

Strong orographic GWD events above the Himalayas associated with anomalously increased upward PW propagation in the stratosphere.

Effects on polar vortex demonstrated and links to SSWs suggested.

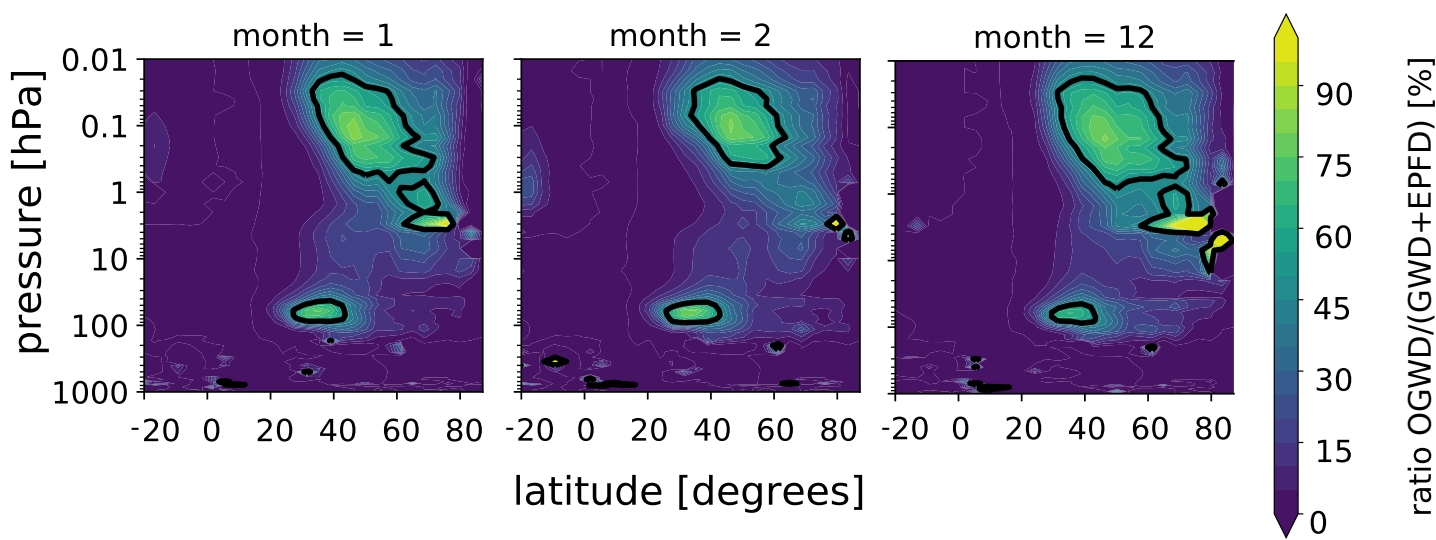
On the impact of the Himalayas on the polar vortex morphology

