Relative importance of **tropopause structure** and **diabatic heating** for baroclinic instability

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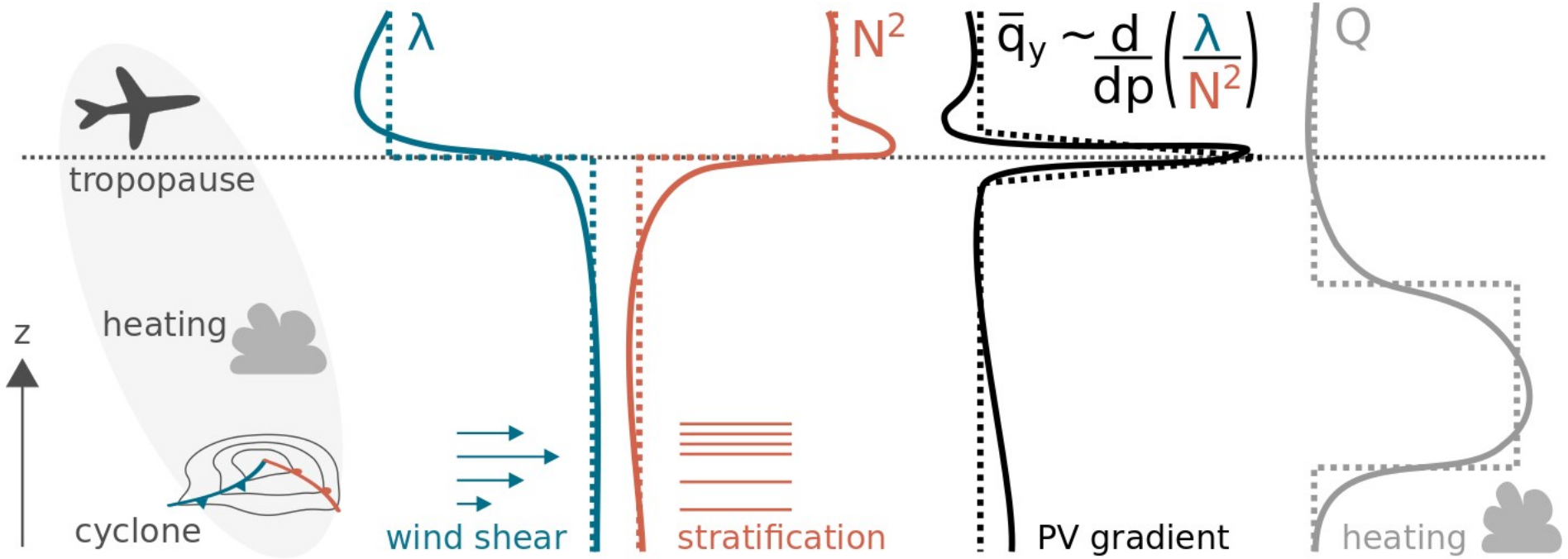

