

Evaluation of the monthly Potential of the 2018 typhoon activity and the effect of the positive PMM and SST of the eastern northwestern Pacific

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Typhoons in the northwest Pacific in 2018 exceeded the average for 29 occurrences, the number of landings to Japan to 5, and for the typhoon which became extreme strength it was updated with the most record and the activity was active. In the ENSO phase, La Niña phenomenon occurred in the beginning of 2018 but converged by early spring and El Niño phenomenon occurred in October. However, during the most active period of the typhoon (from June to November), the ENSO phase was still in a neutral state. Therefore, Pacific Meridional Mode (hereafter PMM) (Chiang and Vimont 2004) is focused recently. At the positive phase of PMM, a zone of warming sea surface temperature (hereafter SST) is formed in the northeast - southwest direction of 20 degrees north latitude, 120 degrees west longitude to 0 degrees north latitude and 180 degrees west longitude. Previous studies have pointed out that this positive PMM favors TC activities in the northwest Pacific (Zhang et al. 2016). Looking at the PMM index (SST) from 1948 to 2018, there was positive PMM in 2018 and the intensity was strong enough to be within 15th place of 71 in each month of active typhoon season. Especially, in August and September, strong positive PMM phenomenon was developed in 4th place and 2nd place.

The purpose of this research is to focus on the monthly SST variation such as ENSO and PMM and to evaluate the Potential of the 2018 typhoon activity. We also focus on the PMM and the SST over the eastern of northwest Pacific, and investigate how they affect the 2018 typhoon activity.

For the above purpose, we conducted perpetual experiments in which boundary conditions were fixed from July to October, respectively, using a nonhydrostatic model NICAM. The horizontal resolution was 56 km, and the number of vertical layers was 38 layers. In sensitivity experiments, PMM region and PMM + eastern northwest Pacific regions of SST in July 2018 sensitivity experiment 1 and sensitivity experiment 2 replaced with climate value were conducted. Comparing the experimental result of sea level pressure (hereafter SLP) with JRA-55, although the position of the maximum value of the high pressure in July is misaligned, the position and overhang of the high pressure does not differ greatly in each month, and perpetual experiments also reproduce the reality well. Both reanalysis and perpetual experiments have more typhoons in July and August than in September and October. Also, the occurrence position of the typhoon occurs more frequently in the eastern side of the northwestern Pacific in order of July, August, September. The same tendency was observed. Such differences in active areas of typhoon activity had an effect on the monsoon trough.

Subsequently, the SLPs of the 2018 experiment, sensitivity experiment 1 and sensitivity experiment 2 were compared. In comparison with the sensitivity experiment 1, the sensitivity experiment 1 became a lower pressure deviation in the west side of the northwest Pacific than 2018 experiment, whereas in the sensitivity experiment 2, the sensitivity experiment 2 had higher SLP in the whole northwest Pacific than 2018 experiment. From this, it was found that the positive SST deviation in the eastern northwest Pacific was more involved in the typhoon activity of 2018.

Keywords: tropical cyclone, Pacific Meridional Mode, nonhydrostatic model