The TKE Budget in a Large-Eddy Simulation of a Tropical Cyclone

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Turbulence Kinetic Energy (TKE) is a commonly used measure of turbulence intensity in a wide range of scientific and engineering disciplines. It is technically defined as the kinetic energy associated with eddies (i.e., fluctuations) in a turbulent flow. In the atmospheric sciences, it has become common to base Planetary Boundary Layer (PBL) parameterizations for weather-prediction models on a predictive equation for TKE and, to reduce computing resources for real-time modeling, neglect terms from the budget that are typically small; however, these terms may not be negligible in hurricanes where horizontal gradients of winds are comparable to vertical gradients. To gain insight, my colleagues and I have been analyzing budgets of TKE in large-eddy simulations (LES) of idealized tropical cyclones. A simulation of a small but intense (Category 5) tropical cyclone with 31-m horizontal grid spacing is used for most of this talk. The analysis is focused on three regions: the inflowing boundary layer, where the TKE budget is simplest; the corner-flow region, near the surface in the eyewall, where an unexpected term plays a large role in the TKE budget; and the eyewall above the boundary layer, where the role of buoyancy has been controversial. Based on these results, recommendations are made for changes to TKE-based PBL parameterizations in weather-prediction models.

Thursday, 4 May 2023, 2:00pm

Refreshments 1:45pm
Please also join colleagues for refreshments and informal discussion after the seminar until 3:30pm

NCAR-Foothills Laboratory, 3450 Mitchell Lane
FL2-1022, Large Auditorium

Seminar will also be live webcast
https://operations.ucar.edu/live-mmm
Participants may ask questions during the seminar via Slido.