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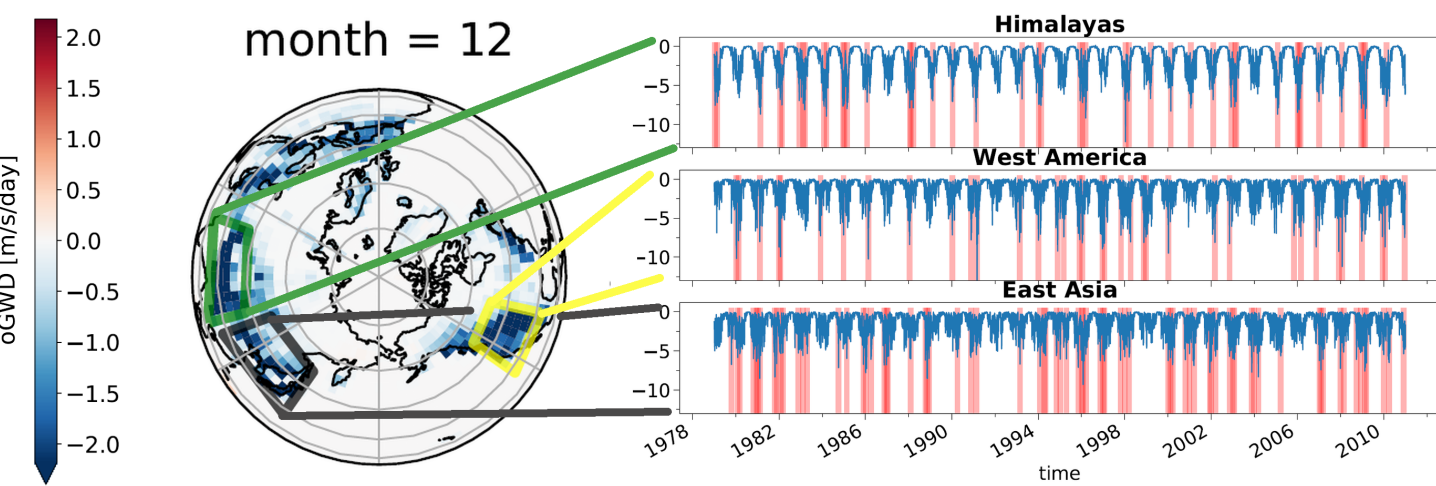
Introduction

The majority of the net drag during boreal winter is constituted by orographic gravity wave drag (OGWD) in the lower stratosphere (LS), i.e. the area of weak winds between sub trop. and PNJ [6].



