

# Different behavior of ASM transport on long-lived and short-lived chemical species

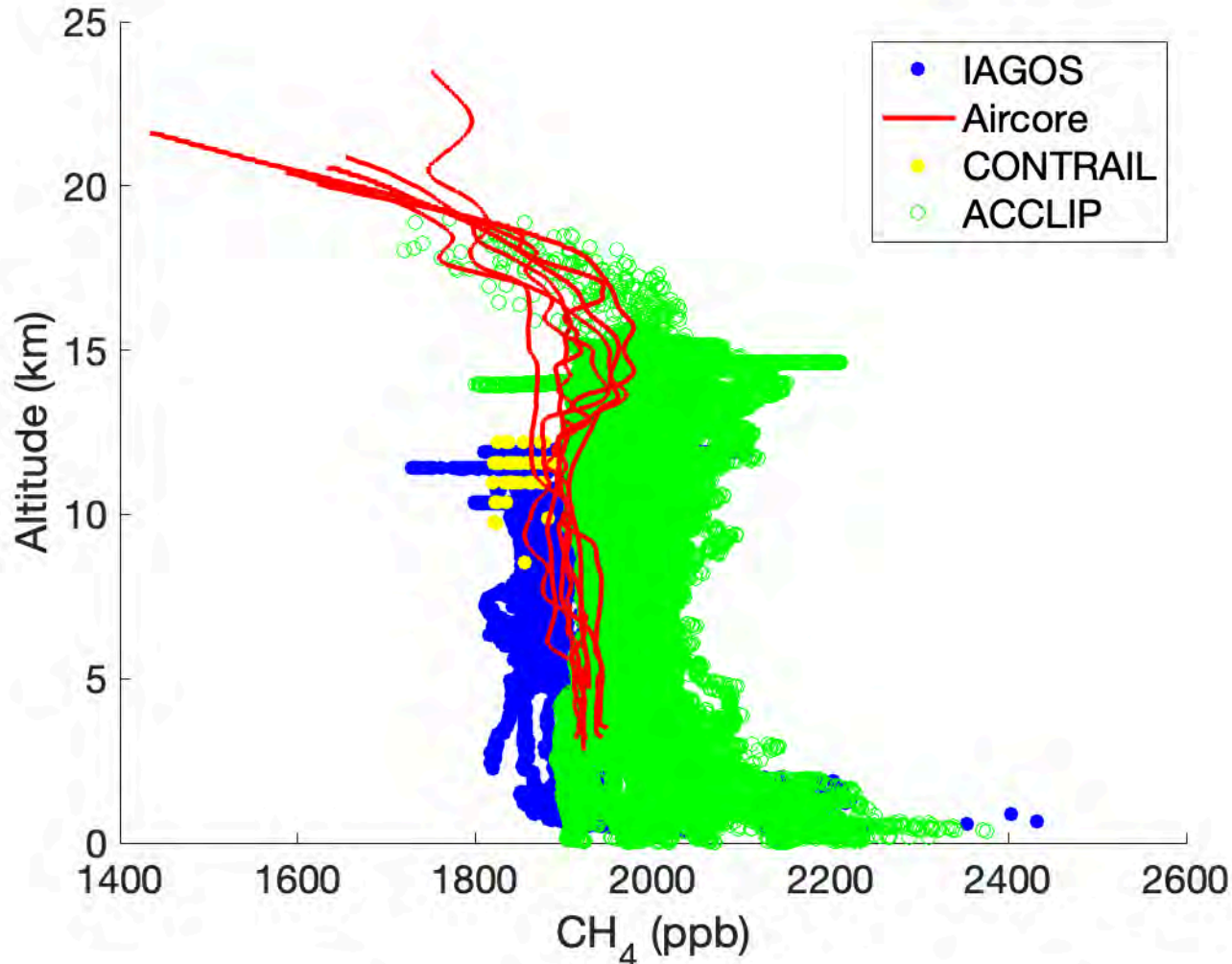
Joy Yi, Laura Pan, Bill Randel

With contribution from Teresa Campos, Sunran Lee, and Ren Smith

ACCLIP science team meeting

2024-04-30

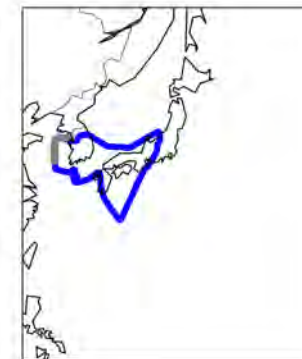
# Methane profiles over ASM region



CH<sub>4</sub> measurement inter-comparison among  
**IAGOS** (2015-2020),  
**AirCore** (2019-2020),  
**CONTRAIL** (2015) and  
**ACCLIP** (2022)

- CH<sub>4</sub> enhancement at upper troposphere
- Largest CH<sub>4</sub> mixing ratios at UT during ACCLIP