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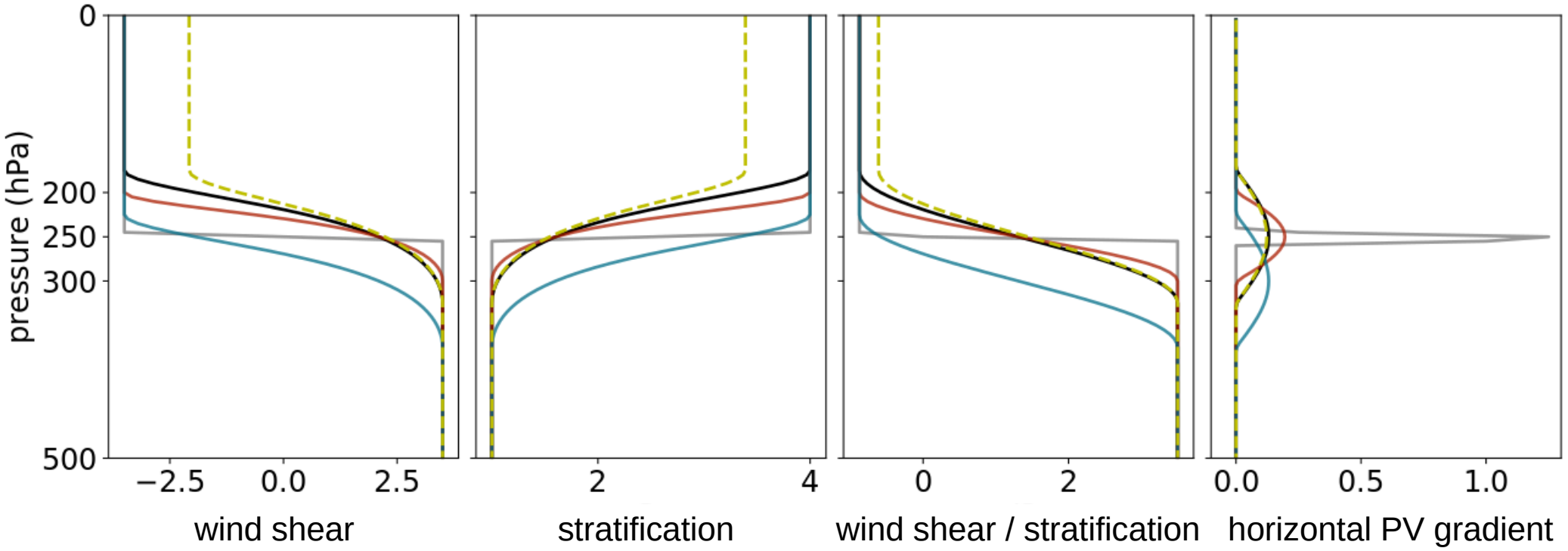
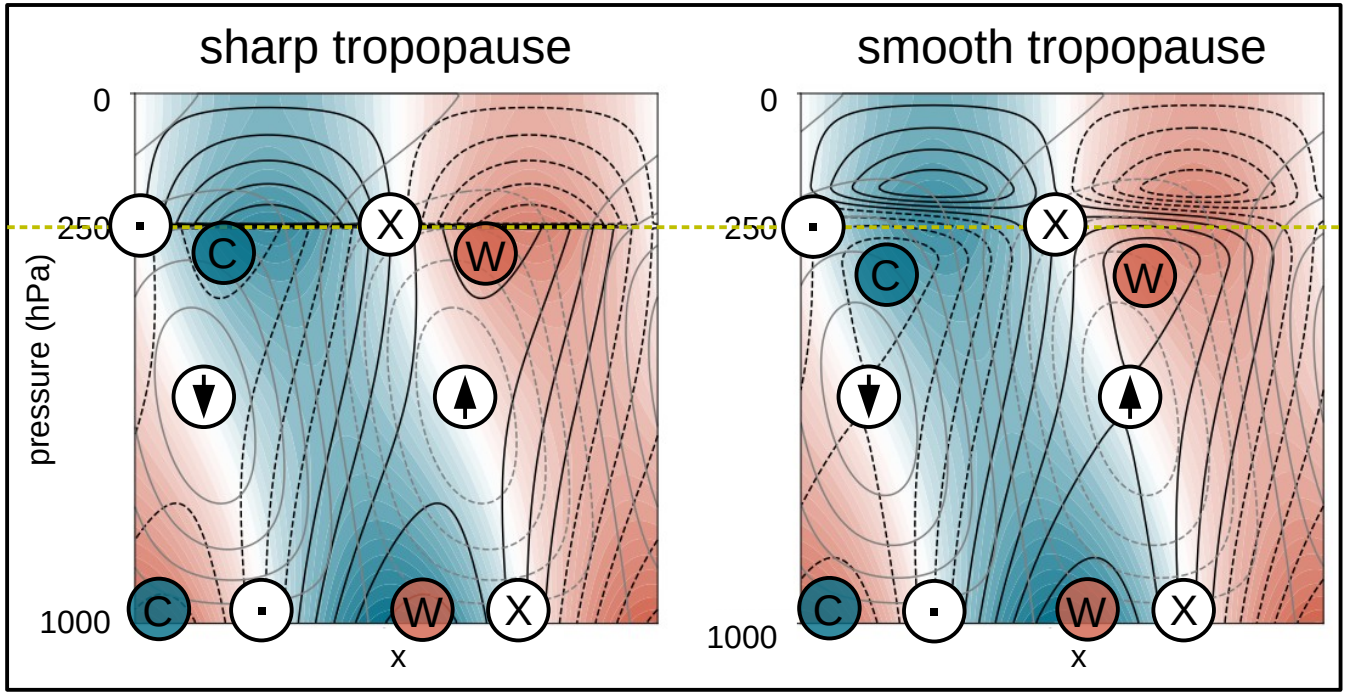
Modifications of tropopause structure

