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Future changes in extratropical storm tracks in the CMIP5 models from a cyclone perspective

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Extratropical cyclones are important components of the general circulation. In this study extratropical cyclones are identified in the high frequency coupled-GCM CMIP5 multi-model ensemble using an objective feature tracking algorithm. Diagnostics focusing on the cyclone track density distributions and storm intensity distributions of vorticity, wind, MSLP and precipitation are explored to determine possible changes associated with the different representative concentration pathway (RCP) scenarios. For this, the end-of-century RCP projections (2071-2100) are contrasted with the historical experiment (1976-2005), where all experiments comprise 29 models. The cyclone diagnostics are related to the large scale aspects of the general circulation and how this may change in the future, whilst taking model biases into account.

Results indicate varying responses to the forcing according to the scenario, season, model and hemisphere. Projected changes indicate that in general there is a large decrease in the number of storms on the equatorward flanks of the storm tracks and a corresponding but much smaller increase on the poleward flanks. Also of note is the robust decrease in the Mediterranean winter storm track density. The projected changes are greater in magnitude and more consistent between models for greater forcing under the RCPs, particularly in the vicinity of the main storm tracks. Cyclone intensity changes generally show a small decrease in the number of low and medium intensity cyclones and a very small increase in the number of high intensity cyclones when looking at vorticity, wind and MSLP variables. The magnitudes of the multi-model mean track density and intensity projected responses are less than the mean biases from comparison against the ERA-Interim reanalysis.