Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Numerical study of the effects of rotating forced downdraft in reproducing tornado-like vortices. JINWEI ZHU, SHUYANG CAO, Tongji Univ, TETSURO TAMURA, Tokyo Institute of Technology, TOKYO INSTITUTE OF TECHNOLOGY COLLABORATION, TONGJI UNIV COLLABORATION —
Appropriate physical modeling of a tornado-like vortex is a prerequisite to studying near-surface tornado structure and tornado-induced wind loads on structures. Ward-type tornado simulator modeled tornado-like flow by mounting guide vanes around the test area to provide angular momentum to converging flow. Iowa State University, USA modified the Ward-type simulator by locating guide vanes at a high position to allow vertical circulation of flow that creates a rotating forced downdraft in the process of generating a tornado. However, the characteristics of the generated vortices have not been sufficiently investigated till now. In this study, large-eddy simulations were conducted to compare the dynamic vortex structure generated with/without the effect of rotating forced downdraft. The results were also compared with other CFD and experimental results. Particular attention was devoted to the behavior of vortex wander of generated tornado-like vortices. The present study shows that the vortex center wanders more significantly when the rotating forced downdraft is introduced into the flow. The rotating forced downdraft is advantageous for modeling the rear flank downdraft phenomenon of a real tornado.

Jinwei Zhu
Tongji Univ

Date submitted: 28 Jul 2016 Electronic form version 1.4