Sensitivity of high-resolution global model simulations of tropical cyclones to imposed forcing using a phenomenon-based cyclone tracking scheme

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A modified version of the CSIRO cyclone tracking scheme is applied to detect tropical cyclones in idealized high-resolution atmospheric climate model simulations under various combinations of external forcing. The tracking scheme is modified to remove previously imposed restrictions on the latitude of formation of simulated tropical cyclones and the minimum value of SST required for tropical cyclone formation. The rationale for this change is that these limits depend on thresholds derived only from the current climate and are of limited use for climate change experiments. They are replaced by a phenomenon-based detection method whereby both tropical and extratropical systems are detected and the tropical cyclones are selected on the basis of their formation equatorward of the simulated subtropical ridge. The results show good agreement between this new version of the detection scheme compared to previous versions, with the added advantage of a much faster code through the removal of a time-consuming warm core detection process. The analysed high-resolution model simulations generally produce a significant number of tropical cyclones per year, although with considerable variation between models. Analysis of the sensitivity experiments performed for the CLIVAR HWG for the available models suggest that there is limited agreement between the models for the tropical cyclone response to increases in carbon dioxide alone, increases in SST alone, or a combination of the two, although for the combined SST and CO2 experiment, an average of all model responses suggests a decrease in tropical cyclone numbers.