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Tracer transport and mixing processes in the vicinity of the polar jet stream

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The newly developed global and regional atmospheric chemistry model system MECO(n) ("MESSy-fied ECHAM and COSMO models nested n-times") allows consistent analyses at higher resolution of tracer transport and mixing processes.
The model system couples the limited-area atmospheric chemistry and climate model COSMO/MESSy to the global model ECHAM5/MESSy for Atmospheric Chemistry (EMAC). Both models use the same chemistry implementations and boundary conditions for the nested COSMO/MESSy instances. The latter are are provided on-line from the global model EMAC. Therefore, the MECO(n) system allows for very consistent, simultaneous simulations in different spatial resolutions.
We focus on the temporal development and the depth of mixing in the vicinity of the polar jet stream. Using the tracer interface, as provided by the Modular Earth Submodel System (MESSy), artificial passive tracers can be released to investigate transport pathways and chemical tracer distributions in different resolutions. We found troposphere-to-stratosphere transport (TST) events, accompanied by mixing of air masses with different tracer properties, which are only simulated in the finer resolved COSMO/MESSy instance. Considering the downward transport of stratospheric air in tropopause folds, differences between the simulations with different resolutions are evaluated with ground-based observations. We show the advantages of the finer resolved COSMO/MESSy instance in simulating these stratosphere-to-troposphere transport (STT) events.