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The second aerosol indirect effect and its sensitivity to autoconversion - Global and regional views

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Recent studies have shown that general circulation models are overestimating the increase in cloud liquid water path (LWP) in response to increased aerosol loadings, thus giving a larger second aerosol indirect effect than observed. One of the contributors to this discrepancy is the parameterization of precipitation initiation in warm clouds, autoconversion, through its sensitivity to the cloud droplet number concentration (Nc) and the cloud water content (qc).

We will show results from simulations done with CAM5.3-Oslo, the atmospheric component of an intermediate version of the Norwegian Earth System Model (NorESM), where we have explored different modifications to the autoconversion scheme. We are changing the sensitivity to Nc and qc, both separately and together, based on a suggested link between the two. Especially changing the sensitivity to Nc is shown to reduce the increase in LWP. This result holds globally when looking at how the LWP is responding to present-day vs. preindustrial aerosols, but also locally when using the Holuhraun volcanic eruption as a testbed. The autoconversion rate in the stratocumulus region and its variations with LWP are also improved compared to observations from the VOCALS campaign.