# ACCLIP GV vs. KMA



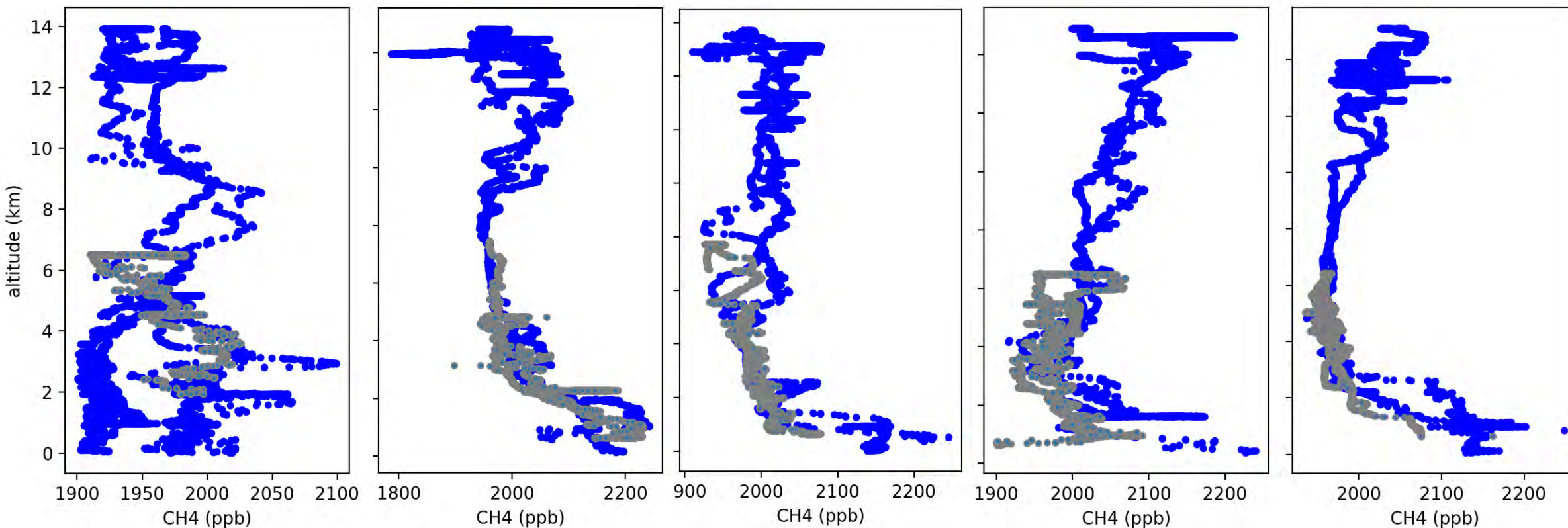
20220804

20220806

20220816

20220819

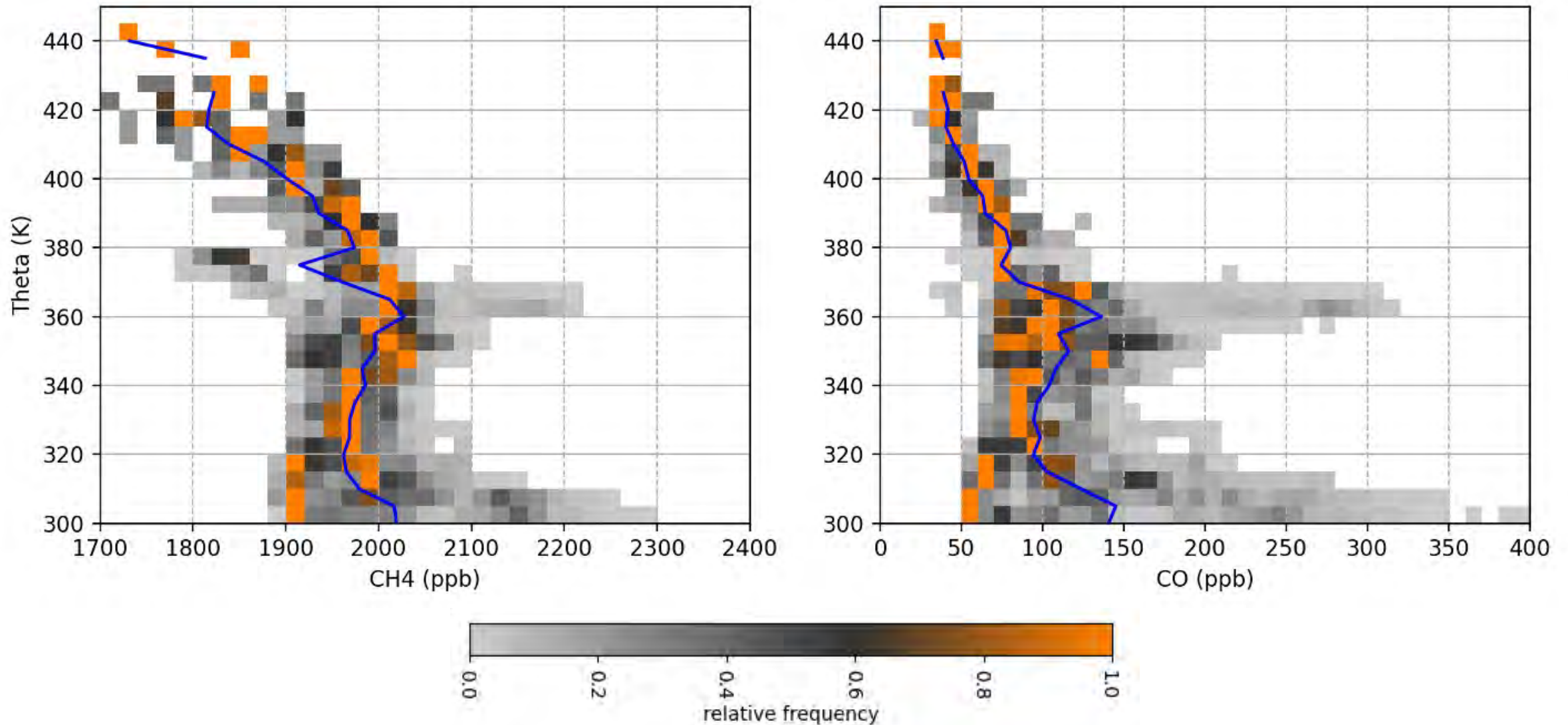
20220826



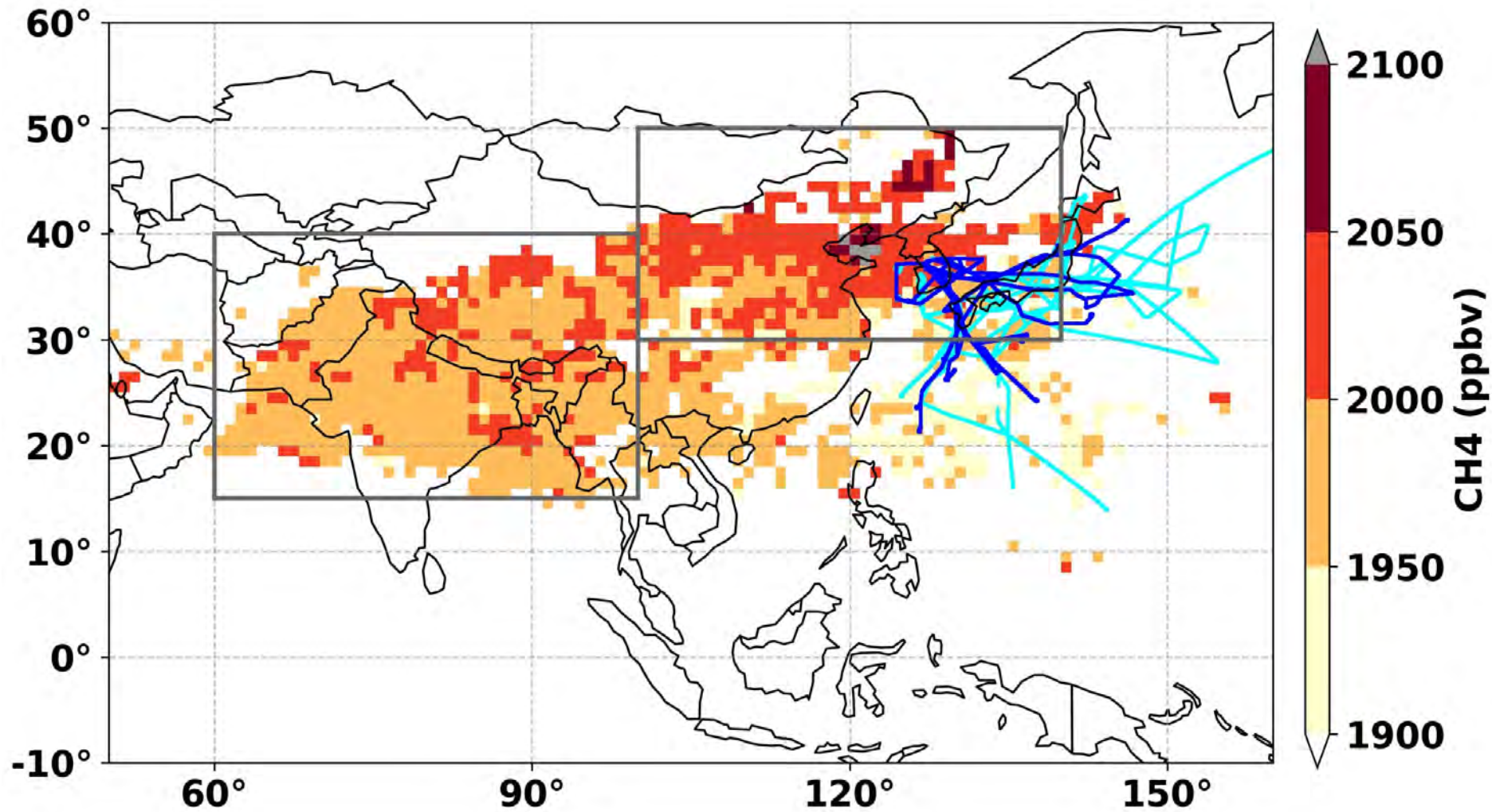
