Large-scale CFD Simulation for Building Damage Analysis and Important Facility Assessment under Tornado

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Category: K Industrial Use

Objectives

In this study, large scale computational fluid dynamic simulations using K Computer will be carry out to simulate the wind flow field nearby ground surface of a real tornado and its effects on building levels. Wind pressure distributions acting on a high-pressure gas storage tank facility during a tornado passing are investigated to clarify the performance of this facility. Verification and validation will be done for the prediction of the local wind pressure distribution, which is well-known as one of main reason of building damages, of a real building in comparison with experimental results.

Outline of Results

In this study, large scale computational fluid dynamic simulations using K Computer were carried out to simulate the wind flow field nearby ground surface of a real tornado using meteorological parameters for its initial and boundary conditions. Strong pressure drop and large wind speed distribution were obtained near the tornado damage area (Fig.1). Strong local pressure distributions acting on a high-pressure gas storage tank facility were found to be changed spatially and temporally under tornado passing (Fig.2). Finally, large scale simulation of 5 billion cell meshes was done and its results show good agreement with experimental ones for the prediction of the largest wind pressure acting on a high-rise building in the actual urban area in the strong wind condition with various wind directions (Fig.3).