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Typhoon and storm surge intensity changes under the warming climate around Korean Peninsula

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This study investigates the intensity change in typhoons and storm surges surrounding the Korean Peninsula under global warming conditions as obtained from the MPI_ECHAM5 climate model using the A1B series. The authors use the Cyclostationary Empirical Orthogonal Function to estimate future background fields for typhoon simulations from twenty-first-century prediction results. A series of numerical experiments applies WRF (Weather Research and Forecasting) and POM (Prinston Ocean Model) models to simulate two historical typhoons, Maemi (2003) and Rusa (2002), and associated storm surges under real historical and future warming conditions. Applying numerical experiments to two typhoons, this study found that their central pressure dropped about 19 and 17 hPa, respectively, when considering the future sea surface temperature (a warming of 3.9 K for 100 years) over the East China Sea (Exp. 1). The associated enhancement of storm surge height ranged from 16 to 67 cm along the southern coast of the Korean Peninsula. However, when the study considered global warming conditions for other atmospheric variables such as sea-level pressure, air temperature, relative humidity, geopotential height, and wind in the typhoon simulations (Exp. 2), the intensities of the two typhoons and their associated surge heights scarcely increased compared to the results of Exp. 1. Analyzing projected atmospheric variables, the authors found that air temperatures at the top of the storm around 200 hPa increased more than those at the surface in tropical and mid-latitudes. The reduced vertical temperature difference provided an unfavorable condition in the typhoon's development even under conditions of global warming. This suggests that global warming may not always correlate with a large increase in the number of intense cyclones and/or an increase in associated storm surges.