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Impact of horizontal and vertical resolutions on the structure and intensity of simulated typhoons

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A set of sensitivity experiments using a numerical model is designed to examine the effect of horizontal and vertical resolutions on typhoon intensity, structure and track. Korean Integrated Model (KIM) with the state of art physics schemes is used for the sensitivity tests. In order to avoid complications, the experimental set-ups are carefully constructed. The horizontal and vertical resolutions of sensitivity experiments are exactly twice of those of the control experiment, while keeping the model bottom and top levels the same. Two real typhoons over Western Pacific basin, typhoon Soulik(2013) and typhoon Haupit(2014) are simulated for the sensitivity.
It is found that the higher horizontal and vertical resolutions result into better track prediction mainly due to better representations of large scale atmospheric flows. Regarding storm intensity, the high horizontal resolution simulation produces stronger typhoon with smaller radius of maximum wind speed as expected mainly due to the capability of resolving steep gradients with smaller grid distance. On the contrary, typhoons simulated by the experiments with more vertical levels are weaker than those with less number of vertical layers. Our analysis shows that the impacts of fine vertical resolutions are producing shallow storm with taller boundary layer height, and less sub-grid scale convective precipitation. Based on diagnostics of this study, the diffusive nature and weaker convective instability caused by fine vertical resolutions are one of the main causes of producing weak typhoon. In order to confirm the generality of this conclusion, it is planned to conduct more experiments with idealized framework and usage of a single column model.