

Assegno di ricerca/Postdoc
Dipartimento di Fisica e Astronomia, Università degli Studi di Bologna, Italia
Gruppo di Fisica dell'Atmosfera

Titolo – Development of data assimilation and machine learning for state-of-the-art rheology-based sea ice models.

Project Synopsis

In the context of the international research project SASIP (The Scale-Aware sea ice project – <https://sasip-climate.github.io/>) the new numerical model of the sea-ice, neXtSIM_DG is being developed. The model features a rheology tensor making it behave similarly to a solid and is numerically solved using a discontinuous Galerkin (DG) method. Within SASIP several activities are related to developing new data assimilation (DA) and machine learning (ML) strategies for several purposes: (1) assimilate efficiently new Arctic observations (especially from satellites); (2) develop new data-driven parametrizations; (3) using DA and ML to emulate the evolution of key sea-ice quantities.

We are looking for a Postdoctoral researcher to work in relation to the first goal. The researcher will focus on developing a data assimilation method for neXtSIM_DG. Initially she/he will investigate the applicability of the novel DA-DG method developed within SASIP (<https://arxiv.org/abs/2305.02950>) and still untested on a realistic setting. By performing the analysis in the space of the DG coefficients, the approach has shown potential to assimilate much denser data than standard methods. The postdoc will apply and study DA-DG in neXtSIM_DG for state and parameter estimation extending the work previously done within SASIP. Pending to satisfactory performance the original one-year contract will be extended for up to three more years. In this second phase the postdoc will work on the coupled version of neXtSIM_DG, coupled to ocean first and possibly to ocean and atmosphere at a later stage. In this setting she/he will explore coupled DA strategies and will work at the structuring a DA-ML setting for the full coupled model.

The postdoc will have the opportunity to work in a large international research effort, with scientists from France, Norway, UK and USA. She/he will travel to our partners facilities and will be fully immersed in a vibrant scientific environment focused to one of the most cutting-edge topics in modern science: understanding and predicting the changes occurring in the Arctic.

Essential Work plan

M1-M4: familiarize with neXtSIM_DG, runs simulation and coupling with a DA toolbox, literature review.

M5-M8: DA experiments with standard and DA-DG approach using synthetic data.

M8-M12: Critical analysis of the experiments, report writing, presentation to the entire project community.