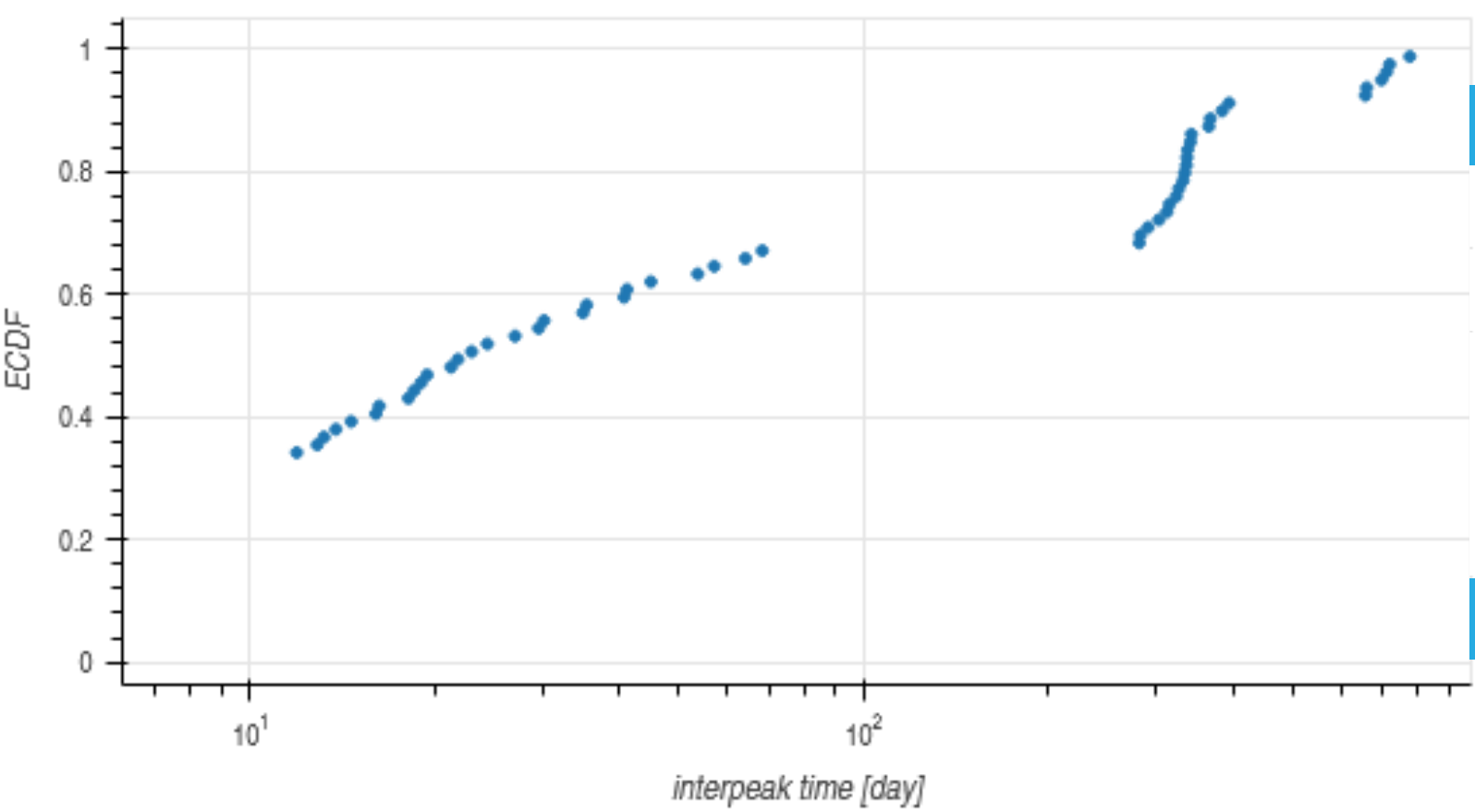
Datasets

- CMAM30-SD [2] model
- total column of ozone from reanalyses: ERA5 [1], MERRA2 [3]



Methods

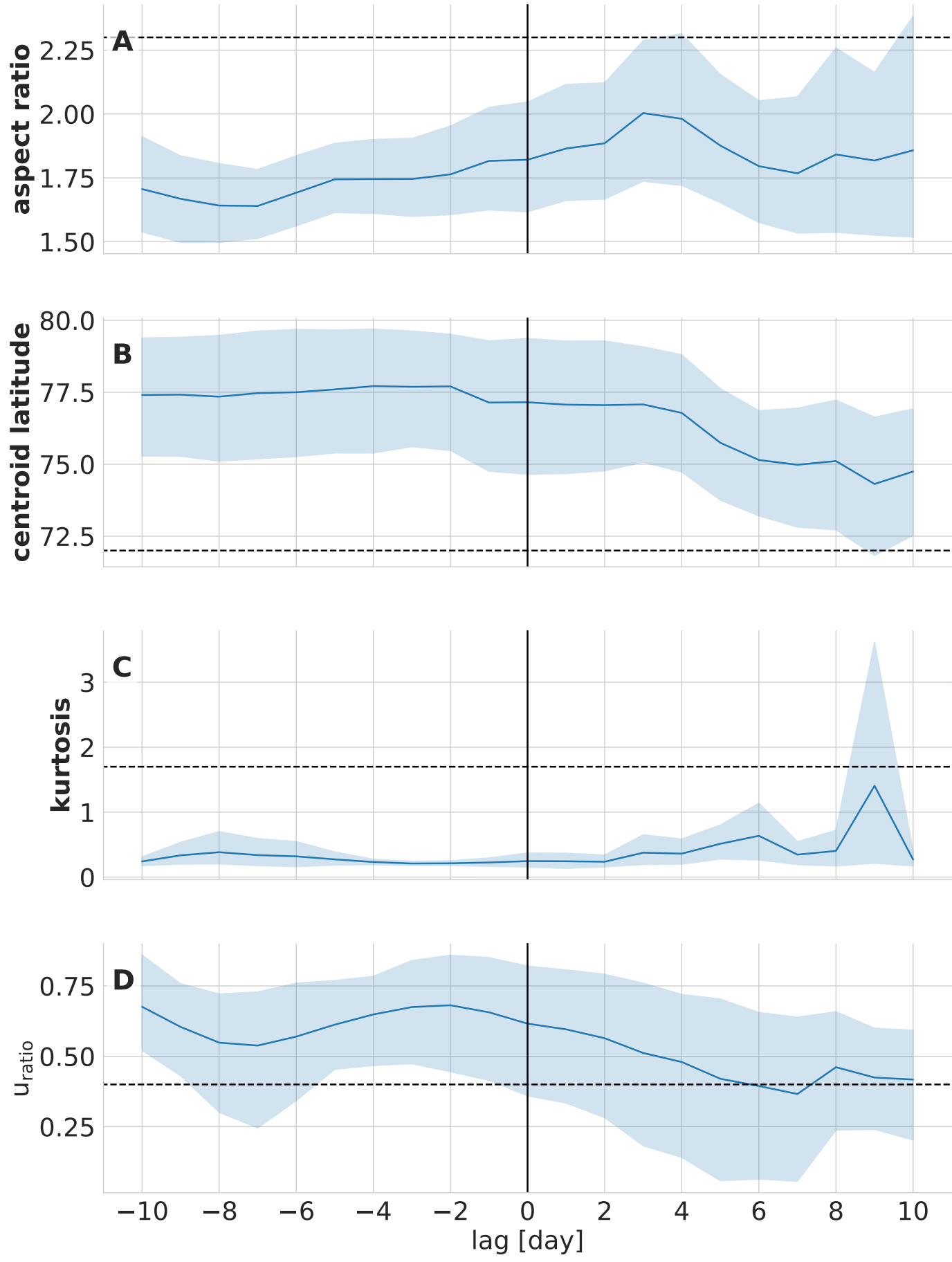
Peak detection algorithm applied on the Himalayas hotspot in LS for detection of strong OGWD events with the 20-day timescale (see Empir. Cum. Distribution Function (ECDF) below)