degree of smoothing | tropopause altitude | modifications in the lower stratosphere



Wave structure

for sharp and smooth tropopause



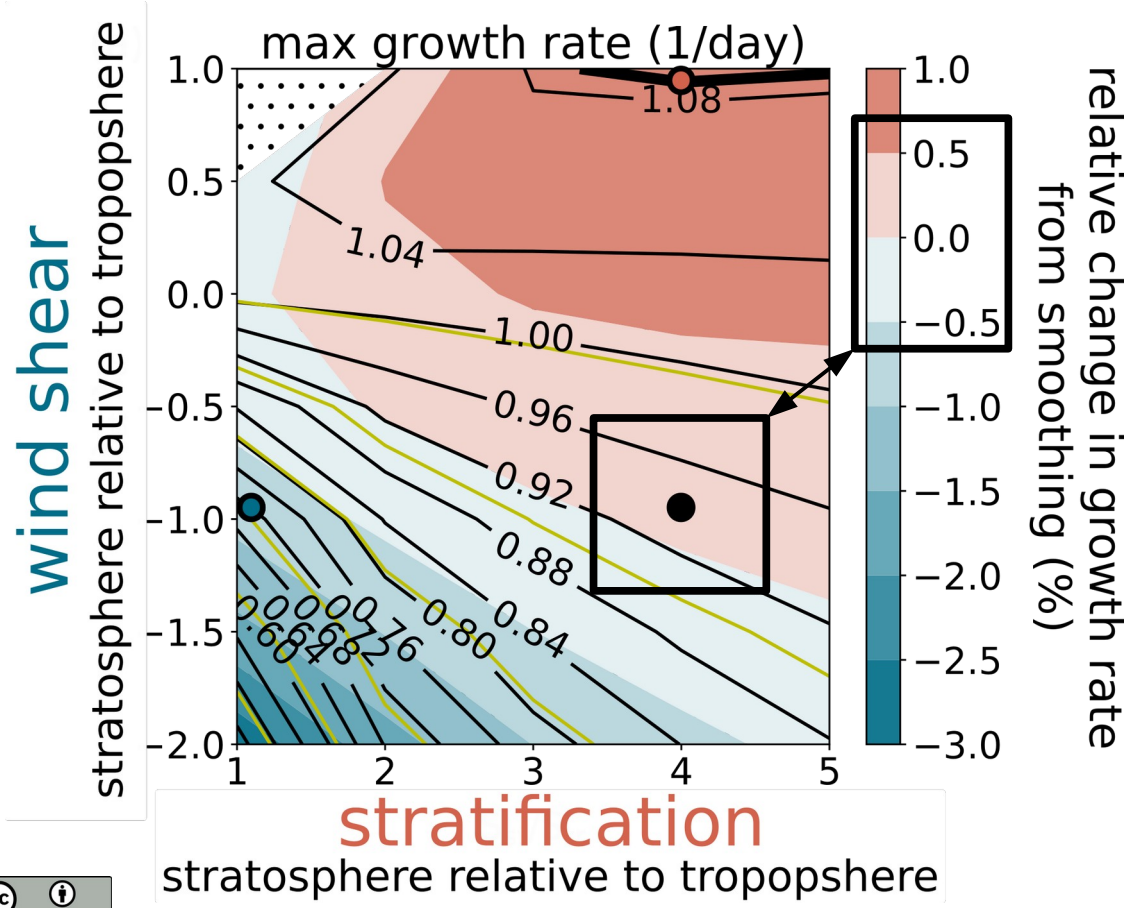
Warm air rises poleward and cold air sinks equatorward

