Master 2 Research Internship Proposal

Sea level rise along the North Atlantic coasts since 1850

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The internship will take place at the Laboratory for Ocean Physics and Satellite remote sensing (LOPS), Brest-Plouzané, France.

Internship period
First semester 2024

Subject
The objective is to investigate sea level rise along the North Atlantic coasts (mostly U.S. and Europe), over the period 1850-2014. The candidate will analyse sea level data from in-situ observations (tide gauges) and coupled ocean-land-atmosphere climate models, from the CMIP - Coupled Model Intercomparison Project. The study will first be conducted on CNRM-CM6 climate model (Voldoire et al., 2019), and then extended to other climate models. The climate simulations will include "natural runs" (with natural forcing only) and "historical runs" (with natural and anthropogenic forcing, such as greenhouse gases and aerosols).

The candidate will tackle down the following scientific questions:

- Do climate models correctly simulate sea level rise in coastal areas?
- What are the different contributions to the regional sea level rise?
- Which part of mean sea level rise in these coastal areas can be attributed to human-induced global warming?

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The work will consist of the following steps:

1) extract long-term (> 80 years) sea level observations from GESLA-3 dataset (Global Extreme Sea Level Analysis Version 3, Haigh et al., 2022); process the sea level data to compute monthly mean sea levels,
2) compute the monthly mean sea levels since 1850 from climate models, among them CNRM-CM6 ("natural run" with 10 historical members and "historical run" with 30 historical members),
3) compare monthly mean sea levels (and their trends) from observations and climate models at tide gauges, in order to investigate if climate models correctly simulate mean sea level rise in coastal areas,
4) compare monthly mean sea levels from observations and climate models with and without greenhouse gas effects, in order to investigate which part of mean sea level rise can be attributed to human-induced global warming.

The tide gauge data and CNRM-CM6 climate model have already been downloaded, and are available on Ifremer supercomputer (Datarmor).

This work takes place in the framework of the ClimEx project (https://climex.ifremer.fr), which aims to investigate changes in extreme sea levels in a warming climate.

Skills

Good knowledge in Marine Sciences, Physical Oceanography or Geosciences.
Technical abilities in data analysis and scientific programming (Python, Matlab, NCL, CDO, NCO).
Good knowledge in Unix/Linux environments.
We are looking for a highly motivated student.

References

Haigh et al. (2022). GESLA Version 3: A major update to the global higher-frequency sea-level dataset. https://doi.org/10.1002/gdj3.174
Voldoire et al. (2019). Evaluation of CMIP6 DECK experiments with CNRM-CM6-1, Journal of Advances in Modeling Earth Systems, https://doi.org/10.1029/2019MS001683