Extra-tropical cyclones in the future: idealised aqua-planet experiments.
Victoria Sinclair
University of Helsinki, Finland
Victoria.Sinclair@helsinki.fi

Extra-tropical cyclones constitute a large part of the circulation in the mid-latitudes and are the dominant mechanism for transporting heat and moisture polewards. In addition, extra-tropical cyclones can cause strong winds, heavy rainfall and snowstorms, all of which can have a large impact on society. Therefore, it is vital to understand how the properties of extra-tropical cyclones will change in the future. However, the current generation of climate models, i.e. those that participated in CMIP5, do not provide a clear prediction of how the number of extra-tropical cyclones will change in the future nor a clear answer to how the properties of extra-tropical cyclones, for example, their precipitation patterns and associated low-level winds, will change. Furthermore, for each individual climate model, it is challenging to fully understand the simulated response of extra-tropical cyclones to climate change. This is at least partly due to the number of complex interactions present in a fully coupled climate model which makes it difficult to identify the underlying dynamical processes responsible for any changes. This study addresses this problem by performing highly idealised “climate change” experiments using a state-of-the-art atmosphere only model in an aqua-planet configuration. Multiple 20-year long simulations are conducted with OpenIFS, a version of ECMWFs Integrated Forecast System (IFS) which is freely available under license to academic institutions. Three sets of experiments are conducted in which (1) the mean sea surface temperatures are uniformly increased; (2) the mean meridional sea surface temperature gradient is decreased; and (3) the amount of CO2 is increased. In all experiments, extra-tropical cyclones are tracked using TRACK, an objective tracking algorithm, and then composites of the 200 strongest, and the 200 most typical cyclones are created. In this contribution, the results from these experiments will be discussed.