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Effective roughness length considering sub-grid heterogeneity and form drag

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The Korea Institute of Atmospheric Prediction Systems (KIAPS; https://www.kiaps.org) is developing a global numerical weather prediction (NWP) system that is particularly optimized to the topographic and meteorological features of the Korean Peninsula. The Noah Land Surface Model (LSM) version 3.6 (http://www.ral.ucar.edu/research/land/technology/lsm.php) is in charge of representing terrestrial process of the KIAPS-developing model, which has been further refined with additional physical processes and enhanced surface parameters from satellite-derived data (Koo et al. 2017).
Most operational global models are heading towards mesh sizes below 10 km. This resolution, however, is still much too coarse to adequately represent the sub-grid heterogeneity which can vary on the order of meters in currently available surface data the effects of sub-grid orography. In the KIAPS model, land surface heterogeneity is represented by averaging surface-cover parameters based on the fractional cover area of all the component land cover types presented in a grid cell, i.e. aggregation (or effective parameter) approach.
The KIAPS model was found to generally have stronger wind biases near the surface because turbulent surface stress is significantly weak compared to other operational models (Zadra et al. 2013), especially over mountainous areas even though sub-grid orographic stress is relatively strong. To enhance turbulent surface stress, form drag from turbulent scale orography is additionally parameterized as an enhanced roughness length in the surface layer scheme, based on the Richter et al. (2010).
The impact of the effective roughness length considering sub-grid heterogeneity and form drag is examined on medium-range forecast and seasonal prediction framework. Further details will be presented in the conference.

References

Koo, M.-S., S. Baek, K.-H. Seol, and K. Cho, 2017: Advances in land modeling of KIAPS based on the Noah Land Surface Model. Asia-Pacific J. Atmos. Sci., in press.
Richter, J. H., F. Sassi, and R. R. Garcia, 2010: Toward a physically based gravity wave source parameterization in a general circulation model. J. Atmos. Sci., 67, 136–156.
Zadra, A., 2013: WGNE Drag Project – An inter-model comparison of surface stresses. Report No. 1.