Courtesy Teresa Campos and Sunran Lee

# CH<sub>4</sub> and CO vertical structure during ACCLIP

Both GV and WB-57 data

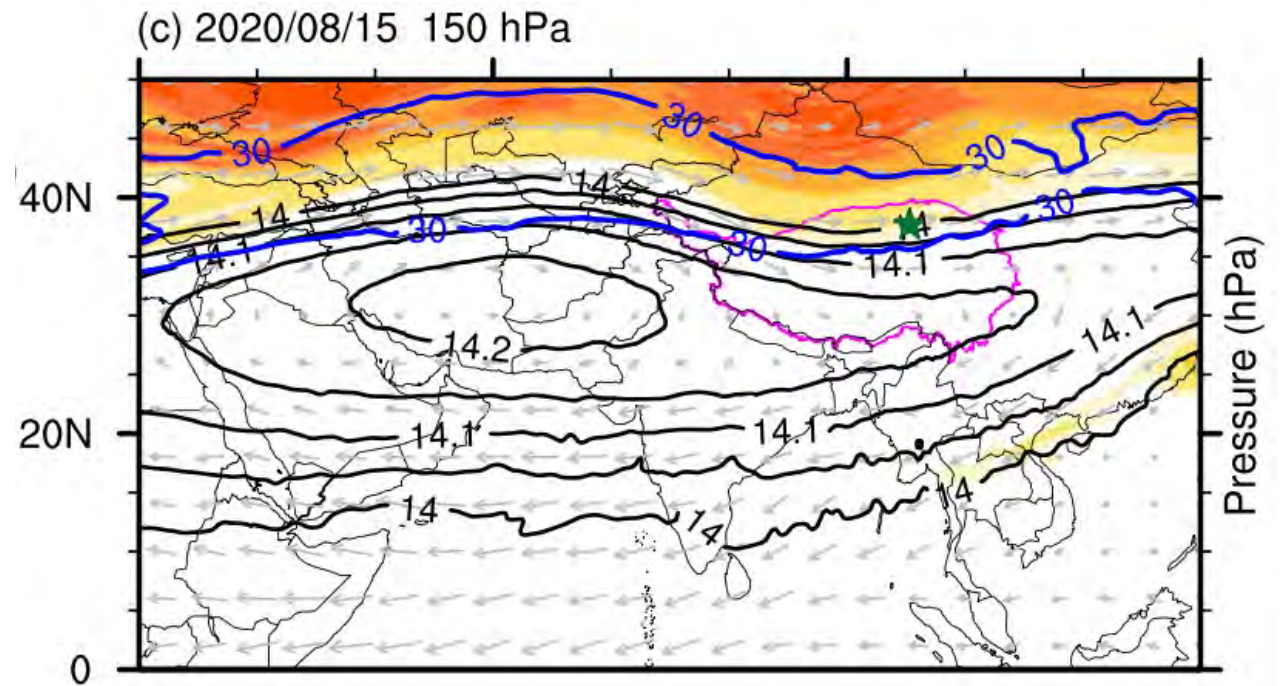
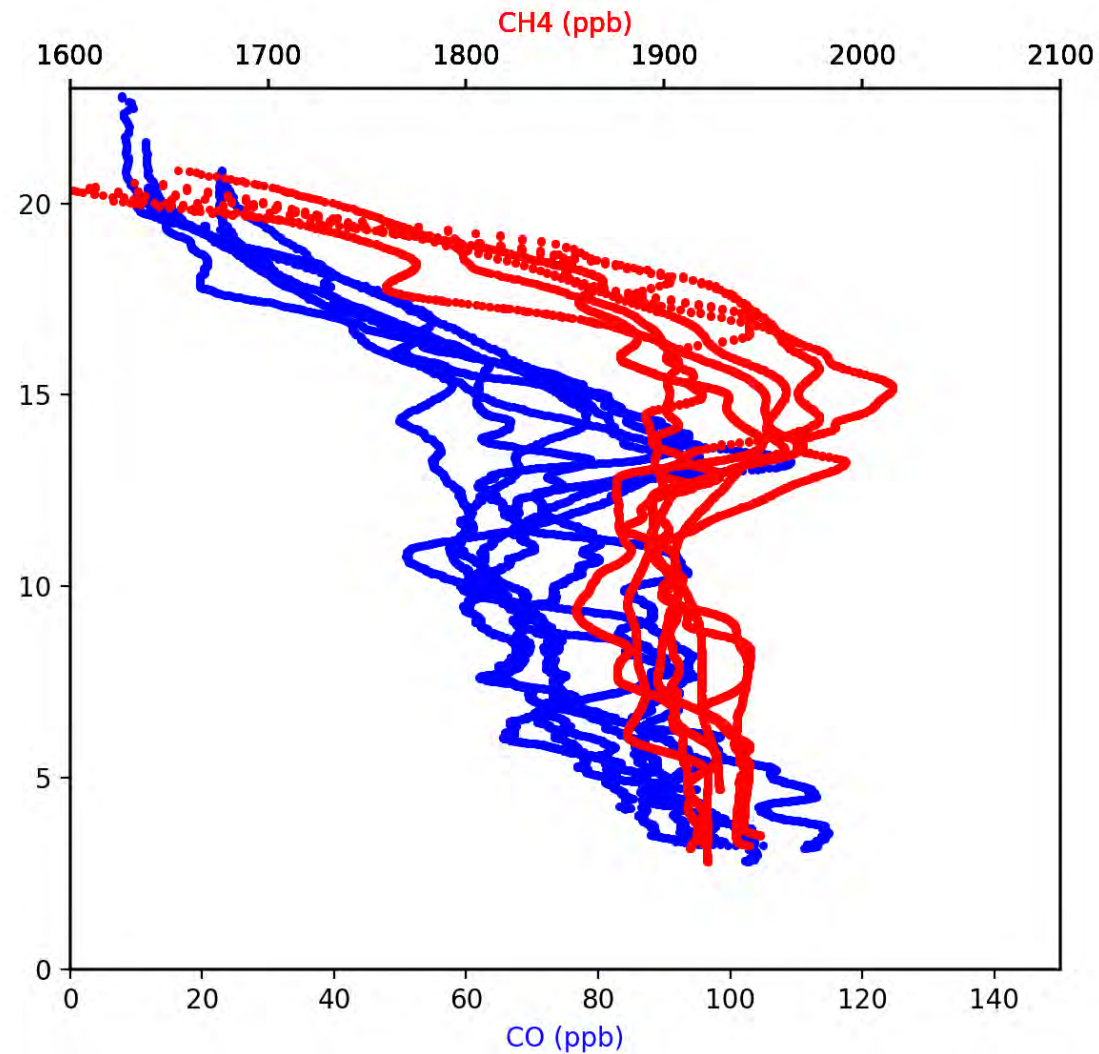


