

Intensification of tropical cyclones: impact of fine scale processes

PhD - 3 year fellowship

University of Milan Bicocca

The intensification of tropical cyclones has long been described as the evolution towards a maximum intensity that depends on the environmental conditions. Under this paradigm, in a homogeneous and stationary environment the intensity of the cyclone should monotonically increase. Recent high resolution numerical simulations question this view, as oscillating intensities have been obtained in modeling experiments. Although such idealized setting is not realistic, as tropical cyclones evolve along a trajectory that brings them in regions characterized by different sea surface temperatures, different tropospheric moisture content, and different upper level winds, the physical processes at the base of the obtained results need to be understood in order to improve the forecast of tropical cyclone intensity. This is of paramount importance considering that, despite the recent efforts, the community skill to predict the strength of a tropical cyclone is still quite low. Recent research also indicates that the intensification rate of hurricanes has been increasing over the last decades, with a positive contribution from anthropogenic forcing.

In this project idealized numerical simulations will be run using an atmospheric non hydrostatic fine resolution model, in which convective updrafts and downdrafts will be resolved. Their characteristics will be linked to larger scale conditions as well as to feedbacks within the low-pressure perturbation, including interactions with clouds and radiative effects. The role of the air-sea fluxes and of the characteristics of the marine atmospheric boundary layer will be assessed.

For the complexity of the computational approach required by the planned simulations, the PhD student will exploit and test the capacity of the new HPC infrastructure developed within the PNRR-TeRABIT project. The project will be carried at University of Milano Bicocca in the framework of the science studies in support of the ESA Earth Explorer X Mission Harmony, whose aim is the study of the fine scale characteristics at the air-sea interface with a focus on extreme weather events and will be developed with the collaboration of Prof. Caroline Muller from IST, Austria, and with OGS, Trieste

Deadline for application : Mid-July 2023

Selections : September 2023

Starting date : November 1st, 2023.

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for more informations, attaching a CV and names for reference letters.