

Study on structural variations of Typhoon based on wind profiler observations

Hiroshi Fujita

*Laboratory of Radar Atmospheric Science Division of Diagnostics and Control of Humanosphere,
RISH, Kyoto University*

It is known that some tropical cyclones (TCs) appeared in low latitudes transform into extratropical cyclone at mid-latitude. This process is called extratropical transition (ET), and various disasters often happen in this process. However, ET is poorly understood yet while mature TCs are rather well researched.

In this study, we mainly examined the transition processes of the wind behavior of two TCs (Typhoons 0310 and 0416) using observation data with Wind Profiler Network and Data Acquisition System (WINDAS) of Japan Meteorological Agency (JMA). When we analyze WINDAS data, transition processes of the TCs were classified into four stages based on structural variations of precipitating clouds obtained by JMA weather radars, which is familiar to the general public. In addition to the variations of wind behavior in the vicinity of TC center, variations of thermal structures and synoptic scale features were also analyzed using radiosonde and RANAL data, respectively.

Synoptic trough and ridge axis shifted eastward as TCs moved. Strong positive vorticity in the vicinity of the center, which existed in former stages, disappeared at the middle troposphere in the latter stages. Distributions of divergence and convergence at lower and upper levels also rapidly changed in the latter stages. Though dry air intruded from upper level to lower level in latter stages, we showed that transitions of precipitating clouds heavily depended on the atmospheric stratifications. Transitions of strong cyclonic winds in the vicinity of the TCs in front side well corresponded to the variations of precipitating clouds, that is, the strongest peak of cyclonic wind gradually weakened and its location shifted outward and higher altitudes. We suggested that disappearance of the strong peak of cyclonic wind could be a criterion whether TCs transformed into extratropical cyclones or not.

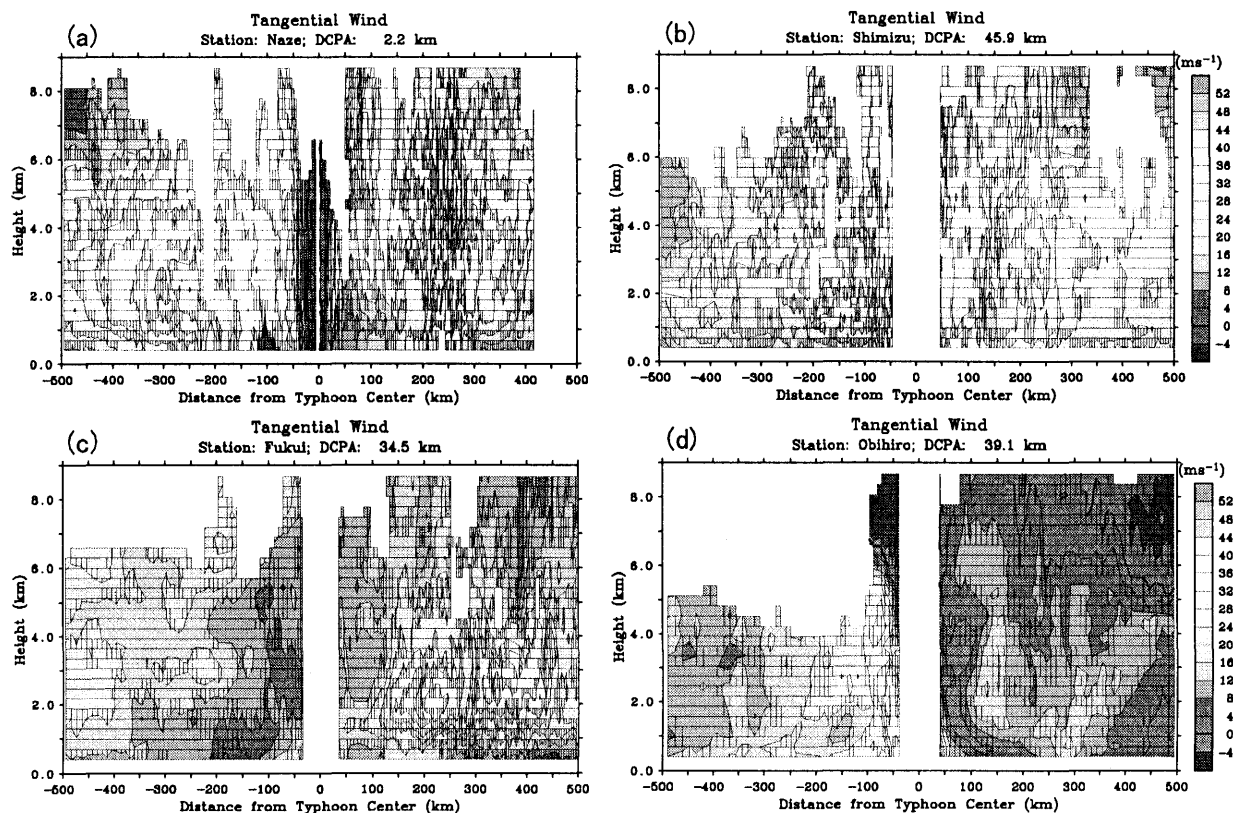


Fig. Radius-height cross sections of tangential winds relative to TC center observed by wind profilers at (a) Naze, (b) Shimizu, (c) Fukui and (d) Obihiro. The positive and negative values of radius correspond to the period when the TC approaches (in front side of TC) and leaves (in rear side of TC) to the observation sites, respectively. Positive and negative values of contour represent cyclonic and anticyclonic winds, respectively.