# Convective Transport Origin of CH<sub>4</sub> at UT during ACCLIP



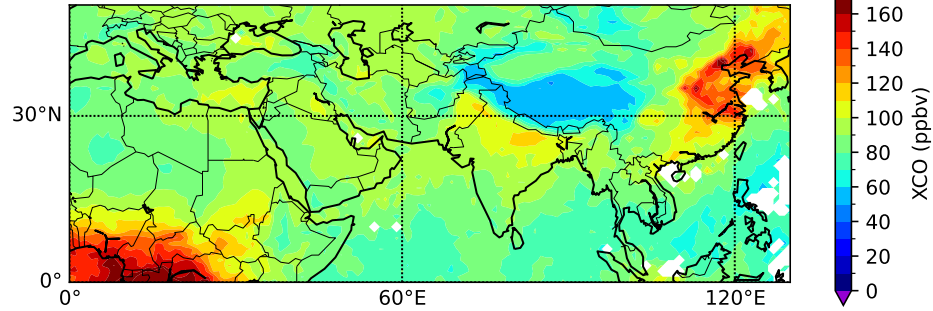
Courtesy Ren Smith

# CH<sub>4</sub> and CO from AirCore on Tibetan Plateau

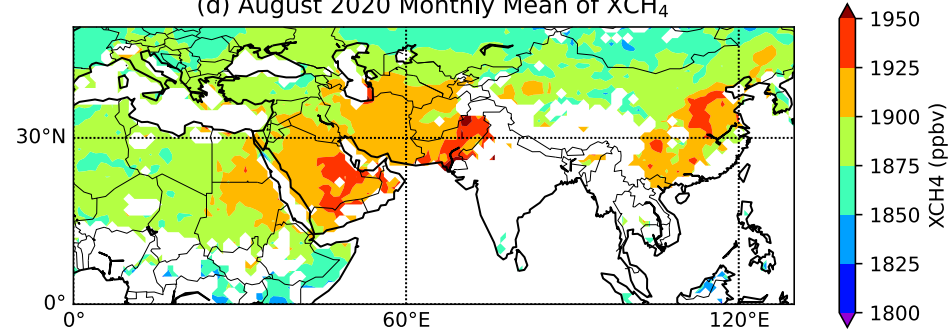


# High CH<sub>4</sub> and CO transport pathway

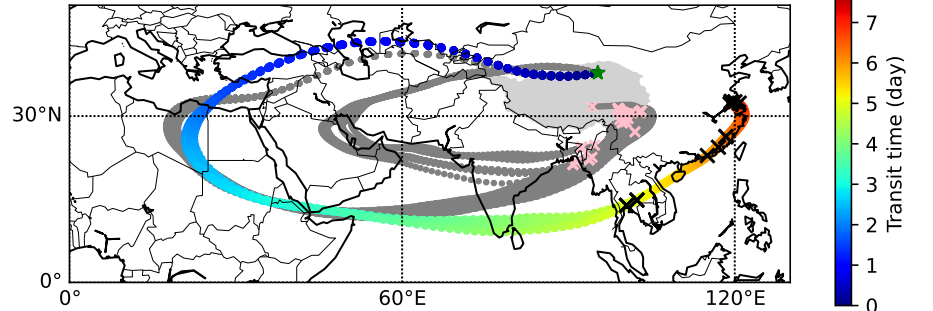
(a) August 2020 Monthly Mean of XCO



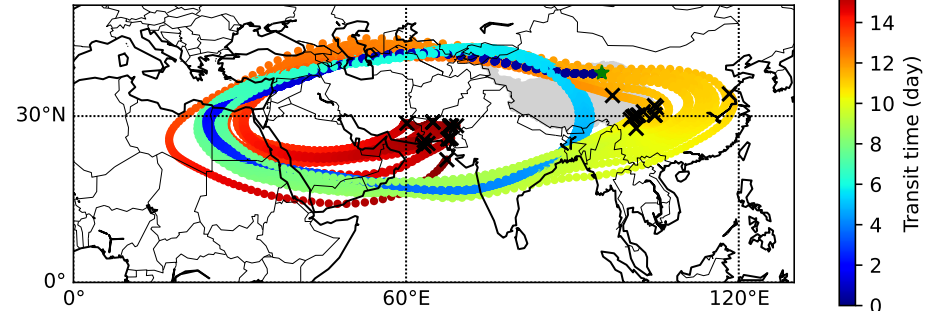
(d) August 2020 Monthly Mean of XCH<sub>4</sub>



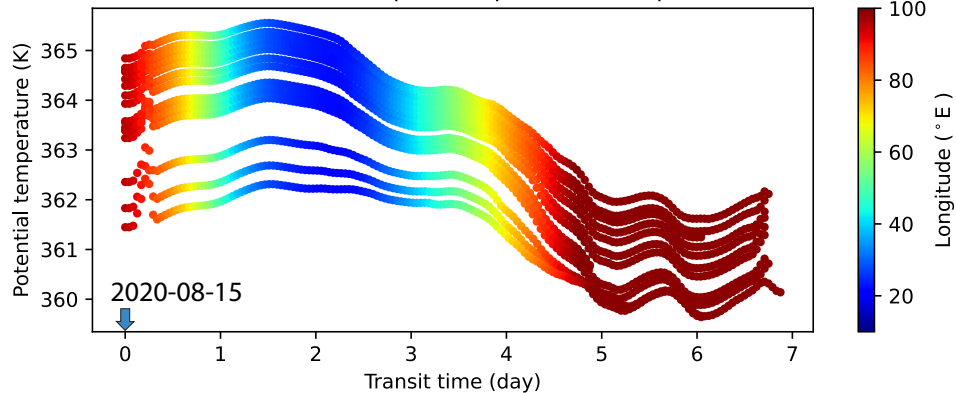
(b) Back trajectories of air parcels near CO maximum



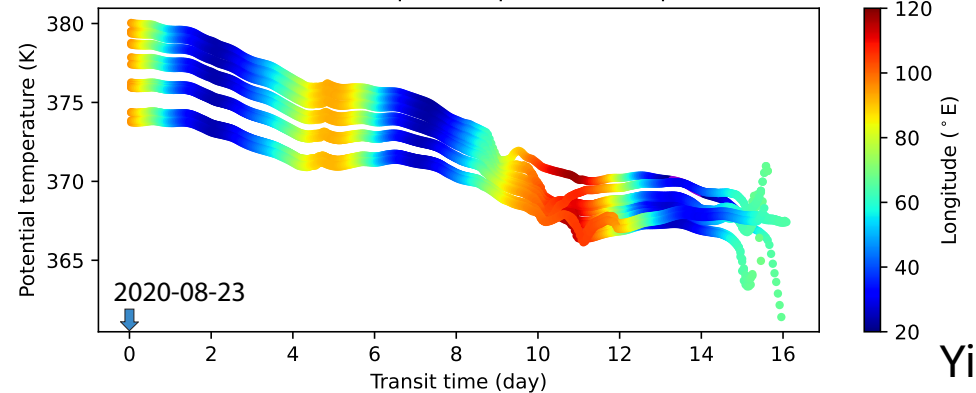
(e) Back trajectories of air parcels near CH<sub>4</sub> maximum