Wide range of diagnostics: moment diagnostics: aspect ratio, vortex centroid, and kurtosis; Northern annular mode (NAM) index; $u_{ratio} \equiv \bar{u}/u_{REF}$ at 60°N, 10 hPa [4]; Eliassen-Palm flux framework; refractive index [5].

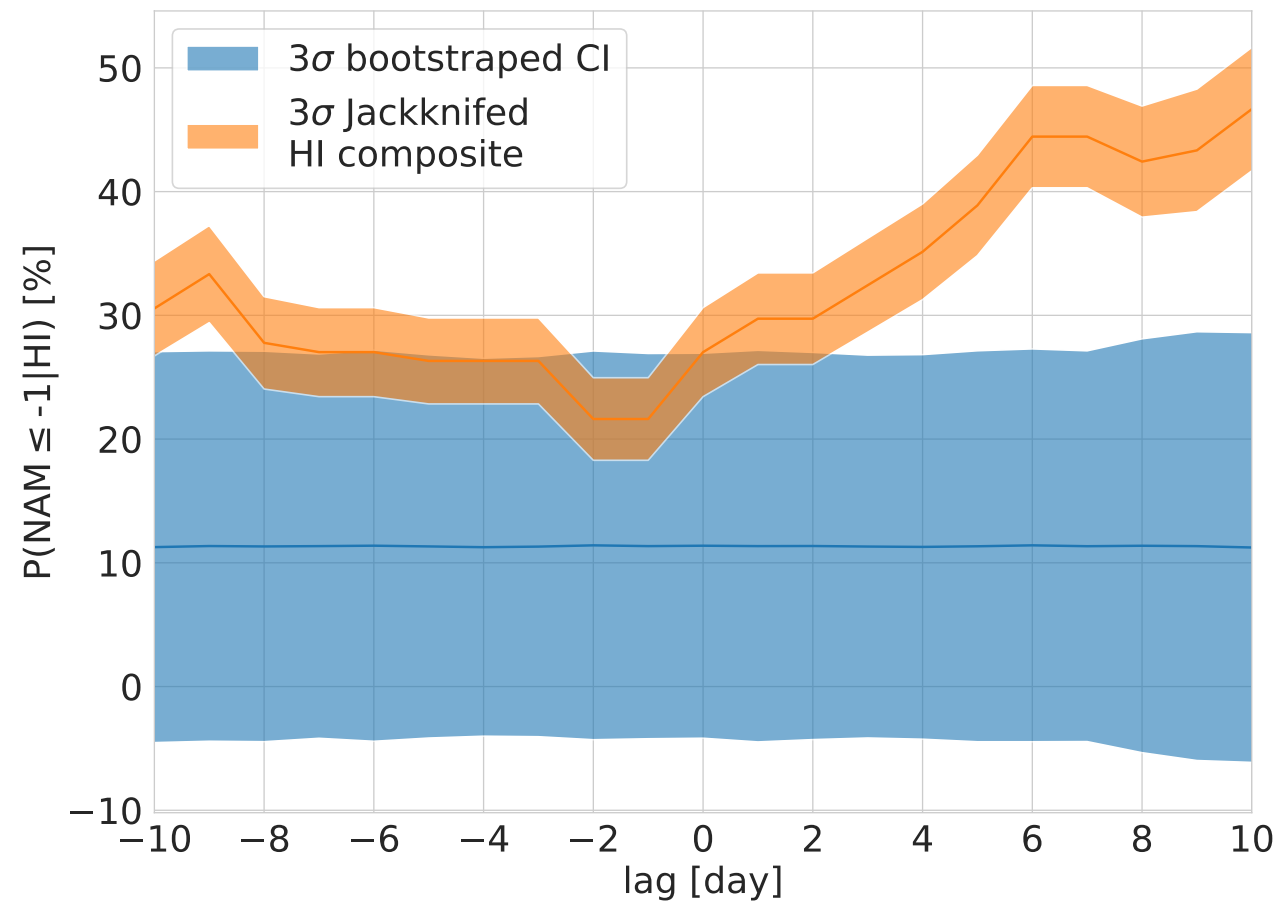
Polar vortex morphology

Strong OGWD events are accompanied by vortex stretching (enhanced WN2) and followed by displacement (enhanced WN1).



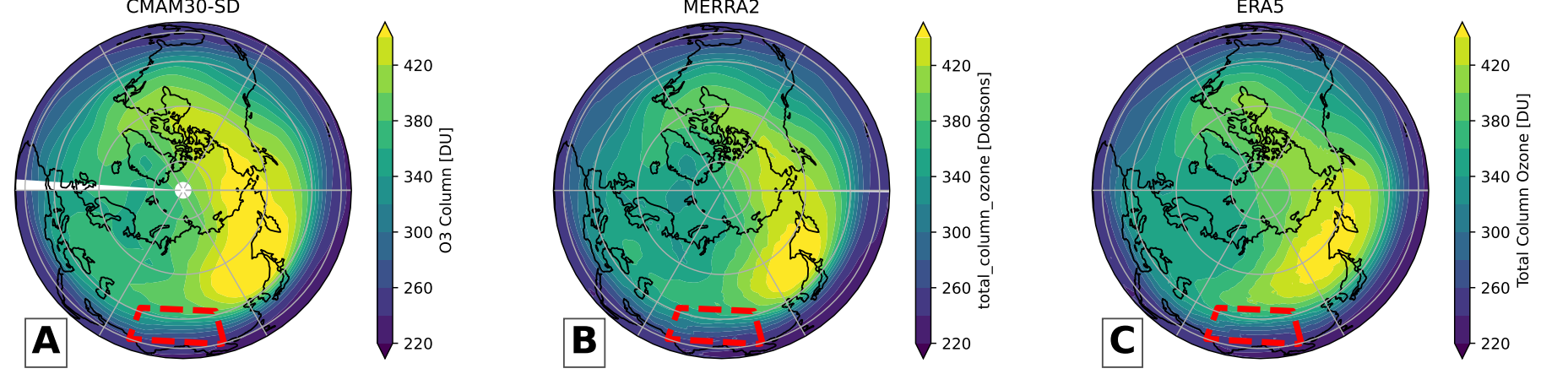
Impact on NAM

Probability of the occurrence of weak PV increased up to 50% – vortex preconditioning.



