The purpose of this bilateral research project was to develop new techniques for the next-generation ultra-high resolution atmospheric modeling to predict weather and climate change more precisely under the fast development of computing power. Both the atmospheric global model and the regional weather model were jointly developed by researchers of the Cavendish Laboratory, University of Cambridge, UK, and the Graduate School of Science, Kyoto University, Japan. The collaboration has started when the researchers in both countries met at the international conference "Cut Cell Methods for Atmosphere and Ocean modeling 2010", held in Berlin in July 2010. The discussion at the conference revealed that both side researchers were strongly interested in the development of ultra-high resolution atmospheric modeling with the use of next-generation supercomputers. Especially, they were very much interested in the application of the cut cell Cartesian mesh method and the adaptive mesh refinement techniques to the atmospheric models over complex topography. Throughout the bilateral research project for one year from April 2011, the Japanese research team has been awarded funding totaling about 2.5 million yen by JSPS. Following the visit of Japanese research team to the Cavendish Laboratory, one young Japanese PhD student stayed in the Cavendish Laboratory, University of Cambridge, for two months under this project and drove the research forward with English research team. By exchanging knowledges, know-how and techniques each other, the joint research has brought a big benefit to facilitate rapid development of both models. In particular, the 2D cut cell method developed by the Japanese team has been successfully implemented in a quasi 3D simulation, which represents an important milestone for full 3D atmospheric cut cell modeling.

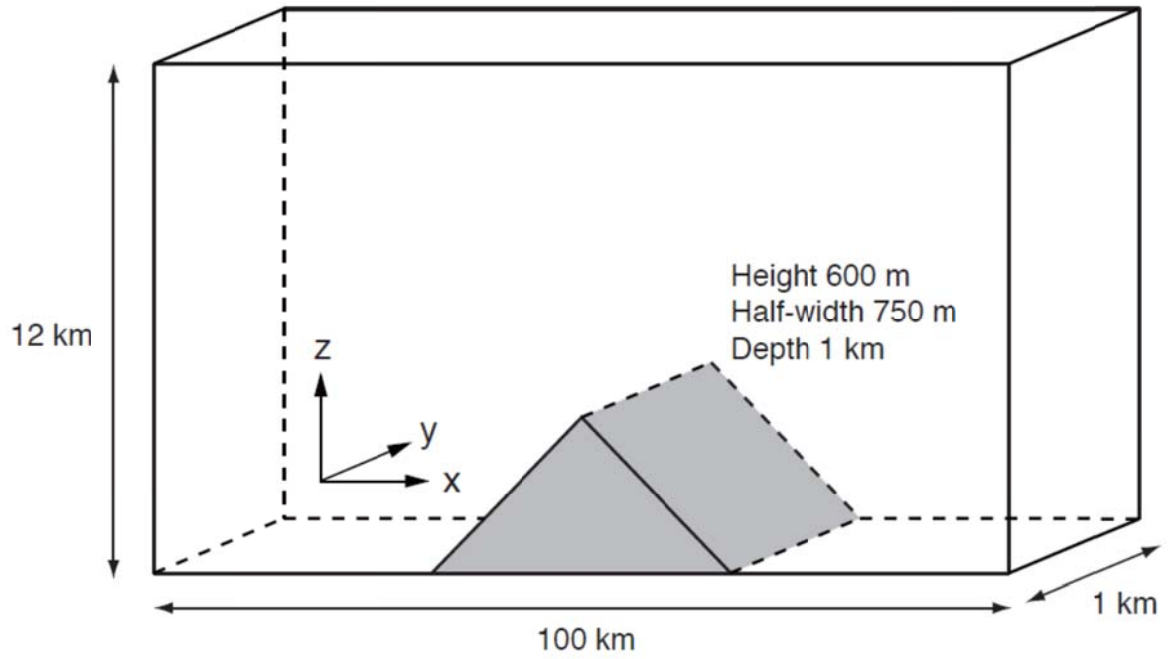

Fig1: Model domain in a quasi-3D numerical simulation of atmospheric flow. A prizm-shaped mountain is located parallel to the y-axis. The boundary of the mountain is represented by cut cells.

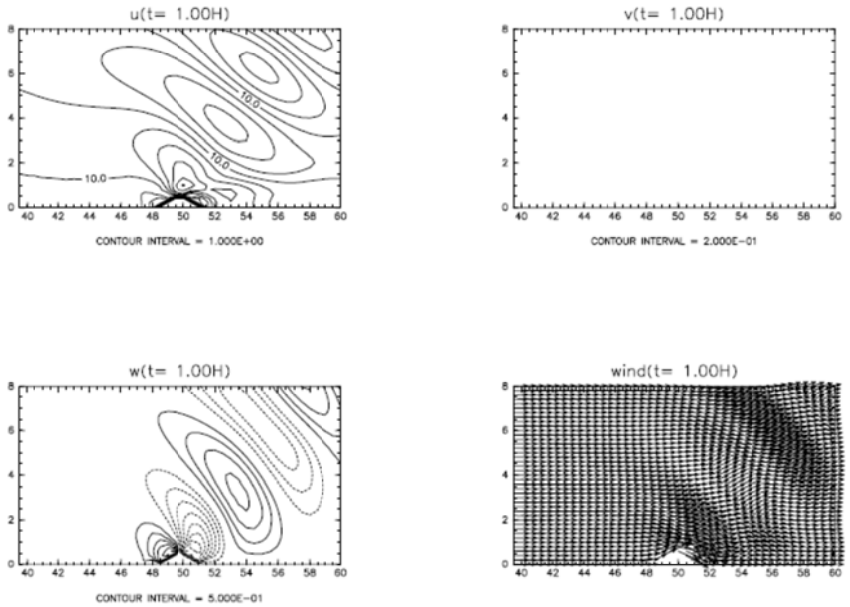

Fig2: Model results of the quasi-3D numerical simulation after 60 minutes of integration. All the pictures show vertical x-z slices at y = 0.45 km: (upper left) horizontal velocity u in the x direction (upper right) and v in the y direction, (lower left) vertical velocity w in the z direction and (lower right) the wind vector.