(c) Timeseries of air parcels' potential temperature

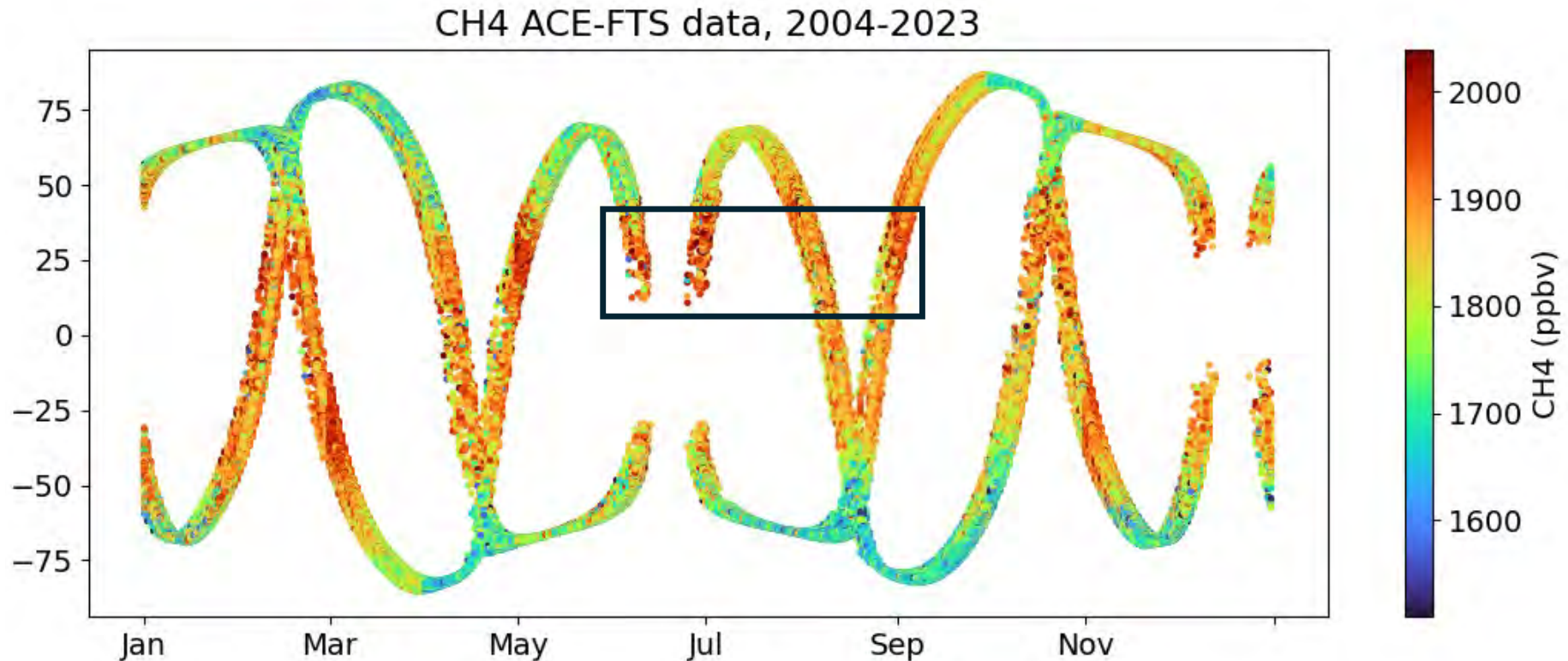


(f) Timeseries of air parcels' potential temperature



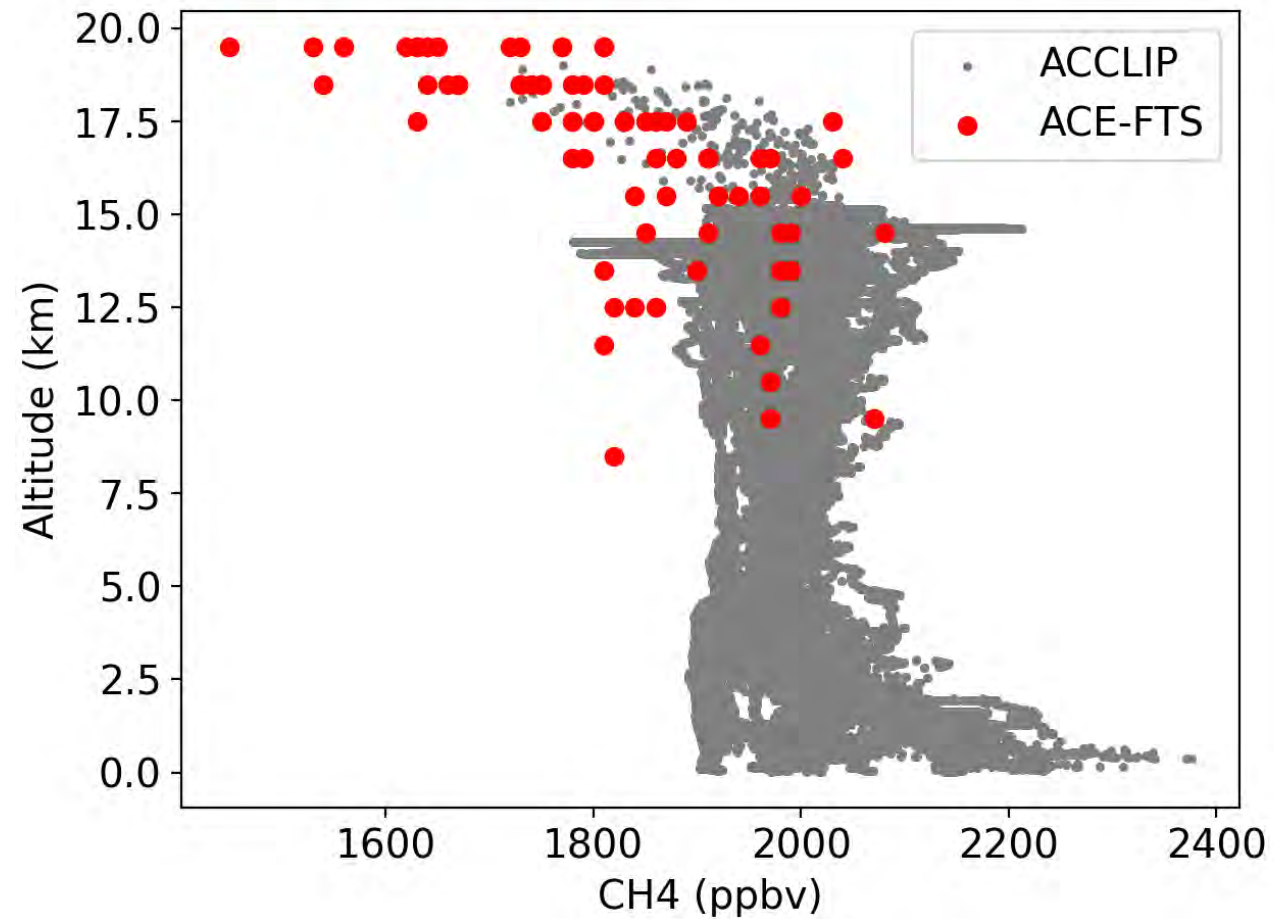
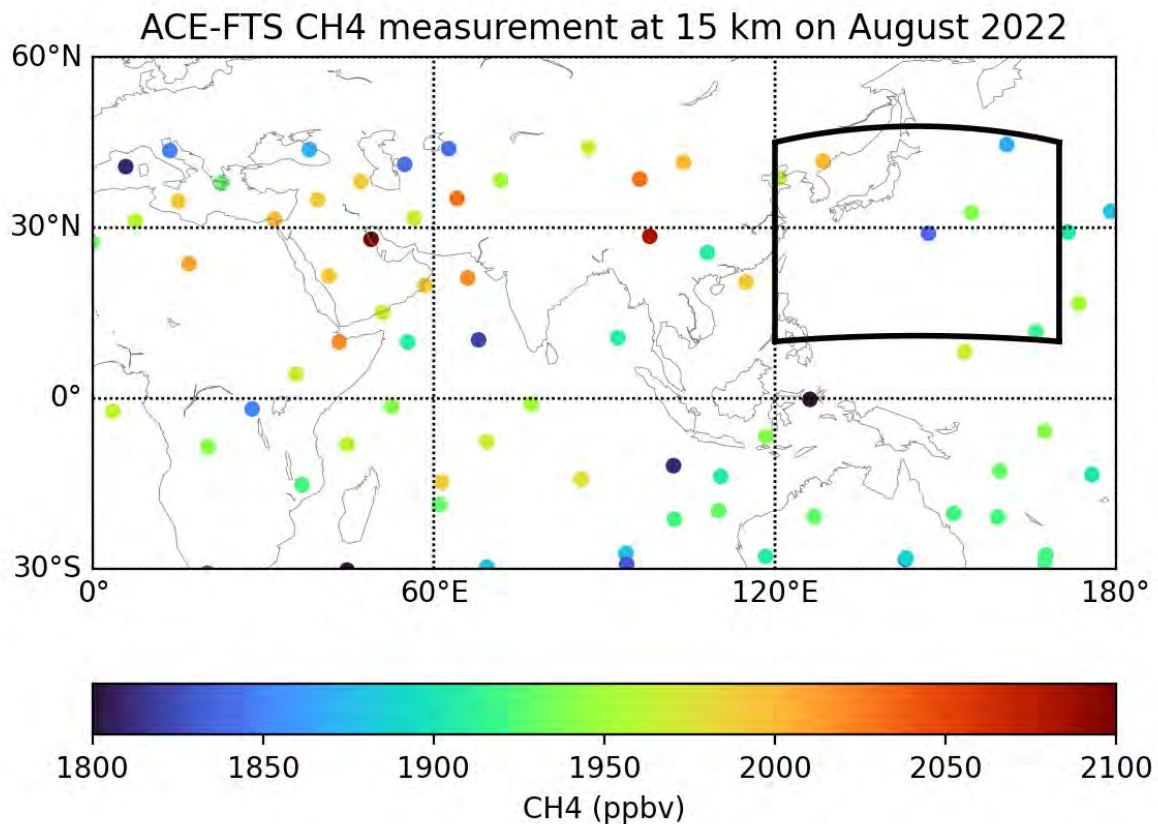
# ACE-FTS v5.3 retrieval

