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Clear Air Turbulence as a mixing process for trace species in the UTLS

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Clear air turbulence (CAT) is an often occuring phenomenon in the upper troposphere. It is mainly driven by the wind patterns associated with the jetstreams in the UTLS region. In addition to the implications of CAT for air traffic, CAT can also contribute to cross-isentropic transport of air masses and trace species, and therefore representing a subgrid-scale mixing processes usually not captured by large-scale chemistry climate models. However, this mixing can have implications for e.g. ozone depleting substances (VSLS species) and their entry into the stratosphere or a disturbance in determining the mean age of air. Additionally, CAT mixing can also contribute to uncertainties in climate projections due to the mixing of radiatively active species (N2O, O_3) in this region that is characterised by a high sensitivity of surface climate to tracer mixing.
In this study we present large-scale model simulations, in which CAT is represented with the help of the (extended) Ellrod-Knox index. The associated mixing by CAT of trace species is performed with the help of a mixing algorithm which takes both the occurrence and strength of CAT, but also the inhibition of mixing due to high static stability into account.
Both idealised as well as real case studies will be presented which show a more efficient mixing of trace gases in the UTLS region compared to the mixing by the large scale dynamics.