RAL SEMINAR SERIES

Investigating the Impact of Land Cover and Skin Forcings in Microscale Weather Simulations Across Urban-rural Heterogeneous Landscapes

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The role of surface forcings arising from realistic land cover and skin properties is poorly understood in microscale turbulence resolving weather prediction, particularly in the context of urban environments. Building-resolving large-eddy simulations (LESs) with detailed land cover and surface characteristics enable the exploration of how these factors influence urban wind speed and turbulence patterns, crucial for tackling modern challenges such as urban heat islands, transport and dispersion, and urban-induced convective cloud formation. Typically, large-scale land cover databases are used in atmospheric models; however, their resolution is often too coarse for properly representing the relevant local land cover features. This study explores the critical impacts of varying land cover classifications (both in granularity and resolution) and their corresponding surface characteristics, such as roughness length, on microscale weather simulations. A series of systematic and comprehensive experiments were conducted for the urban-rural interface of Murcia (Spain) using RAL's GPU-accelerated FastEddy® LES model coupled to WRF. With the aim of enhancing the fidelity of these simulations, a number of non-standard microscale modeling practices were incorporated into this research study. These include the use of high-quality land cover data, along with the modification of default roughness length values to more realistic estimates, the implementation of both a local terrain smoothing method and a dynamic thermal roughness length parameterization in FastEddy®. This seminar provides an insight into the preliminary results of the ongoing cooperative work between the Regional Atmospheric Modeling Group at the University of Murcia and the Research Applications Laboratory at NCAR.