- Solar occultation measurement technique
- 15 profiles for sunrise, 15 profiles for sunset, totally 30 profiles/day

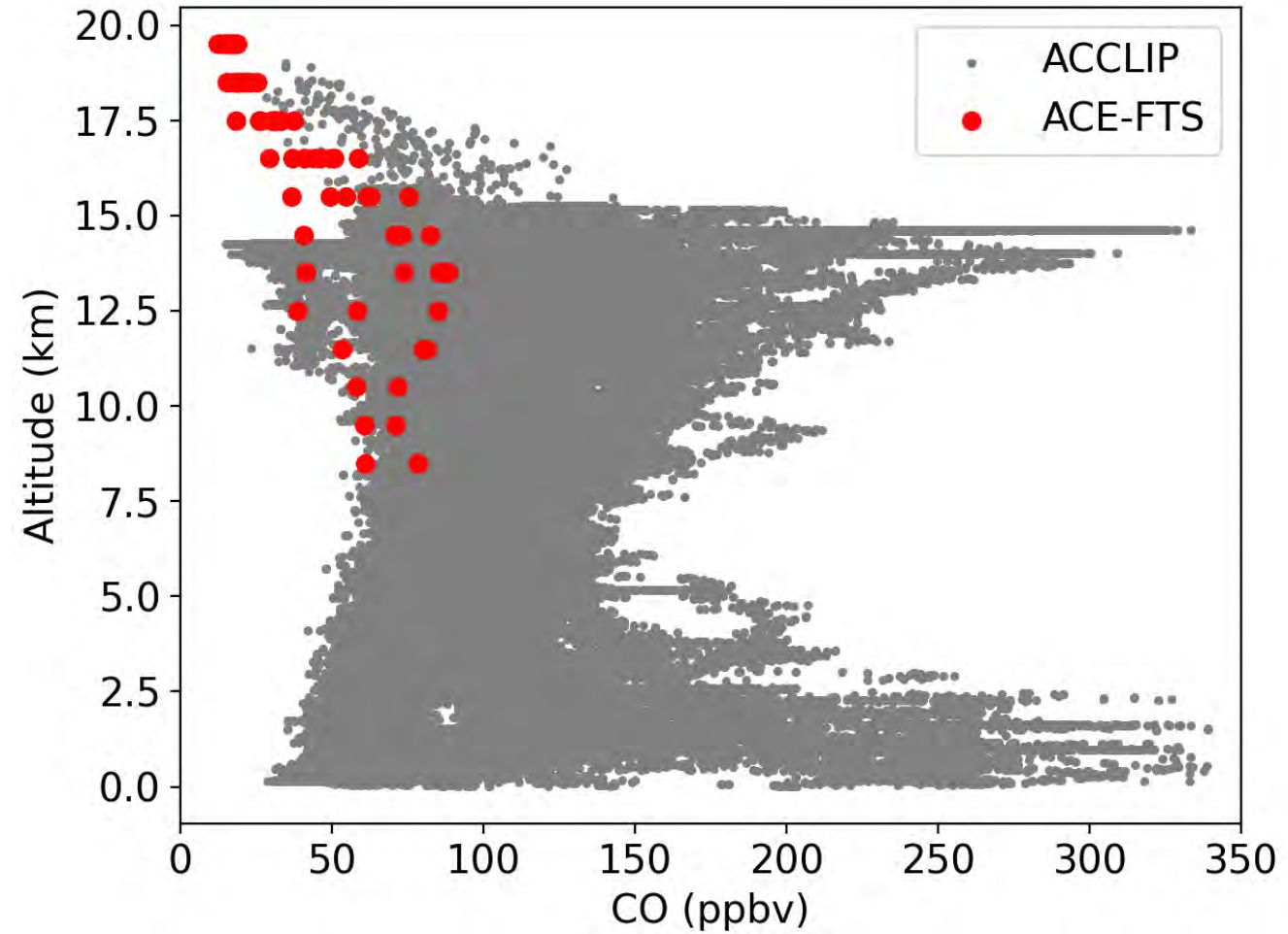
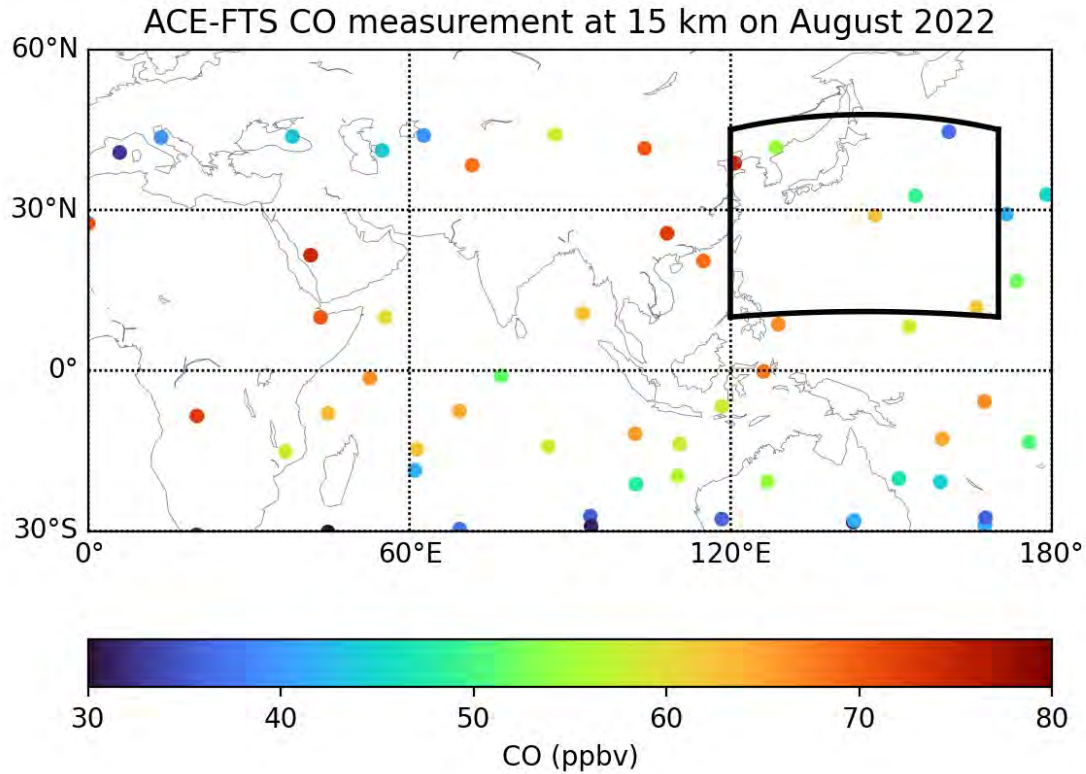




