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Finite-time instabilities in the stratosphere-troposphere interaction

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Finite-time instabilities are an important ingredient in the explanation of perturbation growth mechanisms in the troposphere. To determine such finite-time instabilities singular vectors are used. Singular vectors identify regions where perturbations of the initial condition grow rapidly during a finite forecast time and for a given energy norm.

In this talk we explore the use of singular vectors in studying mechanisms that contribute to the interaction beween stratosphere and troposphere. Using the ECMWF forecast model, we have computed singular vectors for Northern Hemisphere winter and summer cases, which propagate from the stratosphere to the troposphere, or vice versa. Their properties, such as preferred location, growth rate and wavenumber spectra, will be discussed. We will also show that the same framework allows us to investigate to what extent, for example, ozone depletion can influence the magnitude of the NAO. The latter application requires the computation of optimal model perturbations.