large-scale nudging in tropical cyclone forecast

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Regional models often face a chronic problem caused by inconsistencies between simulated model fields and large-scale forcing data, which could limit predictability of regional models. Spectral nudging is a technique which can ameliorate this issue by providing large-scale forcing in the regional model interior. In this study, spectral nudging was applied to tropical cyclone (TC) track and intensity forecasts, and its effects were investigated using a high-resolution regional model. Case studies on Typhoon Neoguri and Vongfong showed that spectral nudging was effective at enhancing track forecast by improving large-scale winds and the western North Pacific subtropical high. However, simulated TC intensity was underestimated without the optimization of spectral nudging. Sensitivity tests on spectral nudging options were performed to improve TC intensity while maintaining forecast track improvements. By reducing the nudging coefficient, intensity errors were reduced with a more reasonably developed TC structure. A total of 51 experiments for 18 TCs were conducted with revised spectral nudging options to investigate the general effects of spectral nudging on TC forecasting. The track forecast was generally improved by spectral nudging, especially after 96 hr, and forecast intensity was also improved as compared to experiments without nudging. Furthermore, spectral nudging was especially effective for TCs which occurred to the east of the western North Pacific and turned near Northeast Asia. Therefore, the impact of spectral nudging can be increased by selectively applying spectral nudging based on TC characteristics.