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High Resolution Forecasting System for Mountain area based on KLAPS-WRF

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This paper reviews the results of recent observations and simulations on the thermal belt and cold air drainage, which are outstanding in local climatic phenomena in mountain areas. In a mountain valley, cold air pool and thermal belt were simulated with the Weather and Research Forecast (WRF) model and the Korea Local Analysis and Prediction System (KLAPS) to determine the impacts of planetary boundary layer (PBL) schemes and topography resolution on model performance. Using the KLAPS-WRF models, an information system was developed for 12 hour forecasting of cold air damage in orchard. This system was conducted on a three level nested grid from 1 km to 111 m horizontal resolution. Results of model runs were verified by the data from automated weather stations, which were installed at twelve sites in a valley at Yeonsuri, Yangpyeonggun, Gyeonggido to measure temperature and wind speed and direction during March to May 2012. The potential of the numerical model to simulate these local features was found to be dependent on the planetary boundary layer schemes. Statistical verification results indicate that Mellor-Yamada-Janjic (MYJ) PBL scheme was in good agreement with night time temperature, while the no-PBL scheme produced predictions similar to the day time temperature observation. Although the KLAPS-WRF system underestimates temperature in mountain areas and overestimates wind speed, it produced an accurate description of temperature, with an RMSE of 1.67 ˚C in clear daytime. Wind speed and direction were not forecasted well in precision (RMSE: 5.26 m/s and 10.12 degree). It might have been caused by the measurement uncertainty and spatial variability. Additionally, the performance of KLAPS-WRF was performed to evaluate for different terrain resolution: Topography data were improved from USGS (United States Geological Survey) 30" to NGII (National Geographic Information Institute) 10 m. The simulated results were quantitatively compared to observations and there was a significant improvement (RMSE: 2.06 ˚C -> 1.73 ˚C) in the temperature prediction in the study area. The results will provide useful guidance of grid size selection on high resolution simulation over the mountain regions in Korea.