# Formation Process of a Tornado that Formed in a Quasi Linear Convective System Over Kanto Plain, Japan

*栃本 英伍[1]、新野 宏[1]
*Eigo Tochimoto[1], Hiroshi Niino[1]

1. 東京大学大気海洋研究所
1. Atmosphere and Ocean Research Institute, The University of Tokyo

Tornadoes are mainly classified into three groups based on different types of convective systems: supercells, quasi-linear convective systems (QLCSs), and non-supercells. In the United States, it is estimated that 18% of all tornadoes are spawned by QLCSs. In Japan, although tornadoes associated QLCSs also occur and cause severe damages, the detailed features and formation mechanism of tornadoes have not been well understood. Thus, we performed a high-resolution numerical simulation to reproduce and examine the formation process of a tornado that formed in a QLCS at Chiyoda-town, Ibaraki prefecture, Japan on 8 December 1992.

A quadruple-nested simulation using Japanese Meteorological Agency non-hydrostatic model was performed. A simulation with the finest horizontal scale of 50m successfully reproduced the tornado in the QLCS. At around 500m height, a low-level mesovortex, which was accompanied by strong updrafts (>20m/s), formed and developed around the location of tornadogenesis. A lagrangian circulation analysis showed that the source of the mesovortex was due to environmental wind fields. A lagrangian vorticity budget analysis showed that vertical tilting of crosswise vorticity associated with vertical shear in the forward inflow region contribute to the increase of vertical vorticity and then the vertical vorticity was stretched by strong updrafts. Near the surface, at 1 or 2 minutes before the tornadogenesis, strong rear-inflow jet (RIJ) accompanied by relatively cold air developed and cyclonic circulation was intensified in the northern part of the RIJ region. The tornadogenesis occurred in the northern part of the RIJ. Thus, it is suggested that the RIJ play significant roles in the formation and development of the tornado. The lagrangian circulation analysis showed that a half of the cyclonic circulation of the tornado was produced by frictional effects and another half of the cyclonic circulation originated from environmental wind fields.

キーワード：竜巻、対流システム
Keywords: Tornado, Convective system

©2020. Japan Geoscience Union. All Right Reserved. 