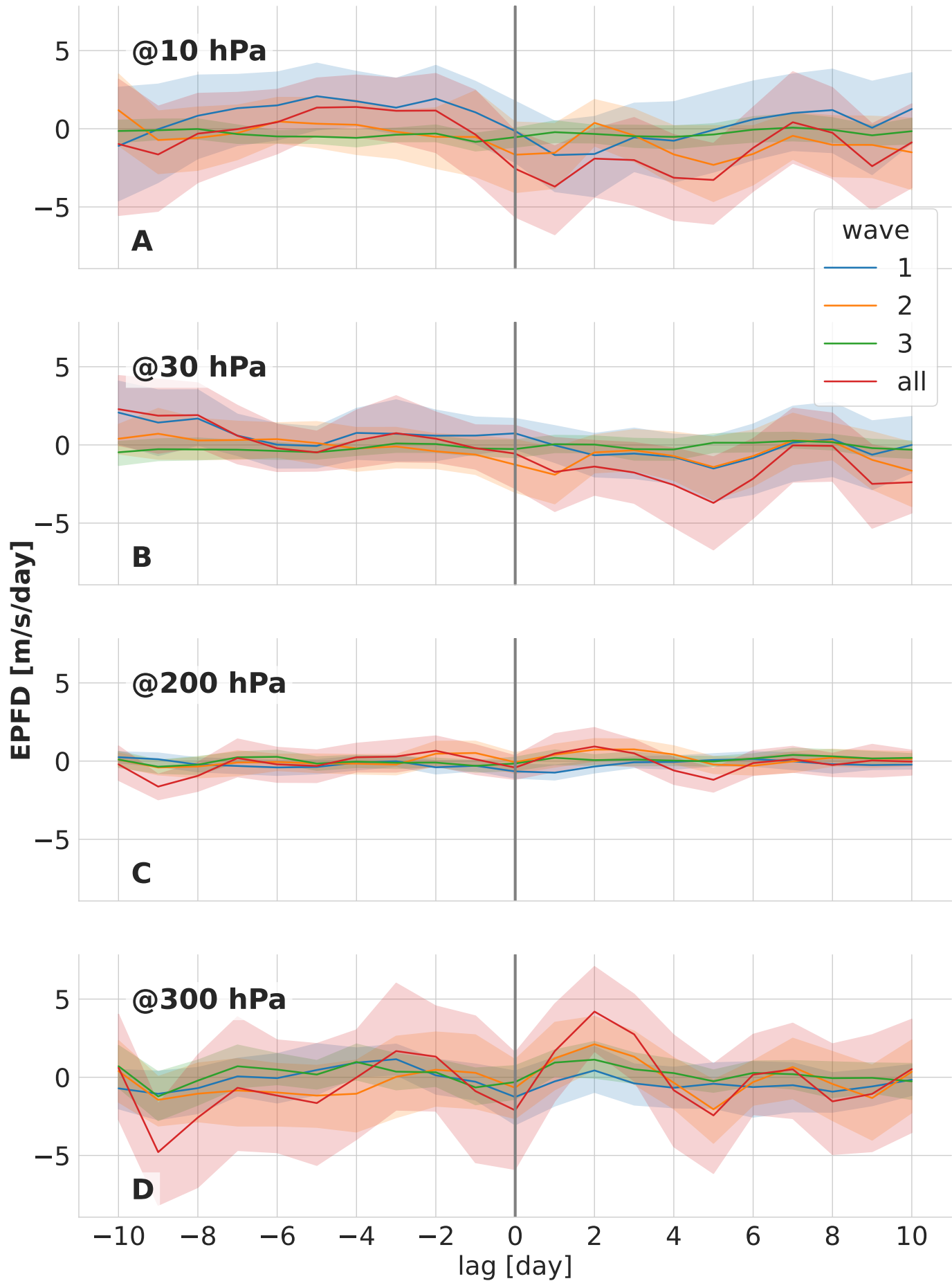
Impact on ozone

Values > 400 DU NE of the HI hotspot. Patterns in agreement with reanalyses. Ozone intrusion via mixing or advection from lower latitudes.



