

# On the Mechanism of the Heavy Rainfall Associated with Typhoon Hagibis in 2019

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The heavy rainfall associated with the Typhoon Hagibis (2019) caused widespread flood damages, including overflow of big rivers such as the Chikuma River and the Abukuma River. How did the precipitation system of the typhoon cause such widespread flood damages? To answer this question, we analyzed the precipitation process using 5-minute interval Range-Height Indicator (RHI) scan data from X-band polarimetric radar and observation data from an optical disdrometer. The results showed that a distinct melting layer existed in the upper layer, and that raindrop diameter increased rapidly below the 0 degree level. In addition, cellular echoes indicating shallow convection were found in the lower layer. These results suggest that raindrops falling from the upper layers of typhoon rainbands were enhanced by accreting cloud droplets in shallow convective clouds. This phenomenon, in which raindrops falling from the upper layers grow in low-level clouds, is generally called "seed-feeder interaction". However, this mechanism is usually observed in mountainous areas, not over plain. In the present case, surprisingly, the seeder-feeder interaction occurred over the plains as well. The heavy rainfall over wide areas were caused by the widespread seeder-feeder interactions and it caused inundation of big rivers with large basins. It is often said that "heavy rainfall is caused by cumulonimbi", but the analysis of this case suggests that stratiform precipitation with shallow convection caused the widespread heavy rainfall. Typhoons approaching and making landfall in the autumn season may bring extensive stratiform precipitation due to the interaction with fronts, and may cause extensive heavy rainfall by the same mechanism as in this case.

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