ISENTROPIC TRANSPORT OF WATER VAPOR INTO THE EXTRA-TROPICAL LOWER STRATOSPHERE

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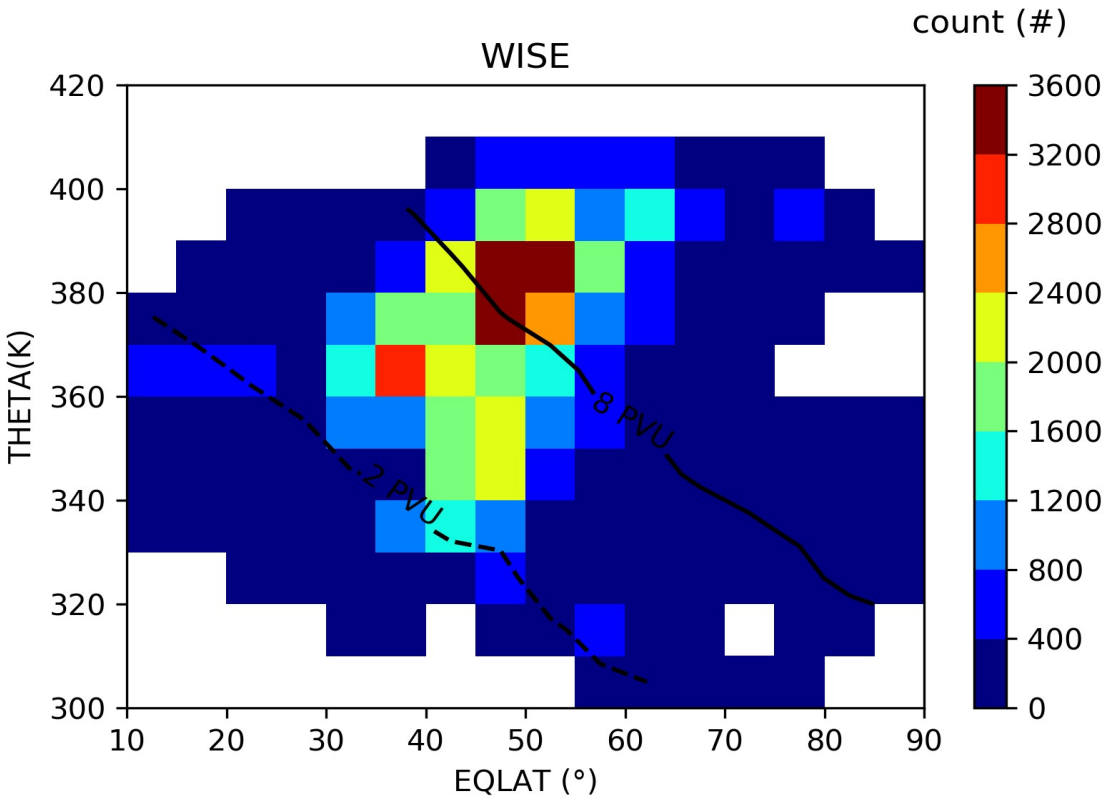
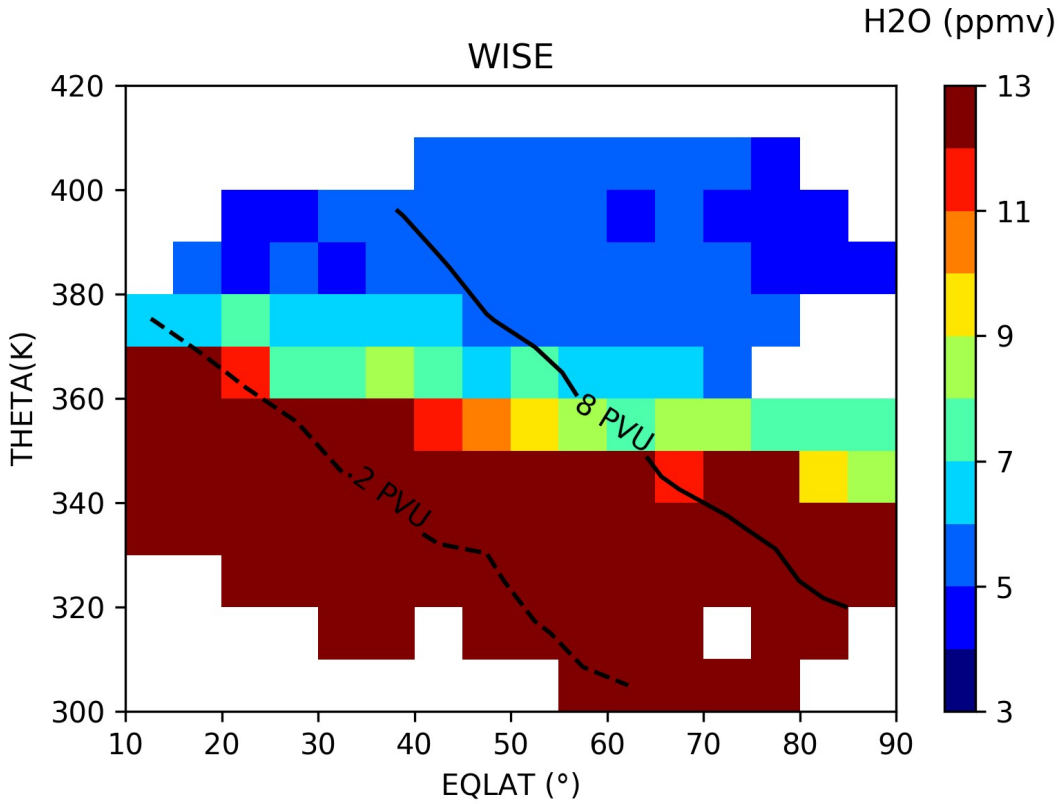
WISE AIRCRAFT CAMPAIGN SEPTEMBER/OCTOBER 2017

