

Recent advances understanding the extratropical Tropopause Inversion Layer

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The extratropical Tropopause Inversion Layer (TIL) consists of a sharp temperature inversion at the extratropical tropopause with corresponding high static stability values in a thin layer right above the tropopause, which are well above typical stratospheric static stability values. This, in theory, should inhibit stratosphere-troposphere exchange, and affect the dispersion relations of atmospheric waves like Rossby or inertia-gravity waves. The TIL as a topic of research is relatively new, spanning only the last decade, therefore its properties are sparsely understood and the mechanisms leading to its formation are still under discussion. Adding to this, the TIL is poorly represented in models and reanalyses.

Investigating the TIL from a synoptic-scale point of view instead of climatologies has uncovered new properties of this layer related to near-tropopause flow, and has shed light on atmospheric waves as an important mechanism contributing to TIL formation by modulating tropopause height and N_2 around it. We also found that planetary and synoptic-scale waves in the extratropics are present in large amounts especially near the tropopause. Regarding reanalyses, we found that data assimilation in ERA-Interim and the ECMWF operational forecasts improves the representation of the TIL, in contrast to earlier studies with less sophisticated assimilation systems.