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Assessing Sting-Jets in Convection-Permitting Climate Simulations

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This study assesses the added-value offered by a regional convection-permitting climate model (CPM) in its representation of sting-jets (SJs); a mesoscale slanted core of strong winds within a Shapiro-Keyser type of cyclone that can lead to extremely damaging surface wind speeds close to southern side of a cyclone's centre. Low-resolution climate models cannot resolve SJs, and so estimates of risk posed by extreme winds due to SJs are difficult to determine and will likely be underestimated in coarse-resolution climate simulations.

We analyse three 10-year simulations from the UK Met Office, run at a 2.2km resolution over a European domain. The simulations include a hindcast driven by the ERA-Interim reanalysis dataset (ERA-I) for the period 2001-2010, as well as a present day (2001-2010) and future simulation (2100-2109) that follows the RCP8.5 scenario. Both climate simulations are driven by a 25km GCM. To diagnose potential SJ storms in each simulation, we firstly identify cyclone tracks with a cyclone tracking algorithm and apply an objective indicator that identifies the warm seclusion of a Shapiro-Keyser cyclone and the slanted core of strong winds of the sting-jet.

Within this presentation, we will present the objective indicator as well as results of the added value seen in the CPM. In order to identify any added value of the CPM, we analyse differences between the CPM and its respective driving data, in terms of storm severity metrics and their future projections. An example metric used is the Storm Severity Index that quantifies the overall severity of a storm. In all simulations, the conditional PDF of SSI for sting-jet storms is shifted towards higher values compared to PDF of the SSI from all storms within the studied domain. However, we see little difference in the SSI derived from the CPM and its respective driving model/reanalysis when CPM wind speeds are upscaled to the respective driving reanalysis/GCM grid. In further analysis, we will look to explore the added value at a local scale on the native CPM grid.