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Supersaturation calculation in large eddy simulation models for prediction of the droplet number concentration

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Abstract. A new parameterization scheme is described for calculation of supersaturation in LES models that specifically aims at the simulation of cloud condensation nuclei (CCN) activation and prediction of the droplet number concentration. The scheme is tested against current parameterizations in the framework of the Meso-NH LES model. It is shown that the saturation adjustment scheme, based on parameterizations of CCN activation in a convective updraft, overestimates the droplet concentration in the cloud core, while it cannot simulate cloud top supersaturation production due to mixing between cloudy and clear air. A supersaturation diagnostic scheme mitigates these artefacts by accounting for the presence of already condensed water in the cloud core, but it is too sensitive to supersaturation fluctuations at cloud top and produces spurious CCN activation during cloud top mixing. The proposed pseudo-prognostic scheme shows performance similar to the diagnostic one in the cloud core but significantly mitigates CCN activation at cloud top.

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