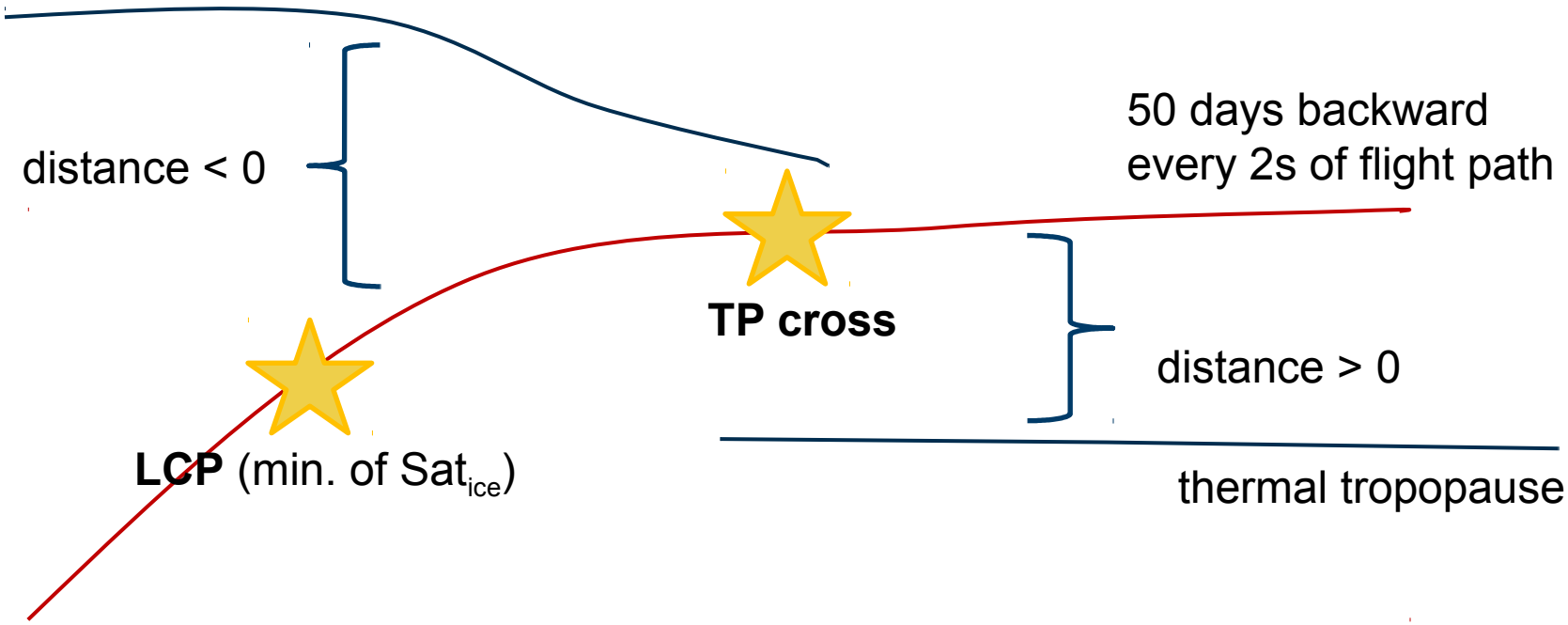


Number of 1Hz water vapor data points



Mean water vapor distribution in the Northern Hemisphere

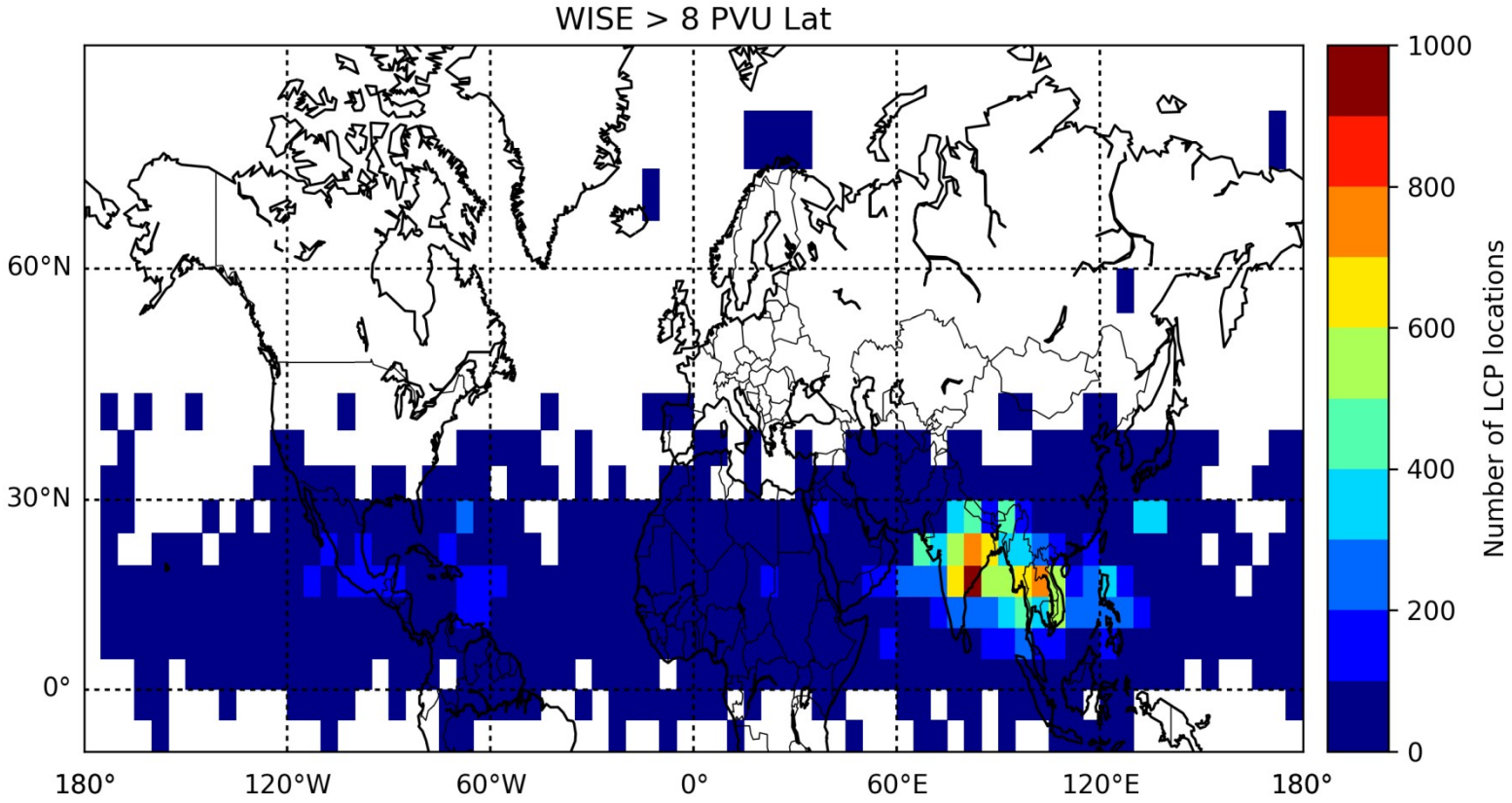
Flightpath back-trajectories with Location of Lagrangian cold point (LCP)



- Trajectories selected which account for transport of air masses from the troposphere -> stratosphere (tropospheric origin)