Same qualitative structure for sharp and smooth tropopause

Shading: QG streamfunction
Black contours: temperature
Grey contours: vertical motion ω
Dashed yellow line: tropopause

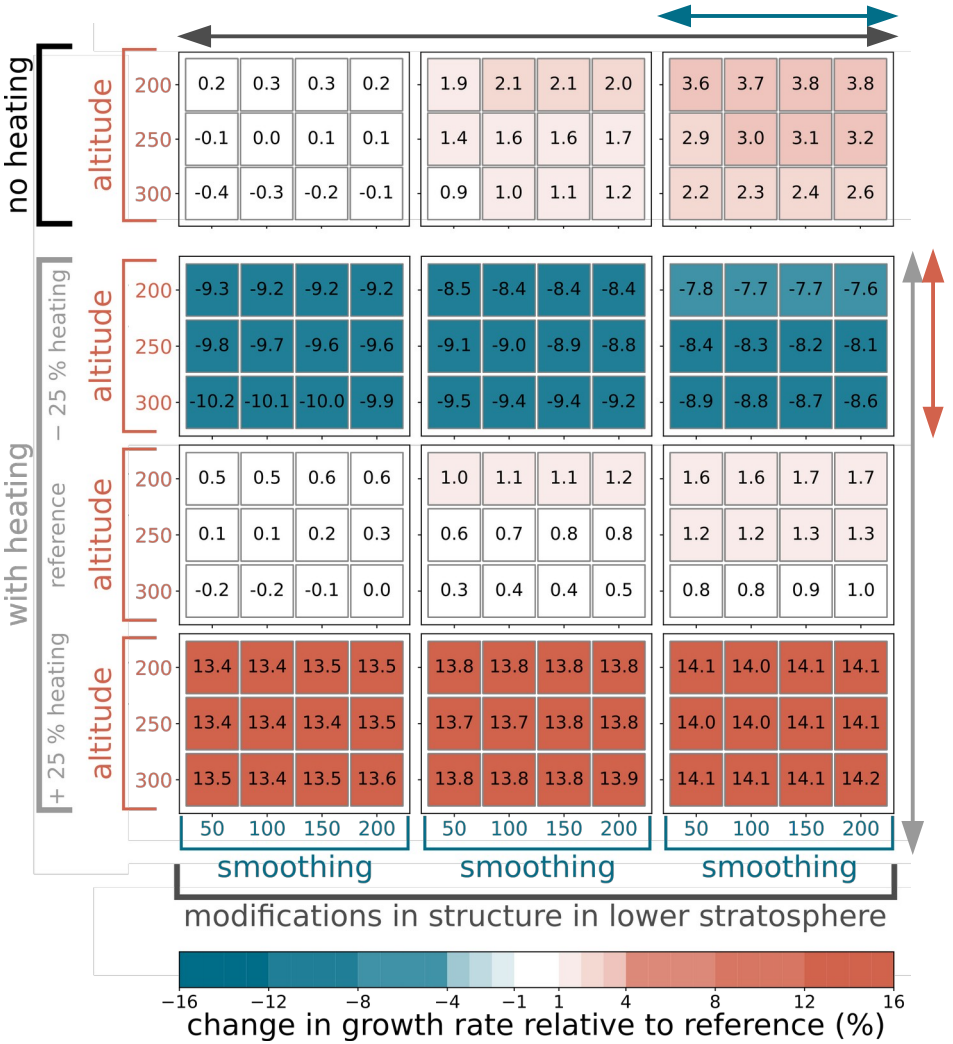
Baroclinic growth rate

and the impact from smoothing



Impact from smoothing (shading)

