1. Introduction
On the morning of 21 August 2011, a tornado (called the Fukuoka tornado) struck the downtown area of Fukuoka City located in northern Kyushu, Japan. This tornado showed multiple-vortex structure. Multiple-vortex tornado has been rarely observed in Japan. Several Doppler radars observed the Fukuoka tornado, the mesocycle and precipitation patterns of its parent storm. We aim to describe relationship between the tornado vortex and the mesocycle (MC), and their vertical profile of the Fukuoka tornado by using different radars’ data.

2. Instrumentation and Data Analysis

3. Overview of the Fukuoka tornado

4. Structure of mesocyclone (MC) and tornado vortex

5. Conclusions
• The Fukuoka tornado that had a multiple-vortex structure originated from a supercell storm containing the MC.
• By analysis of several Doppler radars, we showed that the tornado vortex that correspond to the Fukuoka tornado connected vertically to the MC of the parent storm.

Table 1. Specifications of radars.

<table>
<thead>
<tr>
<th>Radar Type</th>
<th>JMA</th>
<th>DRAW</th>
<th>HyARC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation range</td>
<td>250km</td>
<td>75km</td>
<td>12km</td>
</tr>
<tr>
<td>Resolutions</td>
<td>Range</td>
<td>500m</td>
<td>150m</td>
</tr>
<tr>
<td>Number of elevations</td>
<td>20</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Time interval</td>
<td>10 min</td>
<td>5 min</td>
<td>5 min</td>
</tr>
</tbody>
</table>

Structure of the Fukuoka Tornado Observed by Different Radars

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FIG. 3. Snapshots of the Fukuoka tornado. The location of the tornado vortex corresponded to those of the misocyclone.

FIG. 6. Locations of the MC and the tornado vortex.

FIG. 7. Vertical profiles of the MC, mc1, mc2 and the tornado vortex. On S-N and W-E cross sections, each diameters of the MC and the tornado vortex was relatively constant in a vertical sense, respectively.

We found that the tornado vortex connected vertically to the mc1 within the MC of the parent storm.