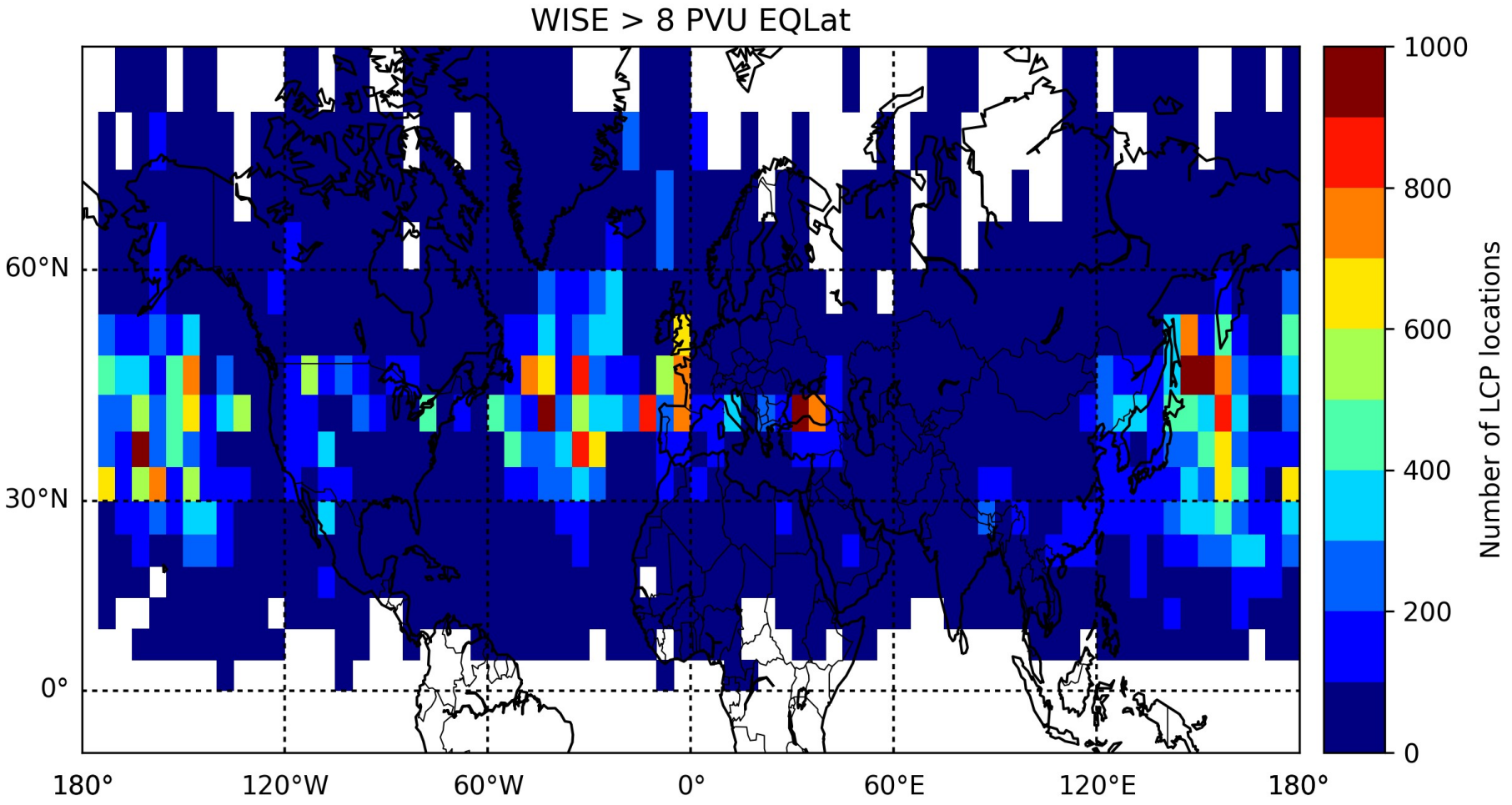
- Tropopause crossing (**TPcross**) and the Lagrangian cold point (**LCP**) are not neccesarryly the same (Rolf et al., ACP, 2018)

