Introduction

An estimate for maximum intensity of tropical cyclones has scientific and practical values. There are three general strategies to attack this problem: (1) analytic (e.g. potential intensity theories), (2) observational (using datasets) and (3) numerical (e.g. using full 3D models and/or axisymmetric models).

The analytic approach requires knowledge of the flow to be studied and relies upon imperfect knowledge of the governing equations for the atmosphere and assumptions about the processes that occur in tropical cyclones.

When using observational datasets, statistical analysis is used to determine the maximum intensity as a function of observed environmental conditions. However, it requires a large dataset of observations to infer statistically significant characteristics of the flow.

A numerical model will generate the flow of interest given initial and boundary conditions. Both the model's numerical techniques and the governing equations have to be as accurate as possible to produce reasonable and physical solutions.

Often the greatest uncertainty comes from inappropriate or less than ideal approaches used for describing turbulence. Specification of turbulence intensity also influences the structure of simulated tropical cyclones, not just the intensity.

The differences between numerically simulated tropical cyclones and a popular theoretical upper limit can be up to 50%. Interplay between all three approaches is needed advancing our understanding.