The impact of dropsonde data on a numerical simulation of landfalling typhoon Mangkhut

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When typhoon Mangkhut entered the northeastern part of the South China Sea, nine dropsondes were released in the typhoon’s northwest quadrant at 10:00 UTC on 15 Sep 2018 and five were released in the typhoon’s northeast quadrant at 12:00 UTC on 15 Sep 2018. Based on dropsonde data taken from this experiment, preliminary analysis is done on the characteristics of atmosphere such as wind field, humidity, etc. in the northeast and northwest quadrants of Mangkhut. A feature of the wind speed profile in the northwest quadrant is revealed as a peak wind speed located between 850 hPa and 800 hPa, while a feature of the humidity is a thick moist layer (greater than 85%) starting from 400 hPa to the surface, with the exception of a relatively dry layer at around 900 hPa (less than 80%). The atmosphere above 850 hPa is neutral or stratified stable. The atmosphere in the northeast quadrant is characterized by a peak wind speed presenting at around 900 hPa, a thick moist layer (greater than 85%) starting from 500 hPa to the surface, and an unstable layer extending from 550 hPa down to near the surface.

To investigate the impact of dropsonde data on a forecast for the typhoon, two experiments, one with the initial condition obtained with an assimilation of dropsonde data (DROP) and another that is not (CTRL), were run for 48 hours by using the GRAPES model. Results are as follows:

1) By an assimilation of dropsonde data, the typhoon’s circulation is shown to weaken in the lower level, and strengthen in the middle and upper levels. The assimilation also intensifies the asymmetry of wind speed values between the eastern and western parts of the typhoon at the initial time. Water vapor over the northwestern side of the typhoon from the lower level to the middle level shows a positive increment, and the warm core structure of the typhoon has been further strengthened by the end of the data assimilation.
2) Dropsonde data assimilation results in improvements of quantitative precipitation forecasting during the landfall event, and path prediction. The values of the maximum surface wind speed and that of the minimum sea level pressure are all closer to those of the observation compared with CTRL during the 24-hour forecast.

Keywords: dropsonde data , assimilation

