Roles of preexisting oceanic condition and ocean coupling processes in the intensity prediction during the mature phase of Typhoon Trami (2018)

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Typhoon Trami (2018) is one of the typhoons that made landfall in Japan. According to the Regional Specialized Meteorological Center (RSMC) Tokyo best track analysis, the central pressure reached 915 hPa at 18 UTC on 24 September around 20˚N and then rapidly increased by 950 hPa in 18 hours. After the rapid increases in the central pressure, intensity forecasts announced further intensification to 935 hPa, but the typhoon could not intensify again. In order to clarify the impact of the cold eddies over the ocean on this forecast error, we conducted numerical simulations with different oceanic initial conditions (daily data from 19 to 25 September were used so that the number of ensemble members is seven) using a 2 km-mesh nonhydrostatic atmosphere model coupled with ocean surface wave and multilayer ocean models with the Japan Meteorological Agency (JMA) global objective analysis with horizontal resolution of 20 km and the JMA North Pacific Ocean analysis with horizontal resolution of 0.5˚. In addition, a sensitivity numerical experiment was conducted with the oceanic initial condition on 23 September merged with an artificial cold vortex centered at 21˚N, 129˚E of which both a mixed layer and thermocline was 50 m shallower than the control experiment. Moreover, a simulation with a 2 km-mesh nonhydrostatic atmosphere model was performed with the oceanic initial condition on 23 September. The initial time and integration period are 00 UTC on 23 September and 180 hours with the time interval of 3 seconds.

The results of simulated tracks were reasonable compared with the RSMC best track analysis, while the rapid decrease in the central pressure could not be simulated due to a large difference in central pressure at the initial time so that the simulated minimum central pressure was higher than the best track central pressure. From the analysis with the ratio of a difference to the standard deviation obtained from the ensemble experiments, the impact of different oceanic initial conditions on central pressure was different from that on the maximum wind speed particularly from 25 to 27 September when the typhoon passed near the cold eddy. The impact of ocean coupling on simulated central pressure and maximum wind speed was considerably greater than that of the artificial cold eddy and that of different oceanic initial conditions. The impact of the artificial cold eddy was a few times greater than that of different oceanic initial conditions around 26 September. The result indicates that more detailed observation and more accurate analysis regarding the cold eddy over the ocean will contribute to the improvement of typhoon intensity predictions.

Keywords: tropical cyclone, atmosphere-wave-ocean coupled model, intensity forecast, preexisting cold eddy

