Characteristics of East Asian extratropical cyclones in CMIP5 climate models

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Extratropical cyclones (ETCs) in East Asia and their response to climate change are examined by comparison of historical and RCP8.5 simulations of CMIP5 climate models. In both simulations, East Asian ETCs are objectively detected and tracked with an automated Lagrangian tracking algorithm. This algorithm, which is applied to 850-hPa relative vorticity fields, captures most synoptic-scale cyclones.

Generally, most historical simulations reproduce spatial distribution and seasonal cycle of ETC genesis, frequency and intensity qualitatively well. However, ETC genesis in the leeside of Altai-Sayan Mountains and Tibetan Plateau is underestimated in quantity. This underestimation to lee cyclogenesis in East Asia is sensitive to model resolution. Comparing historical and RCP8.5 simulations, the frequency and intensity of ETCs are predicted to decrease in warm climate especially over the western North Pacific. This is due to weakened cyclogenesis downstream of southeastern Tibetan plateau and across Kuroshio current, likely caused by enhanced static stability and reduced sea surface gradient in warm climate. It is further found that because of vertical wind shear and static stability changes in autumn, weakening and reducing of East Asian ETCs are most evident in autumn than in any other seasons.

Key words: extratropical cyclone, CMIP5 climate models, East Asia, climate change