

# The leading mode of NH interannual tropopause height variability and its relationship with ENSO

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The tropopause is the boundary between the troposphere and the stratosphere, thus critical for dynamical coupling and mass exchanges of various gases between them. It is also an indicator of changes in thermal structure of the atmosphere, expected to change under global warming. Yet, its long-term change and variability are relatively under studied. In this study we examine spatial characteristics of interannual variability of the Northern Hemisphere dynamical tropopause height based on the JRA-55 reanalysis data. The dynamical tropopause is defined by the distribution of potential vorticity.

In particular, we focus on the dominant mode of spatial variability defined by the leading mode of EOF of the wintertime tropopause height field in the Northern Hemisphere. The analysis reveals that (i) the leading spatial pattern shows a north-south dipole structure along with the subtropical westerly jet, (ii) the leading principal component is significantly related to the Niño3 index ( $r=0.79$ ), and (iii) there are two main action centers, one over the eastern Pacific region and the other over the southern China, which are negatively correlated ( $r=-0.65$ ).

The analysis is based on the dynamical tropopause, which means that the leading mode thus identified has two inter-related components, one from vorticity dynamics and the other from stability structure. We shall discuss how those two kinds of processes jointly give rise to the leading mode of the tropopause height variability, which is related to ENSO.

Key words: tropopause, ENSO, westerly jet