



Photo 1 : F3 class tornado attacked Tsukuba on May 6, 2013



Photo 2 : a house damaged by Tornado

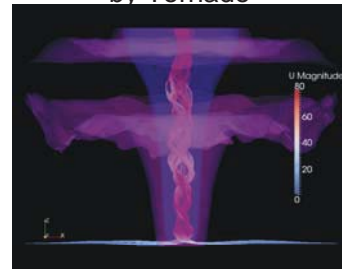


Fig.1 : Tornado-like flow generated by LES

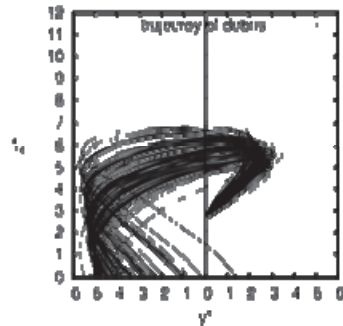


Fig.2 : Trajectories of windborne debris in Tornado-like flow

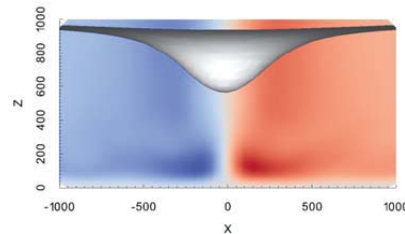


Fig.3 : Funnel cloud reproduced in numerical tornado-like flow

Content:

Tornado is one of the most dangerous meteorological phenomenon that cannot be ignored. Tornado occur regardless of the location with serious damages. (Photo 1 and 2) In order to assess the risk of Tornado disaster, flow structure of tornado, behavior of windborne debris, and aerodynamic force on buildings should be clarified. Therefore it is necessary to investigate tornado-like flow generated by experimental or numerical method. We have generated tornado-like flow by the developed tornado simulator and LES (Fig.1). In addition to the extremely strong wind, windborne debris also plays an important role to increase the risk in tornado. On the other hand, in order to estimate the strength of real tornadoes accurately, it is necessary to create a Japanized EF-scale and understand the relation between the characteristics of tornadoes and its appearance by funnel clouds or windborne debris. Therefore, we have developed a method to simulate the 6 DOF motion of 3D debris in tornado-like flow (Fig.2) and have investigated the appearance by funnel cloud (Fig.3).

Keywords: Tornado, Windborne debris, Funnel cloud, LES, Tornado simulator, Wind Engineering

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