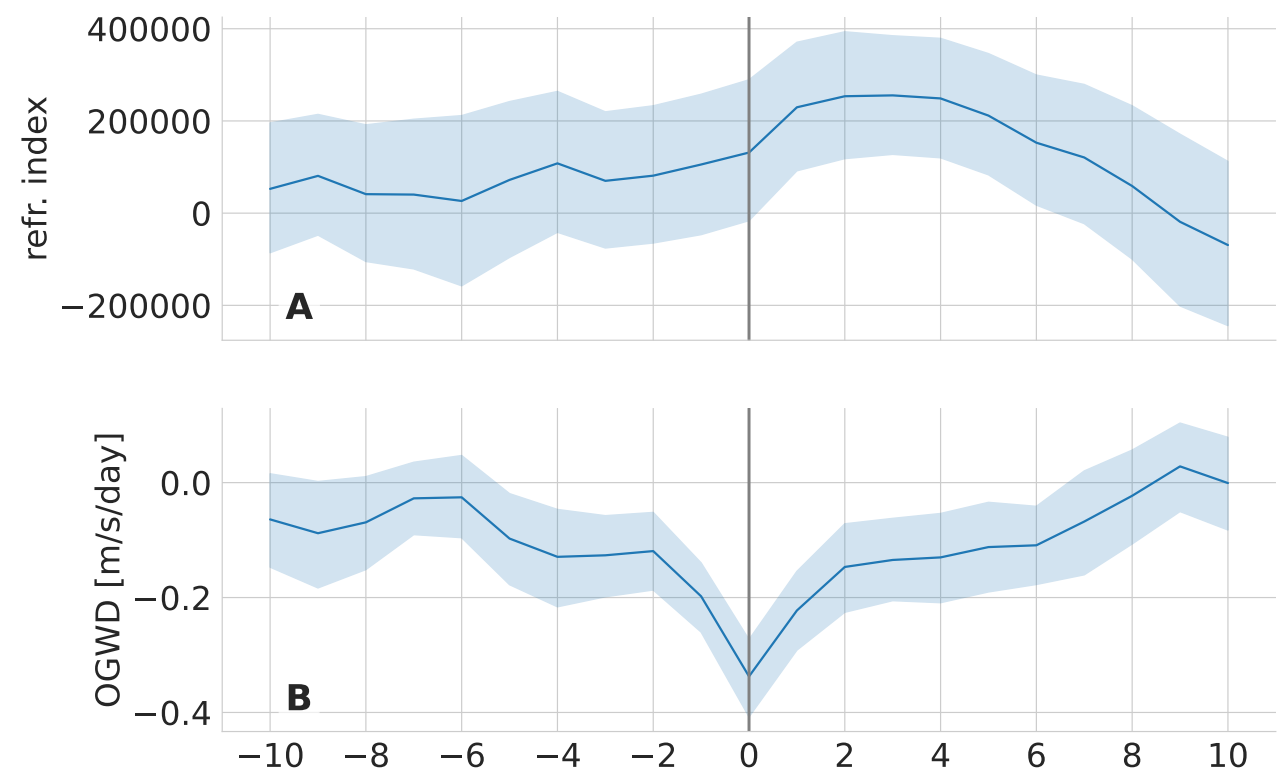
Eliassen-Palm flux discussion

Resolved wave forcing responds to OGWD events. Indication of ↑PW sourcing around the tropopause.



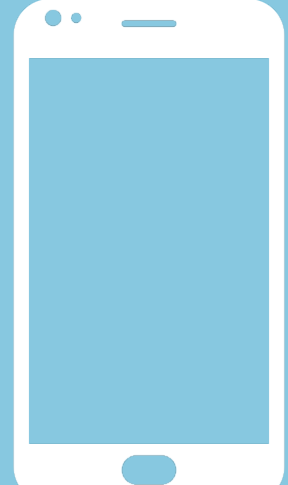
Future outlook

Refr. index controlling the vertical wave propagation into the stratosphere [7]. Any connection between OGWD and biases in CMIP5(6)?



References

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