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LES of Tropical Cyclones with Adaptive Mesh Refinement and Non-Column Based Microphysics.

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To improve our understanding of the mechanisms that drive the intensification of tropical cyclones (TCs), researchers are pushing the boundaries of simulation resolution, leaning towards scales as fine as a few meters. Increasing the model resolution and numerical accuracy are the primary means to reduce both the model error from parameterization and the error from excessive diffusion. Employing effective grid spacing of approx. 100 m and smaller allows for the explicit calculation of more dynamics, but at a possibly unbearable computational cost if we are not clever about it.
In a pursuit to alleviate the computational burden of very-high resolution large eddy simulation (LES) of TCs using high-order spectral elements, we are harnessing adaptive mesh refinement (AMR) to dynamically boost resolution where needed, guided by indicators such as potential vorticity and shear intensity, to mention only a few. In this talk we will present results obtained using the spectral element Nonhydrostatic Unified Model of the Atmosphere (NUMA) –dynamical core of NEPTUNE, developed at the U.S. Naval Research Lab (NRL)– with adaptive mesh refinement. Furthermore, in this talk we will present our most recent work on non-column based microphysics with rain and link it to the use of AMR to simulate TCs.

Primary author: TISSAOUI, Yassine (New Jersey Institute of Technology (NJIT))

Co-authors: GUIMOND, Stephen R. (Hampton University); GIRALDO, Francis X. (Naval Postgraduate School); MARRAS, Simone (New Jersey Institute of Technology (NJIT))

Presenter: MARRAS, Simone (New Jersey Institute of Technology (NJIT))

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