LCP OCCURRENCE ALONG TRAJECTORIES



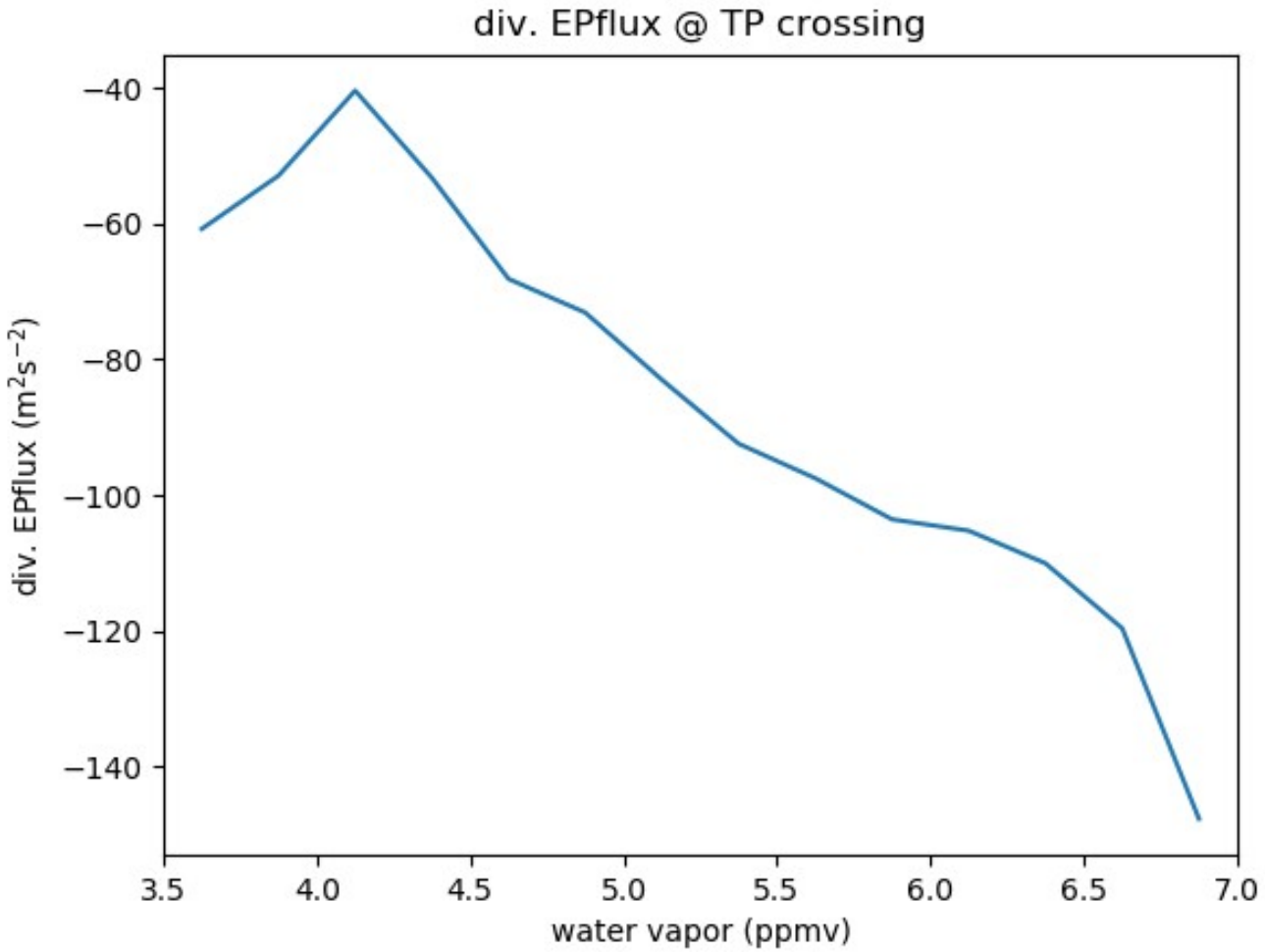
- Dominant region of Lagrangian cold points is the Asian monsoon region
- Lagrangian cold point is setting the amount of water vapor which could be potentially transported
- Air masses during WISE above 8 PVU are mostly affected by air originating from the Asian monsoon region

