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Surface Hail Simulations in a High-Resolution Regional Climate Model

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The past years have seen a rapid advancement in computational resources, enabling regional climate models to perform at convection-permitting resolutions. This feature has allowed the use of complex bulk microphysical parameterizations as a means to improve cloud and precipitation representations within these models. Given the increased trend in the last decades of extreme precipitation events in numerous regions around the world, developments and evaluation of microphysical parameterizations implemented in regional climate models are crucial in order to better assess future precipitation projections. One important aspect for accurate deep convective storm simulations is in the hail parameterization within models, which can substantially impact precipitation and dynamical features within the cloud along with subsequent cold pool-driven secondary convection. Great economic costs and hazardous implications have been associated with hailstorms, which makes it of the utmost importance to properly simulate hailstone sizes at the surface. And yet many models have so far struggled to reproduce characteristic observational features of hail producing storms linked to weaknesses within microphysical parameterizations.

As part of the aims for the Modeling Atmospheric Composition and Climate for the Belgian Territory (MACCBET) project[1], we used the COSMO-CLM model, a nonhydrostatic regional climate model, driven by ERA-Interim data to simulate, at high resolution (3km), a selected number of intense convective cases in the 2000-2014 period with more than half having surface hail reports. A modified version of the 2-moment Seifert and Beheng (2006; Van Weverberg et al. 2014) microphysical scheme, with an added hail category, was used for this study. Preliminary results showed that the 2-moment scheme produced significant simulated hail as opposed to negligible amounts present in the model runs with a 1-moment version of the same parameterization. Additionally, the 2-moment version using gamma (2M-GAM) size distributions for the precipitating hydrometeors showed better agreement with radar observations compared to the simulations with particle size distributions represented as negative exponential distributions (2M-EXP). The 2M-EXP generally showed larger areas of hail reaching the surface together with greater hailstone sizes in comparison to the 2M-GAM and radar observations. The causes and implications of these results will be further discussed.

References

Seifert, A., & Beheng, K. D. (2006). A two-moment cloud microphysics parameterization for mixed-phase clouds. Part 1: Model description. Meteorol Atmos Phys 92, 45-66.

Van Weverberg, K., Goudenhoofdt, E., Blahak, U., Brisson, E., Demuzere, M., Marbaix, P., & van Ypersele, J. P. (2014). Comparison of one-moment and two-moment bulk microphysics for high-resolution climate simulations of intense precipitation. Atmospheric Research, 147, 145-161.

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