Current topic for a Master's Thesis

Data-Driven derivation of wave period from radar altimetry

For the past decades, the radar technology of satellite altimetry has been used for determining physical parameters of the ocean surface, among them wind-related wave heights (*sea state*).

Promising solutions are now available to retrieve the wave period based on a combination of estimated parameters, such as the backscatter coefficient, the wave height itself and its gradient along the satellite tracks.

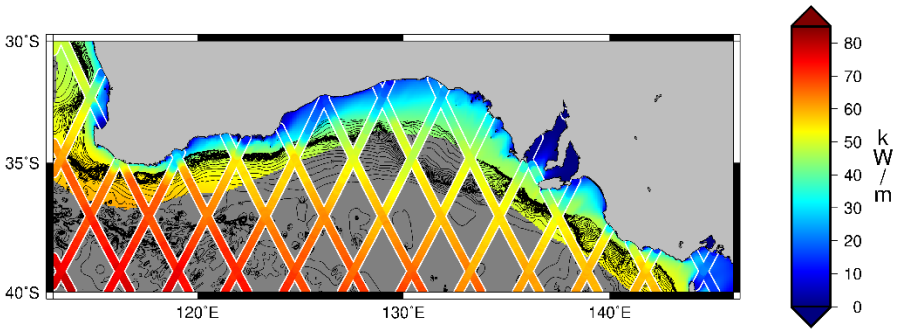

Figure: mean wave energy flux along altimetry tracks, compared to modelled results along the southern Australian coast (from Passaro et al., 2021)

While both empirical and physical algorithms have been designed, data-driven techniques have recently achieved the best performances and can be enhanced using the latest advances in terms of noise reduction of the wave height retrievals.

The objective of this Master's Thesis is the tuning of a data-driven estimation of wave period for selected missions from the latest *ESA Sea State Climate Change Initiative* and its application to estimate wave energy flux in the coastal zone.

Main tasks:

- Learn the basics of data-driven parameter estimation through Python (dataframes, datasets, scikit-learn package)
- Assemble test & train dataset using satellite altimetry, buoys and model data, to derive wave period based on other geophysical parameters (wave height and its gradient, wind speed,…)
- Find suitable predictors (e.g. Random Forest Regression, Support Vector Machines, Deep Learning) and validate the performances
- Test the impact of the wave period in computing the wave energy flux in the coastal zone

Prerequisites:

- Experience in Python programming
- Basic knowledge of satellite altimetry and/or machine learning tools is an advantage

References:

Passaro, M., Hemer, M.A., Quartly, G.D., Schwatke, C., Dettmering, D. and Seitz, F., 2021. Global coastal attenuation of wind-waves observed with radar altimetry. Nature Communications, 12(1), pp.1-13. https://doi.org/10.1038/s41467-021-23982-4

Wang, J., Aouf, L. and Badulin, S., 2021. Retrieval of wave period from altimetry: Deep learning accounting for random wave field dynamics. Remote Sensing of Environment, 265, p.112629. https://doi.org/10.1016/j.rse.2021.112629

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