1. TP CROSS OCCURRENCE ALONG TRAJECTORIES



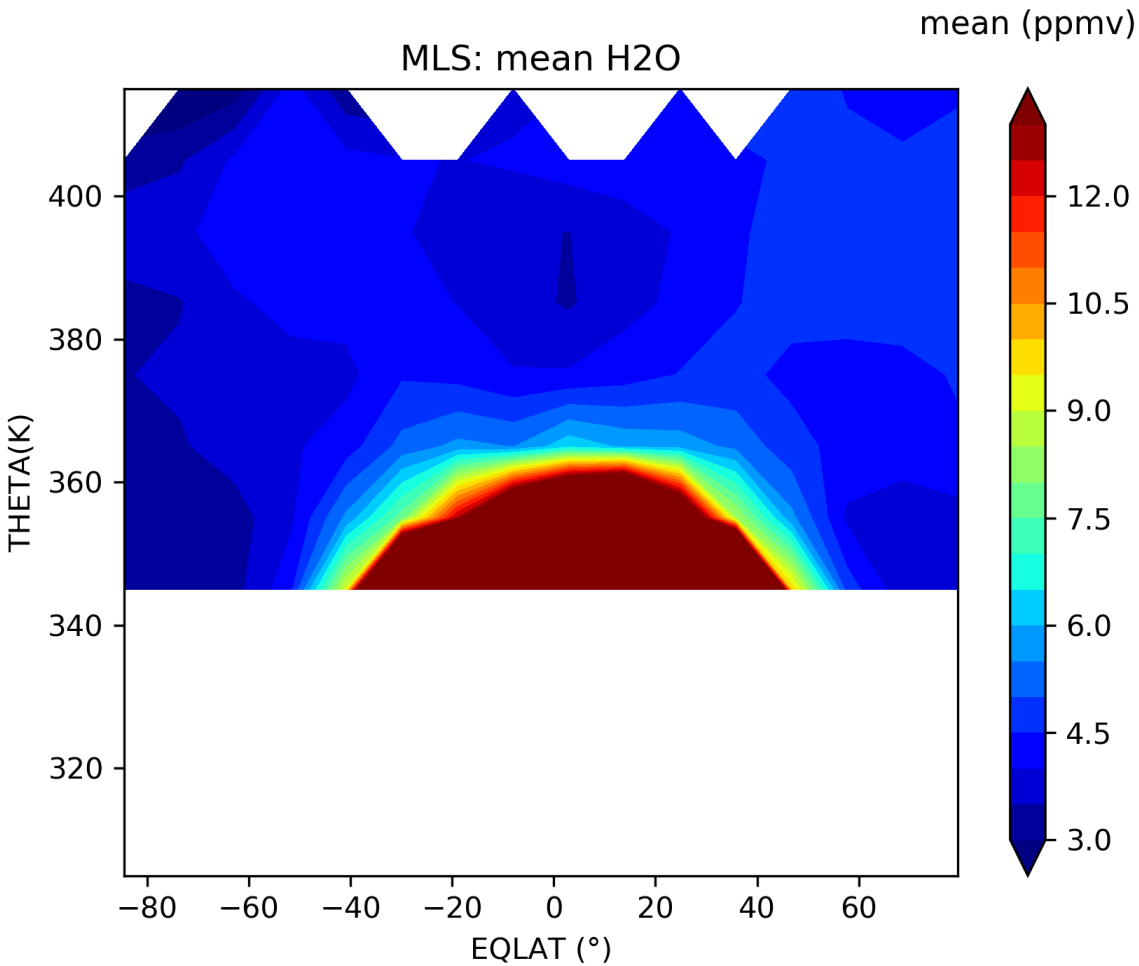
- Dominant regions of tropopause crossing are ocean regions larger than 30 degrees North
- Rossby wave breaking occurs typically at those locations and transports wet air masses from the tropics into the extratropical lower stratosphere

