

The Cloud-Resolving Model for Numerical Simulations of High-Impact Weather Systems

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Ever since 1998, we have developing the cloud-resolving model named the “Cloud Resolving Storm Simulator” (CReSS). Objectives of the model development are numerical simulations and high-resolution predictions of high-impact weather systems. The CReSS model has been used for numerical studies of typhoons (Tsuboki 2006), heavy rainfalls (Wang et al. 2005), snowstorms (Maesaka et al. 2006; Liu et al. 2006) and tornadoes. CReSS was designed for parallel computers and was optimized for the Earth Simulator in 2003.

Typhoons are one of high-impact weather systems in East Asia. They bring heavy rainfalls and strong winds, and often cause disasters. Quantitative and accurate prediction of rainfall and wind is necessary for prevention/reduction of disasters. The typhoon 0423 (T0423) landed the main lands of Japan and caused severe disasters due to heavy rainfall. We performed a simulation experiment of T0423 using the CReSS model with 1km-resolution. Distributions and intensity of rainfall were successfully simulated. We compared the simulation result with observations with regard to rainfall and evaluated scores of rainfall. This showed that the cloud-resolving model predicted quantitatively the heavy rainfall which is more intense than 50 mm hr^{-1} . The threat score and bias score over the western Japan are high enough for quantitative prediction.

A typhoon occasionally accompanies tornadoes and causes disasters due to strong winds. When the typhoon 0613 (T0613) approached the western Japan on 17 September 2006, it accompanied with a tornado (tatsumaki in Japanese). It killed three people and caused the train accident in Kyushu. We performed a simulation experiment of T0613 and the associated tornado using the CReSS model. Spiral rainbands were formed in the eastern part of T0613 in the simulation of 500m-resolution. Supercells are simulated along the rainbands. One of the suprecells caused an intense tornado in the eastern part of Kyushu. The simulation experiment with a horizontal grid spacing of 75m showed the horizontal diameter of the tornado is about 300m and its maximum vorticity is about 0.9 s^{-1} .

In this meeting, we will introduce the present status of the CReSS model and the latest results of simulation experiments using the model on the Earth Simulator.

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