an international consortium and to collaborate with researchers with different expertises (physical oceanography, AI, image processing, ..).

Location : MIO Toulon/Marseille, supervision Anne Molcard (molcard@univ-tln.fr) & Léo Berline (leo.berline@mio.osupytheas.fr).

Limited financial support will be provided for 4-6 months.

References :

Witold Podlejski, Léo Berline, David Nerini, Andrea Doglioli, Christophe Lett, 2023 . « A new Sargassum drift model derived from features tracking in MODIS images », Marine Pollution Bulletin.

Audrey Minghelli, Cristele Chevalier, Jacques Descloitres, Léo Berline, Philippe Blanc, and Malik Chami. 2021. « Synergy between Low Earth Orbit (LEO)—MODIS and Geostationary Earth Orbit (GEO)—GOES Sensors for Sargassum Monitoring in the Atlantic Ocean », Remote Sensing.

Vincent Taillandier, Annalisa Griffa, Anne Molcard, 2006. « A variational approach for the reconstruction of regional scale Eulerian velocity fields from Lagrangian data », Ocean Modelling.

Farnebäck, G., 2003. Two-frame motion estimation based on polynomial expansion. In: Scandinavian Conference on Image Analysis. Springer, pp. 363–370.