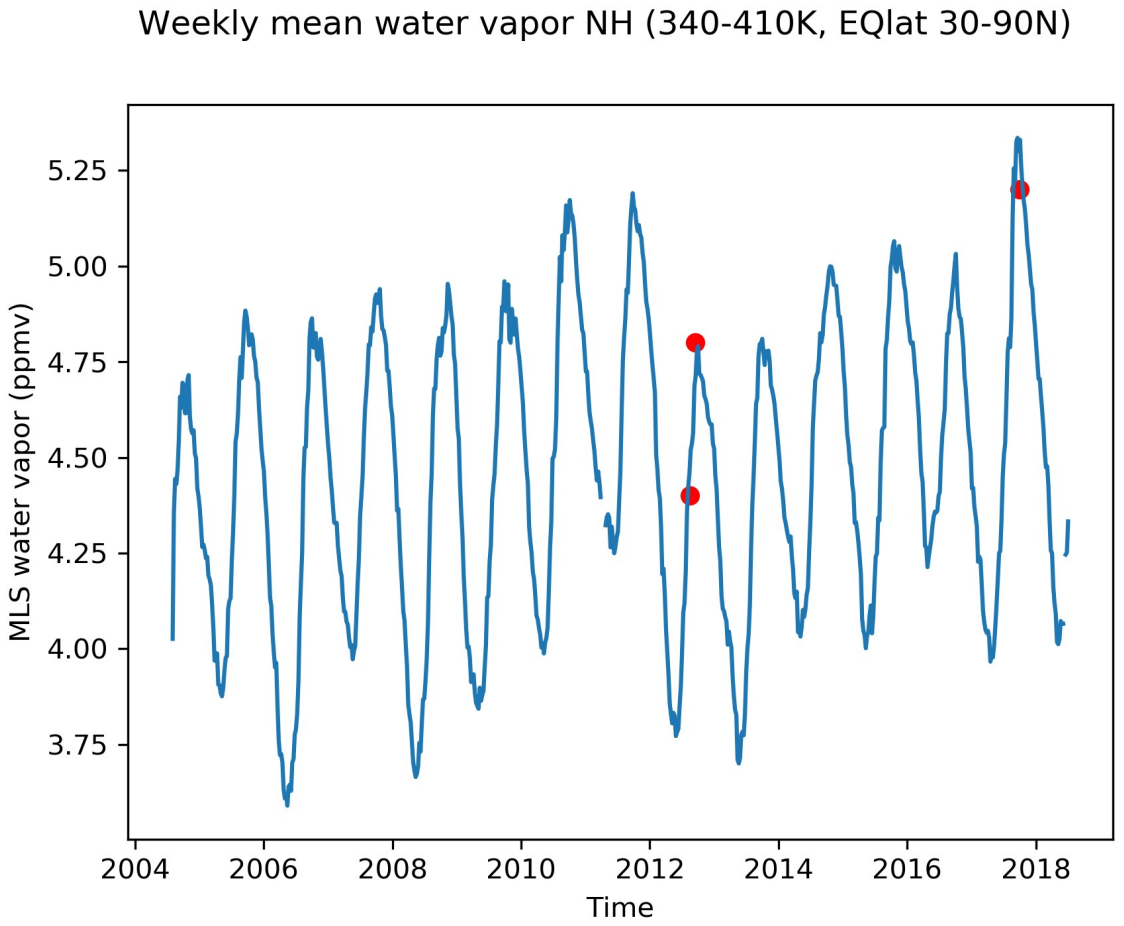
EPFLUX AND LAT/EQLAT @ TP CROSS



- EP Flux divergence as indicator for irreversible Rossby wave breaking is interpolated along trajectories
- Epflux divergence at the location of tropopause crossing is increased, if water vapor concentration in the lower stratosphere is increased
- Indication that Epflux is directly correlated with water vapor mixed into the exLS