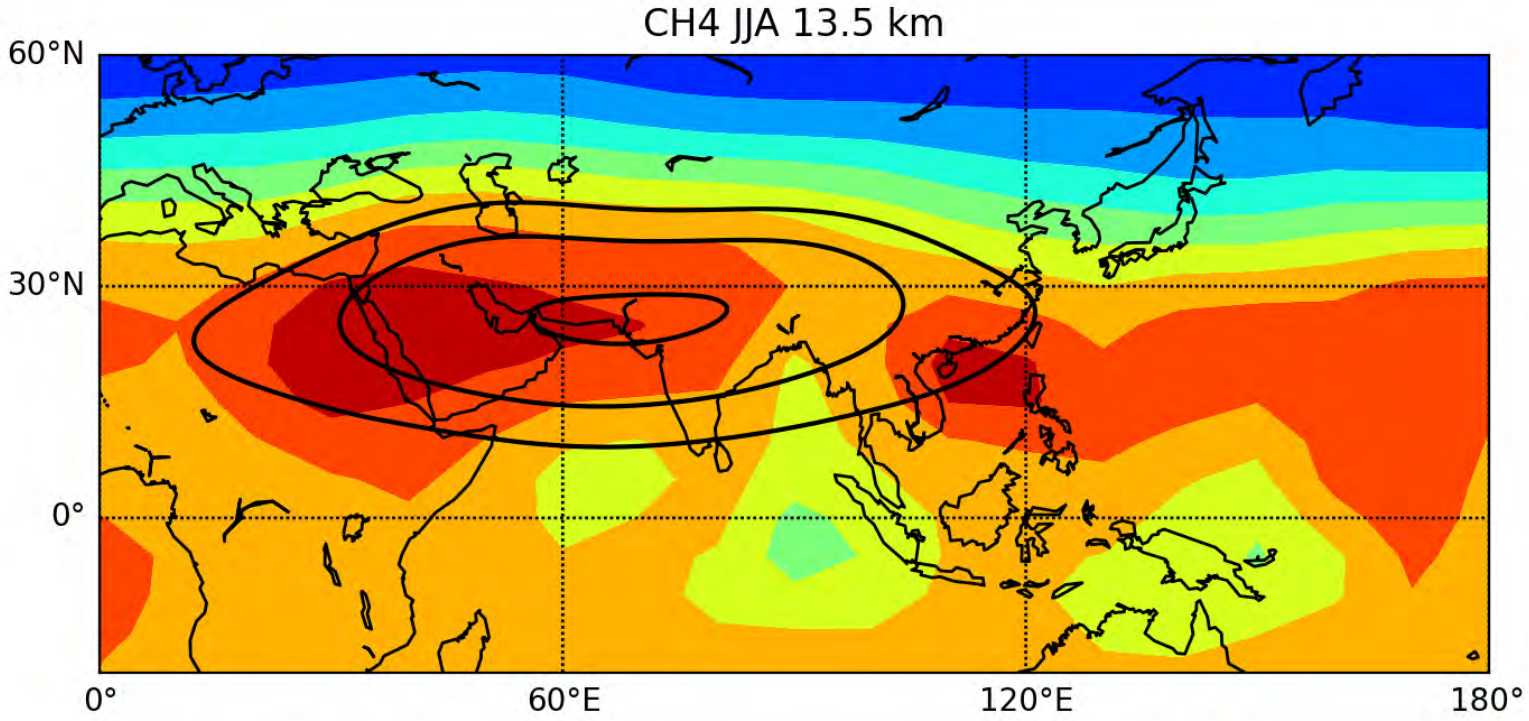
# CH<sub>4</sub> ACCLIP vs. ACE-FTS



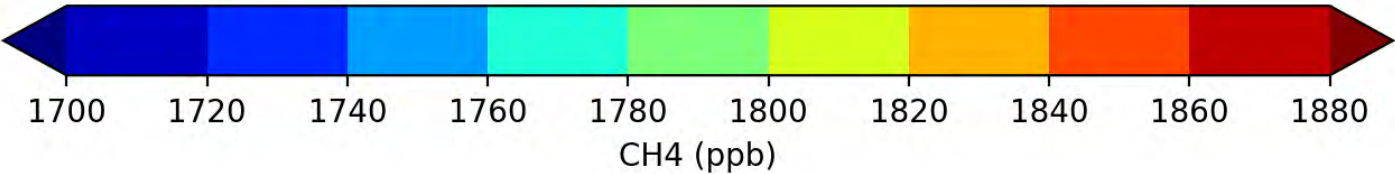
# CO ACCLIP vs. ACE-FTS



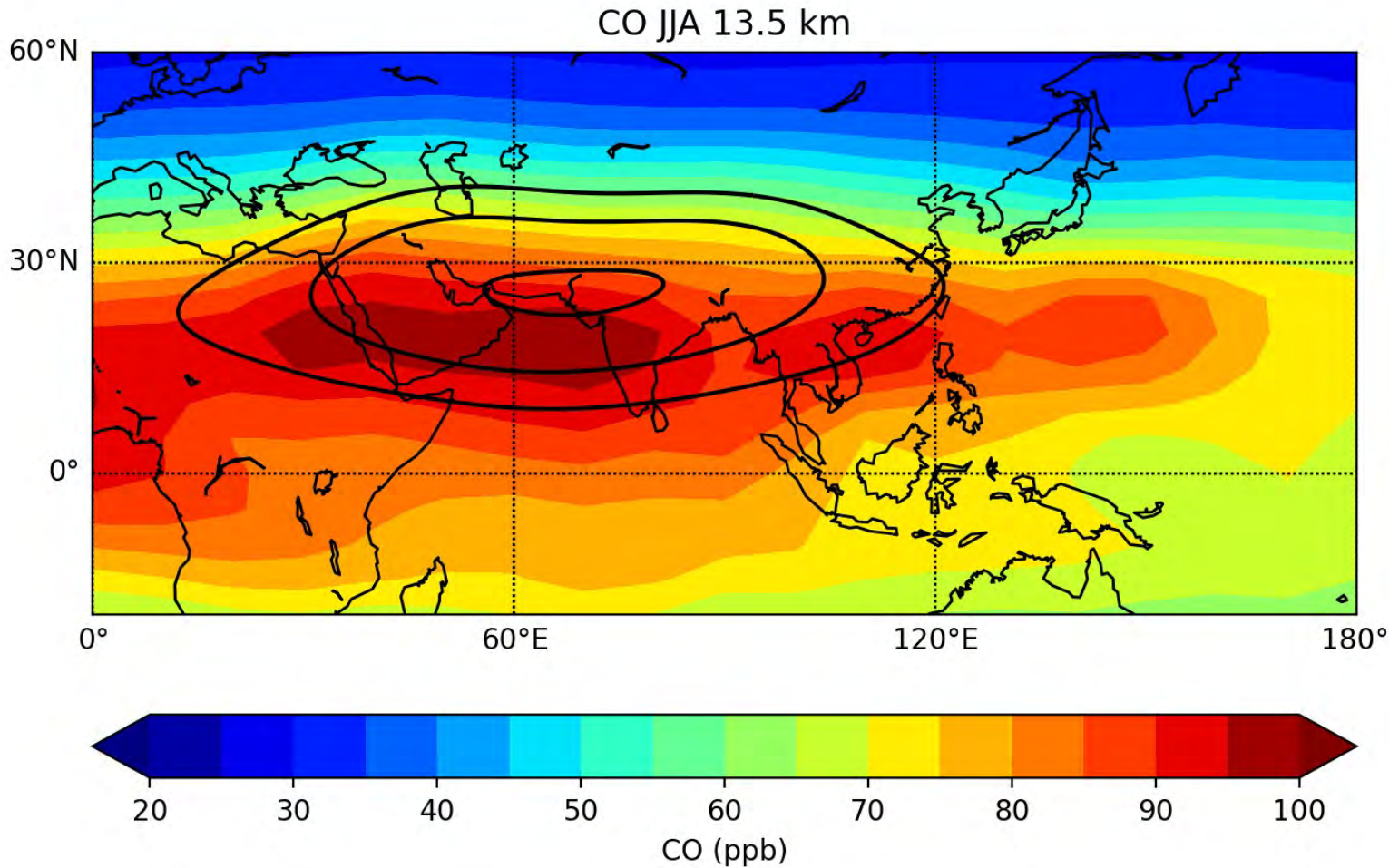
# ACE-FTS climatological CH<sub>4</sub> distribution



