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Stratosphere - troposphere coupling in the northern hemisphere and its relevance for seasonal weather prediction

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Mechanisms of stratosphere-troposphere coupling in the northern hemisphere are investigated to further evaluate the impact of stratospheric perturbations on tropospheric weather and climate. The studies are based on long-term simulations with the chemistry-climate model E39C-A.
Former studies show that during stratospheric extreme situations (weak and strong vortex events), on average, a distinct signal propagation from the stratosphere to the troposphere is found, but there is a high case-to-case variability. Comparison of the strength of the signal (i.e. geopotential height anomaly) in the stratosphere to the strength of the signal in the troposphere suggests that the order of magnitude of the signal in the troposphere is mostly independent from the strength of the stratospheric perturbation. This leads to the assumption that the troposphere could play an active role for the signal propagation.
Accordingly to this, a new method is developed that allows not only for stratospheric differentiation, but also for tropospheric differentiation (intense or low impact) to capture those tropospheric differences that may be responsible for an enhanced tropospheric response. It is shown that in any case of downward propagation into the troposphere significant changes are found (1) of the tropospheric jet in the mid-latitudes, (2) of tropospheric planetary wave generation and (3) wave dissipation, already two to three months before the anomaly signal reaches the troposphere.