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Future changes of East Asian cyclones in the CMIP5 models

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Future changes of extratropical cyclones (ETCs) over East Asia are investigated using the models participating in the fifth phase of the Coupled Model Intercomparison Project (CMIP5). To quantify ETC frequency, intensity, and genesis changes in a warming climate, the objective tracking algorithm is applied to the CMIP5 models which provide 6-hourly wind data with no missing values in the high-terrain region. The historical simulations reasonably well capture the spatial distribution of ETC properties, except for noticeable biases in, and downstream of, the high-terrain regions. Such biases are particularly pronounced in the models with a coarse spatial resolution and a smooth topography which weakens lee cyclogenesis. The best five models, which show better performance for historical simulations than other models, are used to evaluate the possible changes of East Asian ETCs under the RCP8.5 scenario. These models project a reduced cyclogenesis in the leeward side of the Tibetan Plateau, and over East China Sea and western North Pacific in the late 21st century, resulting in a reduced ETC frequency from the east coast of China to the western North Pacific. The ETC intensity also shows a hint of weakening over the North Pacific. These ETC property changes are largely consistent with an enhanced static stability and a reduced vertical wind shear in a warming climate. This result indicates that the local baroclinicity, instead of increased moisture content, plays a critical role in determining the future changes of East Asian ETCs.