- Weak increase or decrease due to
  + Improved phase between v and T
  − Weakening of PV gradient
- Negligible for most realistic setting, i.e., jump in stratification and wind shear (**black dot**)



Growth rate sensitivity

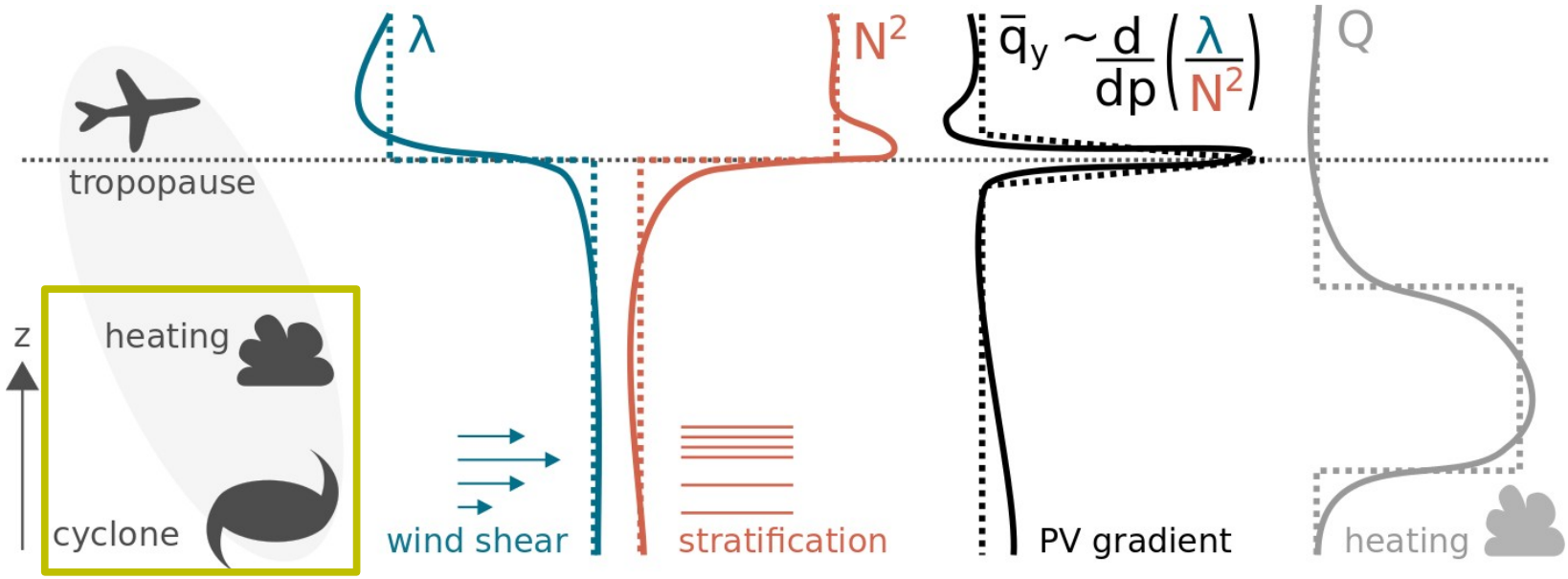
to degree of smoothing, tropopause altitude, structure in lower stratosphere, and latent heating

Change in growth rate relative to reference with sharp tropopause:

- *Weak* sensitivitity to tropopause **smoothing** and **altitude**
- *Moderate* sensitivity to modifications in **structure in lower stratosphere**
- *Strong* sensitivity to **heating intensity**

Take home message

Baroclinic instability is more sensitive to latent heating than tropopause structure



Haualand, K. F. and Spengler, T., Weather Clim. Dynam. Discuss. [preprint], in review, 2021.