EMS Annual Meeting Abstracts
Vol. 16, EMS2019-427, 2019

Effect of network density on horizontal distribution of meteorological variables in the Seoul Metropolitan Area

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High-quality and high-resolution meteorological information is essential to reduce damages due to disastrous weather phenomena such as flash flood, strong wind, and heat/cold waves. There are many meteorological observation stations operated by Korea Meteorological Administration (KMA) in Seoul Metropolitan Area (SMA). Nonetheless, they are still not enough to represent small-scale weather phenomena like convective storm cells due to its poor resolution, especially over urban areas with complex land use. In this study, feasibilities to use additional pre-existing networks (e.g., operated by provincial office, local government, and private company) are tested by investigating the effects of network density on horizontal distribution of two meteorological variables (temperature and precipitation). Two heat wave event days and two precipitation events are chosen, respectively. And the automatic weather station (AWS) networks operated by KMA, local-government, and SKTechX in Incheon area are used. There are 102 AWS networks installed by the KMA, 342 by local governments (Gyeonggi and Incheon), and 414 by private company (SKTechX). It is found that as network density increases, correlation coefficients between the interpolated values and observed data from the highest-density network also becomes large. Effects of network density exhibit different features with respect to the meteorological variables: for temperature, the effects are large in nighttime rather than in daytime; for precipitation, the effects depend on the horizontal synoptic pattern and precipitation type. This study suggests that temperature and precipitation sensors should be added at points with large horizontal inhomogeneity of land use or topography to meet the needs of user-specific meteorological information over the SMA.