

Large-scale rainfall characteristics around the Japan Islands in East Asia relating to the typhoon approach near late autumn (A case study for Ty1326 comparing with the cases in the midsummer and “autumn rainfall” seasons)

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The tropical cyclones, called the typhoons around East Asia, the hurricanes around North America, and so on, develop through the CISK mechanism and their rainfall systems are characterized basically by the organized ensemble of deep convective clouds. However, although the intense typhoons with wide strong-wind area sometimes approach the Japan Islands in mid-latitude from summer to late autumn, the large-scale atmospheric fields there including baroclinicity and stability for deep moist convection, etc., show rather rapid seasonal transition only in a few months, influenced greatly by the global-scale Asian monsoon. These would result in the seasonal variety of the large-scale rainfall characteristics, as well as the total precipitation, relating to the typhoon approach from summer to late autumn. In turn, detailed analyses of such rainfall variety in association with the typhoon approaches also could give us important information for understanding the seasonal cycles of the East Asian climate systems more deeply. Thus the present study examined a case in which a typhoon approached the eastern Japan around 15-16 October 2013 (near late autumn, Ty1326), comparing with those in the midsummer and “autumn rainfall” seasons (Ty1112 and Ty1115, which approached the Japan Islands around 2-4 September 2011 and around 19-21 September 2011, respectively). 10-minutes precipitation data at the meteorological stations by the JMA, the NCEP/NCAR re-analysis data at the grid points with every 2.5 degrees latitude/longitude interval and so on, were mainly used for analysis.

During the stage when Ty1112 passed northward around the western Japan along the western edge of the North Pacific high, the Japan Islands area was covered with very warm and moist air mass, and the stratification for deep moist convection was rather unstable. Besides, the strong low-level S-ly wind area toward the northern frontal zone extended widely to the east of the typhoon center. In this case, many localized meso- β or γ -scale areas with the intermittent intense rainfall persisted there widely. In the Ty1115 case, however, there persisted the synoptic-scale rainfall belt where the total rainfall amount was relatively large, contributed to by the moderate rain (around or less than 2mm/10minutes) about 500 km north of the typhoon center (not only by the convective rainfall area near the typhoon center).

In the Ty1326 case (near late autumn), the time-space integrated rainfall attained the considerable amount in a wide area from the central and eastern part of the Japan Islands due to the similar rainfall characteristics to those in the Ty1115 case, except for the main contribution of the intense rainfall (stronger than about 4mm/10minutes) near the typhoon center. This would be due to the large moisture inflow into the strong baroclinic zone with rather stable stratification for moist convection. It is noted that, although the similar rainfall features occurred around the low-level baroclinic zone with stable stratification corresponding to the “Akisame” (autumn rainfall) front in the Ty1115 case, the baroclinic zone at the Ty1326 case showed a wider meridional and vertical extension due to the more seasonal advance toward winter.