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Towards modular front tracking for Stratocumulus clouds considering unsteady entrainment processes

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Low clouds are increasingly recognized as the main source of divergence in model based estimates of climate change. Our best tool for understanding clouds and microphysical interactions is Large Eddy Simulation (LES), but fundamental issues emerge in precisely those quantities of interest (e.g. Albedo). A reason for this is that current LES cannot resolve the cloud interface physics due to insufficient resolution. Elaborate physically based subgrid models are numerically smeared out (fed wrong), so that a distinction between numerical and physical effects is impossible. Here, we propose a heterogeneous multi scale concept for the modeling of Stratocumulus clouds. The cloud top interface which is driven by large scale motions is explicitly tracked using a level set method. At the same time the important small scale mixing process is considered by embedding (super-) parameterizations in a modular fashion. Therefore the entrainment process is investigated with Direct Numerical Simulations (DNS). The new approach has two key advantages. Firstly, using an interface method avoids numerical smearing. Secondly, the modular coupling procedure, which has been developed for combustion and two phase flow problems, helps to combine small scale entrainment physics with the large scales in a consistent manner.