

GNSS-based Investigation of Precipitable Water Vapor Calculation Processing to Linear Precipitation Bands

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Linear precipitation bands are extreme meteorological phenomena that produces intense rainfall over narrow areas and often cause severe damage. To mitigate the risks associated with heavy precipitation, the Japan Meteorological Agency plans to begin operational nowcasting for these systems in May 2026. In our previous study, we evaluated the accuracy of satellite-based precipitation data (GSMaP) by comparing them with ground-based in-situ observations (AMeDAS). The results showed that temporal variations in precipitation were sometimes consistent, likely due to the coarse spatial resolution of satellite data.

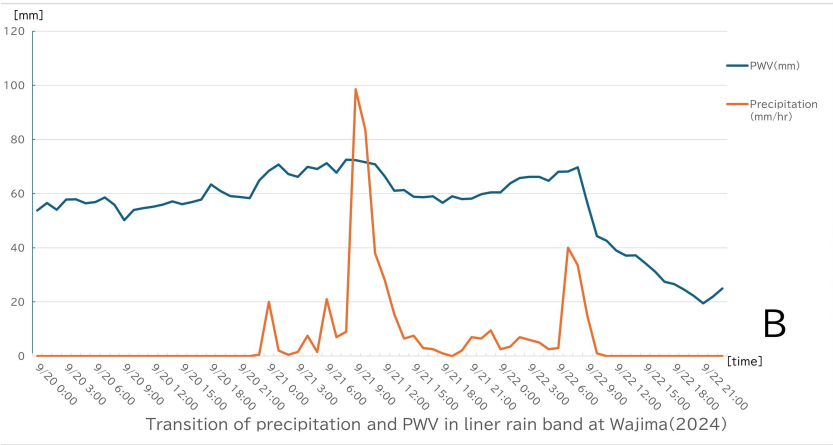
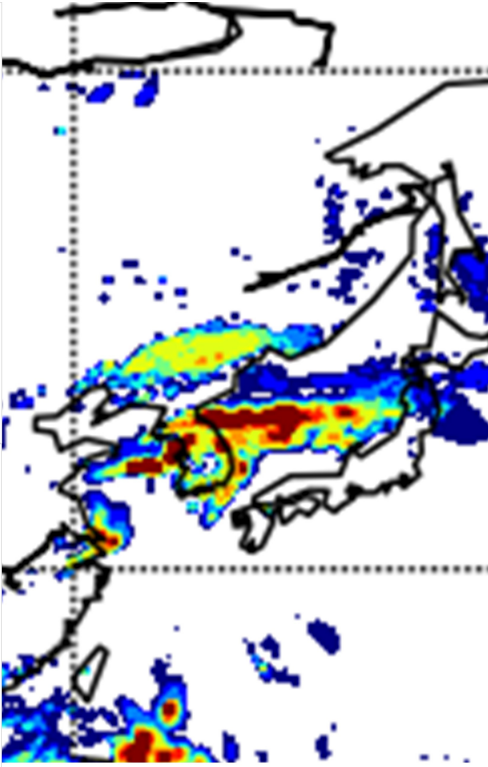
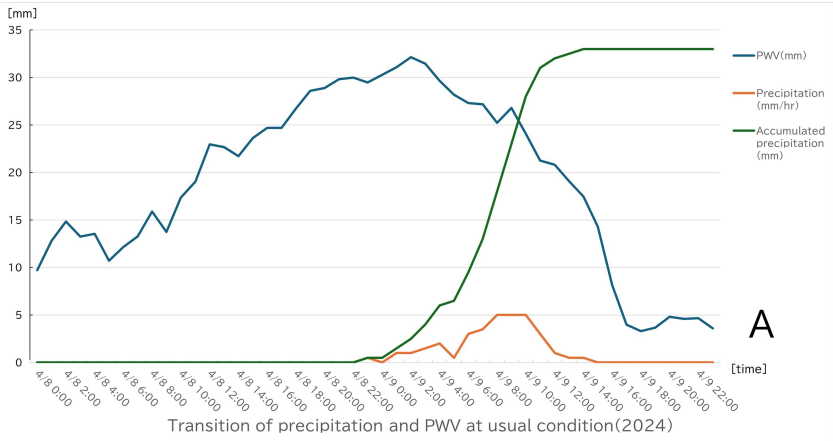
Additionally, the inflow of water vapor, a key factor in the formation of linear precipitation systems, cannot be directly observed from precipitation data alone.

Therefore, this study focuses on precipitable water vapor (PWV), a measure of atmospheric water vapor, with the aim of clarifying changes in PWV during the occurrence of linear precipitation bands.

For the preliminary analysis, we focused on September 2024 Noto Peninsula Heavy Rain as an example of the linear precipitation bands. The results indicate that, while PWV typically decreases gradually or rapidly after the onset of general rainfall (Fig.A), it remains high for several hours to up to a day during linear precipitation events (Fig.B). This behavior suggests the continuous inflow of water vapor.

These findings suggest that PWV has the potential to serve as an effective indicator of the development and maintenance of linear precipitation rainbands.

Keywords: Precipitable Water Vapor (PWV), Linear precipitation band, Global Navigation Satellite System(GNSS)



An example of a linear precipitation band