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Convective exchange matrix - a tool for diagnosing convective tracer transport

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Convective transport is one of the key transport processes for many trace species in the atmosphere. Especially, non-soluble compounds are quickly transported into higher altitudes by convective clouds, both by shallow convection from near the surface to the mid-troposphere, but also by deep convection up to the tropopause region.

Convective transport algorithms are usually applied to individual trace compounds. However, in case of a substantial number of trace species they become computationally time consuming.
In this study we present an alternative algorithm which determines the convective exchange matrix for species from all altitudes by an individual convective event which can be applied to all different species simultaneously under the condition that they are not subject to scavenging and wet deposition in the convective clouds.

Additionally, this diagnostic opens the opportunity for an explicit analysis of the major transport pathways (both upwards and downwards) in convective clouds and the relevance of convective mixing for tracers at arbitrary levels, both on individual events as well as on longterm means. We present results from a global analysis of convective mixing and tracer transport using the chemistry-climate model EMAC.