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Improvement of Climate Analysis Seoul (CAS) based on High Resolution LiDAR Data and Meteorological Model

C. Yi (1), K. R. Kim (1), Y.-J. Choi (1), S.-M. An (2), D. Scherer (3), and U. Fehrenbach (3)

(1) National Institute of Meteorological Research, Seoul, Korea (prpr2222@korea.kr), (2) Institute of ASIA Aero Survey Co., Ltd, Seoul, Korea, (3) Technical University of Berlin, Berlin, Germany

Climate Analysis Seoul (CAS) was developed for analyzing urban climate conditions to provide realistic information considering local air temperature and wind flows. It analyzes the impacts of topography and urban structure on climate conditions. Quantitative analysis are conducted by CAS for the production, transportation, and stagnation of cold air, wind flow and thermal conditions by incorporating GIS analysis on land cover and elevation and meteorological analysis from MetPhoMod - a mesoscale weather model. The underlying topography and building distribution is therefore very important. Airborne LiDAR can be used to produce topography and urban structure at very high resolution. In this study, we incorporated the LiDAR data as one of the improvements of the CAS system.

Three different levels of study domain were considered for CAS: Model Region (MR, 1km resolution), Study Region (SR, 25m resolution) and Detail Region (DR, 5m resolution). Following improvements were investigated. Cold air production and drainage flow are estimated using high resolution (100m) MetPhoMod simulations inside the SR domain. Higher resolution Digital Elevation Model database is updated based on airborne LiDAR data to accurately analyze actual building and plant canopy structure. As a result the building density and thermal conditions were analyzed more in detail to give more realistic total air temperature maps. The intermediately developed DR region was analyzed to have as high as 5 C thermal core in the middle of the region. It was analyzed to have smaller thermal core of 3 C by the improvement of the input dataset. The new dataset made it possible to analyze the individual buildings so that the cold air around the housing complex can penetrate into it. The MetPhoMod model was used to evaluate the improvement of the input data and produced similar improvement by the new input data.

The temperature distribution was observed by installing sixteen temperature probes in DR. The observed temperature deviation of each site was compared to the original and the improved CAS analyses. The differences between observed and analyzed temperature deviations were improved from 1.70 C to 1.14 C. It was mainly due to the improvement of the local-scale temperature analysis of CAS.

Using CAS software, effects of urban development on climate conditions can easily be analyzed and evaluated. However, intensive validation of CAS by using ground and satellite observation data at the study regions are remained as a further study. CAS helps easier analysis and assessment of urban development on local climate. It will contribute to the better life of the people in cities by providing better understanding of the local climate to the urban space planners.