Data Assimilation on the Sub-Kilometer Scale for the Urban Environment

Arianna Valmassoi*[1,2] and Jan D. Keller[2,3]

[1]University of Bonn – D-53121 Bonn, Germany
[2]Hans-Ertel-Center for Weather Research, Monitoring and Diagnostic group – D-53121 Bonn, Germany
[3]Deutscher Wetterdienst – Offenbach, Germany

Abstract

The ongoing urbanization makes urban areas increasingly crucial for NWP especially in relation to extreme events or climate monitoring in the context of regional reanalysis. In this regard, the increase in computational power allows for ever-higher horizontal resolutions in NWP models towards the kilometer scale which is important to tackle the representation of urban environments.

This study investigates high-resolution DA below the kilometer-scale for urban areas in order to assess the potential for future regional reanalyses at the German Meteorological Service (DWD). Therefore, we employ the Icosahedral Nonhydrostatic (ICON) Model in the Limited Area Mode (ICON-LAM), together with DWD's LETKF. We perform experiments at horizontal resolutions of 2.1km (operational) and 500m. We use a modified ICON-LAM surface module compared to the operational mode by employing the Corine land-use dataset (100-meter resolution) instead of the default Globcover 2009 (300 meters) and three urban land use categories instead of one to better capture surface heterogeneity.

With respect to DA, we investigate the impact of assimilating various observing systems such as conventional upper air and surface observations as well as satellite-based land surface temperature (LST) data. We aim to assess their value for enhancing the representation of near-surface temperatures, especially in urban areas. A focus is therefore given to the tuning of relevant parameters such as the localization length to be able to better represent small-scale spatial features such as the UHI. In this regard, the LST measurements can provide valuable information on the spatial structure of surface temperatures and thus help to correct the UHI representation in ICON-LAM.

Keywords: urban, land surface temperature, sub, kilometer scale, regional reanalyses

*Speaker