Geophysical Research Abstracts
Vol. 20, EGU2018-16116, 2018
EGU General Assembly 2018

The role of Stochastic Physics and model resolution for the simulation of Tropical Cyclones in AGCMs

Pier-Luigi Vidale (1,3), Malcolm Roberts (2), Kevin Hodges (1,3), Paolo Davini (4), Antije Wesheimer (5), and Susanna Corti (4)

(1) University of Reading, Meteorology, Reading, United Kingdom (p.l.vidale@reading.ac.uk), (2) Met Office Hadley Centre, Met Office, Exeter UK, (3) NCAS-Climate, Reading, United Kingdom, (4) ECMWF, Reading, UK, (5) ISAC, CNR, Italy

Over the past decades, climate models have started to make use of resolutions that enable geophysical vortices with characteristics that increasingly resemble realistic tropical cyclones. For instance, a number of studies from the US CLIVAR Hurricane Working Group have demonstrated how tropical storm tracks, including their geographical distribution, variability, trends, are credibly represented by AGCMs employing 20km mesh size. The number of Tropical Cyclones in each hemisphere (and even for key basins) starts to be credibly simulated at 20km and beyond. However, the majority of the models analysed can still only simulate storms up to Category 3, while Category 4 and above are significantly or entirely underestimated.
The push for increasing resolution continues, with AGCMs starting to operate under 10km, with the aim of improving realism, but at the same time it has been suggested that the use of Stochastic Physics may act as a surrogate for high resolution, by providing a more dynamic environment for instabilities to grow.
Results from the analysis of a large ensemble of AMIP-type simulations with the ECMWF IFS (project SPHYNX) and the MO Hadley Centre HadGEM3 family of models (PRIMAVERA project) indicate that the use of Stochastic Physics at moderate to high resolution provides a 30-50% increase in the number of simulated Tropical Cyclones, which is roughly equivalent to a doubling of resolution. An investigation of the mechanisms behind this model behaviour, using a hierarchy of sensitivity studies, points to the prominent importance of the Stochastic Kinetic Energy Backscatter scheme for TC formation, but this seems to be largely model dependent, as many of the settings were previously tuned for maximising NWP performance at each centre. These results justify a push for a more systematic investigation, coordinated via the EU-Horizon 2020 PRIMAVERA project.