Water vapor transport associated with remote precipitation caused by typhoon in autumn season

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In the autumn season of Japan, typhoon located far away from Japan increases the supply of water vapor to the rain front and causes significant precipitation. This phenomenon is called remote precipitation due to the indirect effects of typhoon, and in Japan there are only a few case studies. On the other hand, precipitation by the indirect effects of tropical cyclone on the North American continent is called the predecessor rain event (PRE), and many cases or statistical studies have been conducted. In this study, in order to clarify the mechanism of remote precipitation in Japan, I focused on the water vapor transport associated with remote precipitation caused by typhoon in autumn season and analyzed it.

The analysis period is from September 2004 to 2018 for 15 years, covering strong typhoons that developed below 950 hPa. When I checked the course of typhoons obtained, it was found that they were roughly classified into two courses: a course approaching while recurving to Japan and a course proceeding westward. Moreover, when I checked the water vapor transport by course, it was confirmed that a course approaching while recurving to Japan had large impact on Japan. Therefore, the analysis was limited to only typhoons on course that approaching while recurving to Japan.

In order to classify all 12 recurving typhoons into those with and without remote precipitation, I determined the definition of remote precipitation in Japan. As a result, 5 cases were judged as Japanese version of PRE and 7 cases as Not PRE (N-PRE). Moreover, as a result of a composite analysis of PRE cases with the typhoon center aligned with latitude lines, it was confirmed that PRE occurs around Japan on the day the typhoon center is located at 22.5 degrees north latitude. Furthermore, I defined the day as the reference day of day0 and compared the environmental fields before remote precipitation occurred from the composite analysis of PRE cases and N-PRE cases for 1 day before (day-1) and 2 days before (day-2). When I compared the extending changes of the subtropical high, PRE cases showed a weakening tendency from day-2 to day0, and N-PRE cases showed an increasing tendency. As a result, in PRE cases, the water vapor carried by the typhoon is blocked by the downward flow of the subtropical high in front, and there is no route to escape to the north or west, and the high water vapor situation is maintained mainly on the east side of the typhoon. Subsequently, the extending of the subtropical high will weaken, causing water vapor transport northward to Japan, which will lead to the occurring of PRE.

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