

Sensitivity to orography smoothing in numerical weather simulations over high elevation Himalayan mountains

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Precipitation over high elevation Himalayan mountains has a large influence on glacier mass balance and river discharge, which are important factors not only for the water resource management but also for the disaster mitigation of the Himalayan countries. Local weather including air temperature, humidity, airflow, and precipitation is largely controlled by the complex steep terrain. In a numerical simulation of local weather, accuracy of modeled topography can influence simulation results significantly. On the other hand, the terrain elevation data are usually smoothed and given as the lower boundary of atmosphere for the sake of numerical stability. We therefore tested the influence of orography smoothing on simulation results to optimize simulation configurations in terms of the accuracy of modeled elevation and the numerical stability.

The ALOS World 3D -30 m Digital Elevation Model (Todono et al., 2014) was adopted to give surface elevation with different levels of smoothing. A glacier mask was given from the GAMDAM glacier inventory for High Mountain Asia (Sakai, 2019) with a debris mask calculated by using the method of Kraaijenbrink et al. (2017). Downscaling simulations were performed covering the Rolwaling region in Nepal with the 200-m horizontal grid spacing to examine how the different levels of smoothing influence resultant local weather. As a result, intense smoothing disabled the model for reproducing diurnal change of airflow in the deep valley. In addition, the application of the debris mask was found to be effective for improving reproducibility of surface air temperature.

Acknowledgements

This study is partly supported by the Joint Research Program with Swiss National Science Foundation “High elevation precipitation in High Mountain Asia” of Japan Society for the Promotion of Science (JSPS). The computation was performed in part on the FX100 supercomputer system at the Information Technology Center, Nagoya University.

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