Representation of mechanical lifting by subgrid-scale orography using stochastic perturbations

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We aim to improve the model representation of convection triggering using a physically based stochastic parameterization. We extend the stochastic perturbation scheme developed by Kober and Craig (2016). This scheme considers the boundary layer variability and its impact on convection triggering and has been successfully applied to three case studies. Our extension of the parameterization includes the effect of mechanical lifting by subgrid-scale orography on the initiation of convection. The mechanical lifting is parameterized as stochastic perturbations of the vertical velocity which are based on the internal gravity wave formalism and a high-resolution orography data set. Thereby the perturbation amplitudes depend on the average stability of the boundary layer, the steepness of the sub-grid scale orography and the intensity of the horizontal wind fields. Spurious pressure perturbations are minimized by also perturbing the horizontal wind field to yield balanced, i.e. 3d non-divergent perturbations. The influence of these perturbations on convective precipitation is examined by considering several case studies with the COSMO model.