MLS SATELLITE DATA VS. FISH IN-SITU DATA

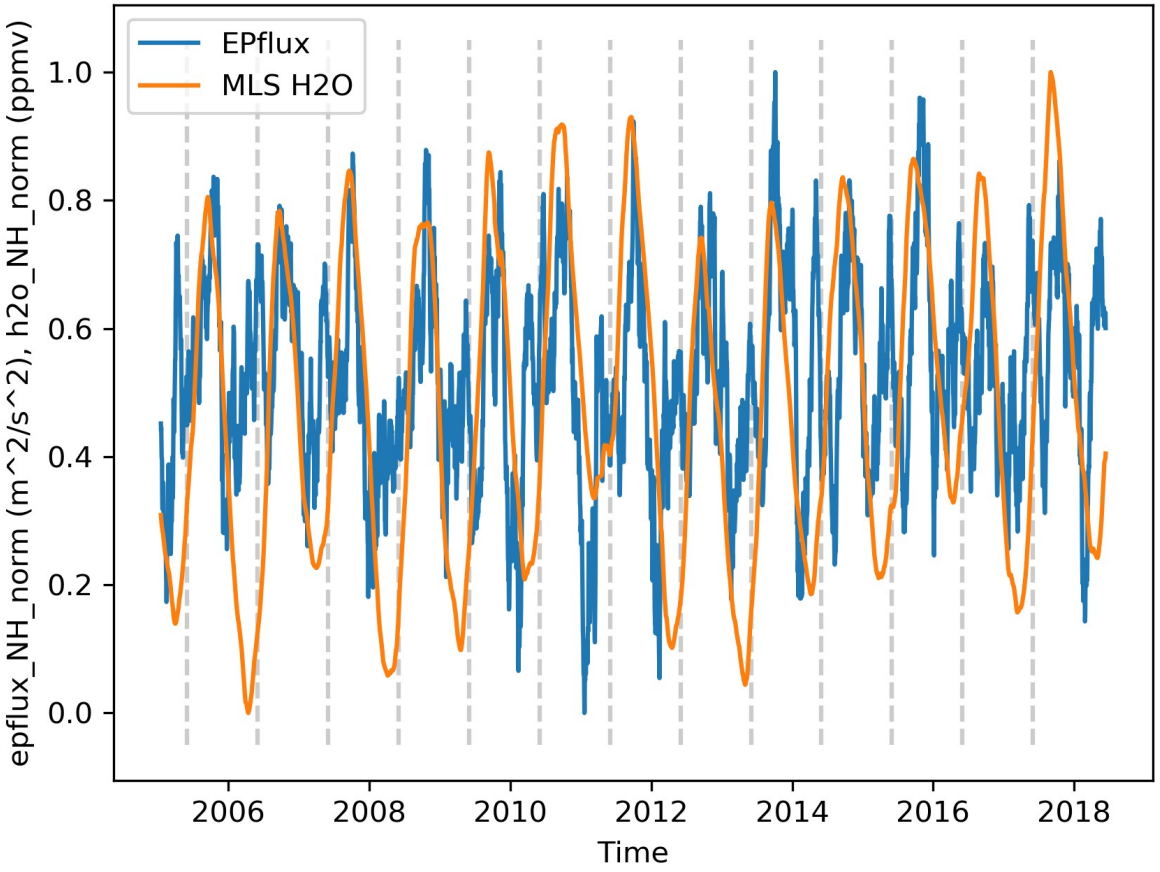


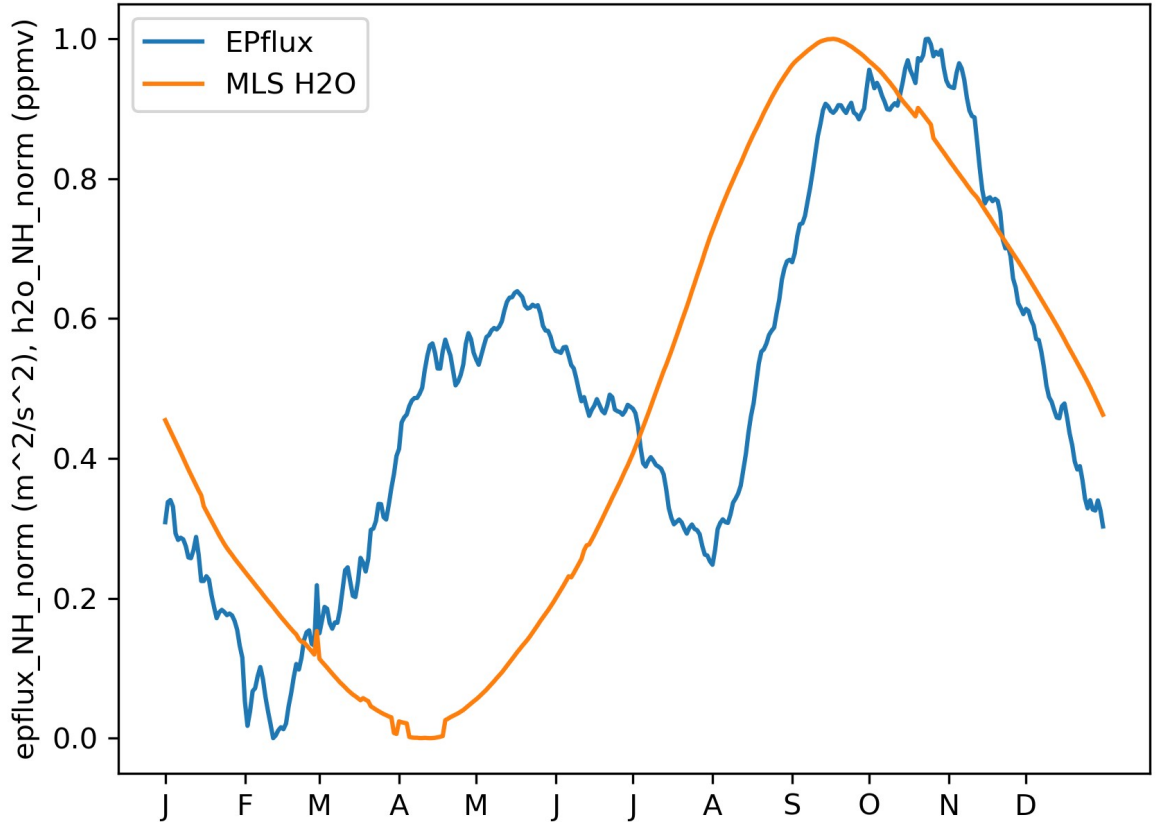


MLS water vapor timeseries is matched by campaign based in-situ measurements (red dots)

MLS VS. EPFLUX DIV. LAT+THETA

daily epflux_NH_norm, MLS h2o_NH_norm (360-410K, eqlat 30-60) Average_year epflux_NH_norm, MLS h2o_NH_norm (360-410K, eqlat 30-6





- MLS water vapor timeseries is correlated with Epflux divergence

CONCLUSION

- Water vapor in-situ measurements from research aircraft campaigns are representative for water vapor distribution in the lower stratosphere
- Airmass Lagrangian Cold Point are located in the monsoon circulations (e.g. Asian, American Monsoon)
- Locations of tropopause crossing can be found mostly above 30 in regions with strong Rossby wave activity
- Time series of MLS water vapor in the LS is correlated with EPflux divergence