Combine all years from  
2004-2023



# ACE-FTS climatological CO distribution

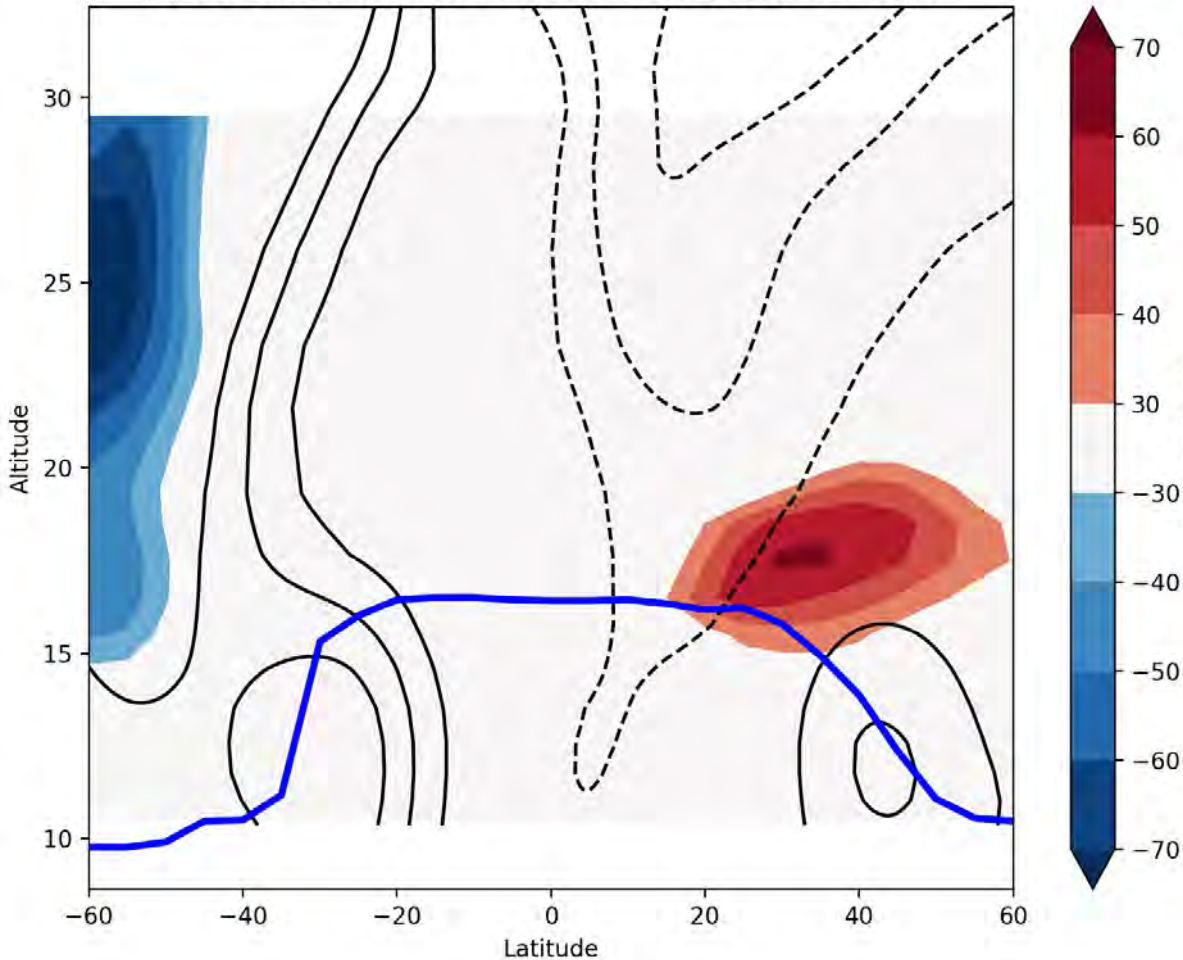


Combine all years from  
2004-2023

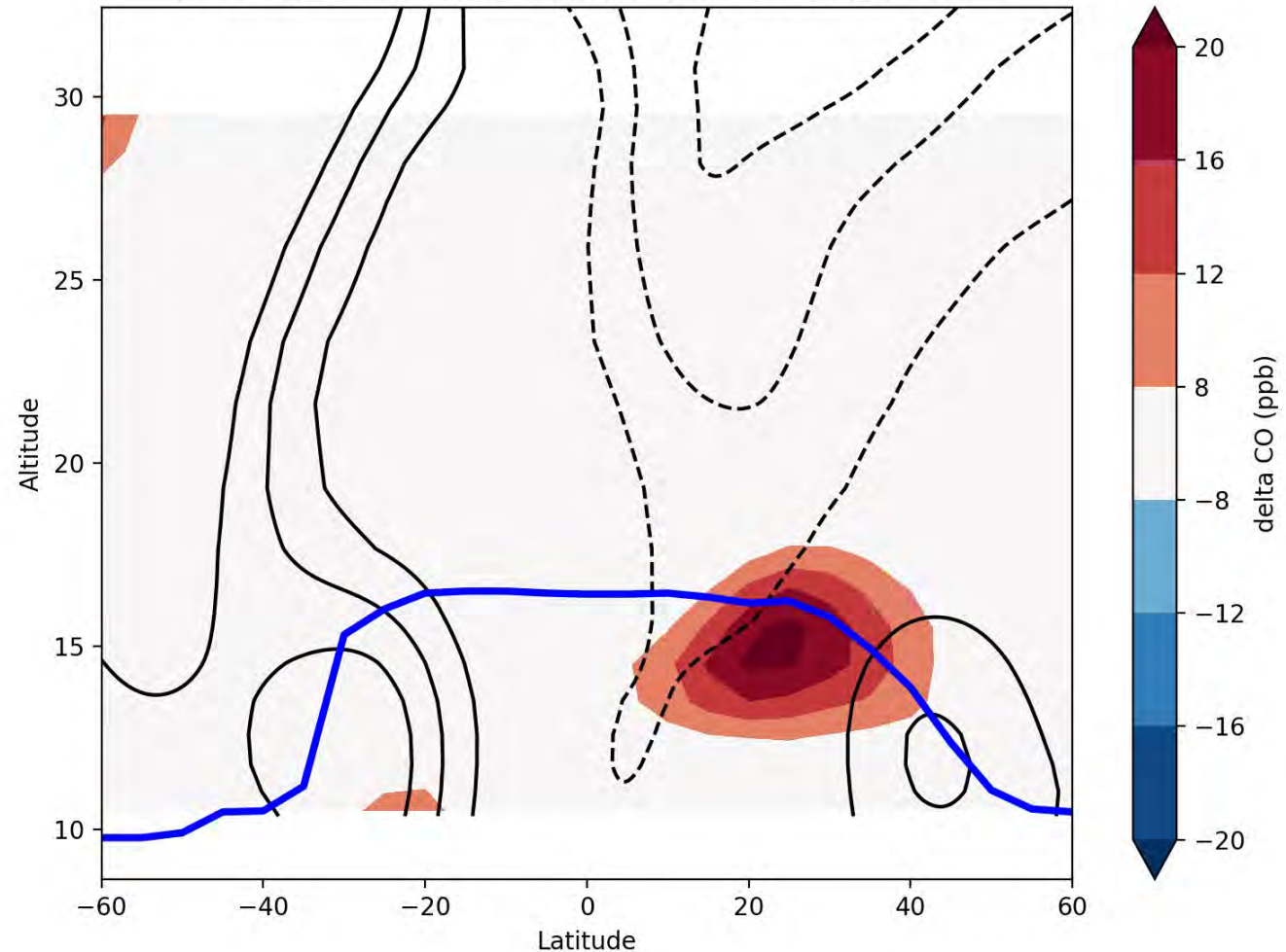
# Anomalous Monsoon Transport on CH<sub>4</sub> and CO

Inside ASM (20E-120E) – outside ASM

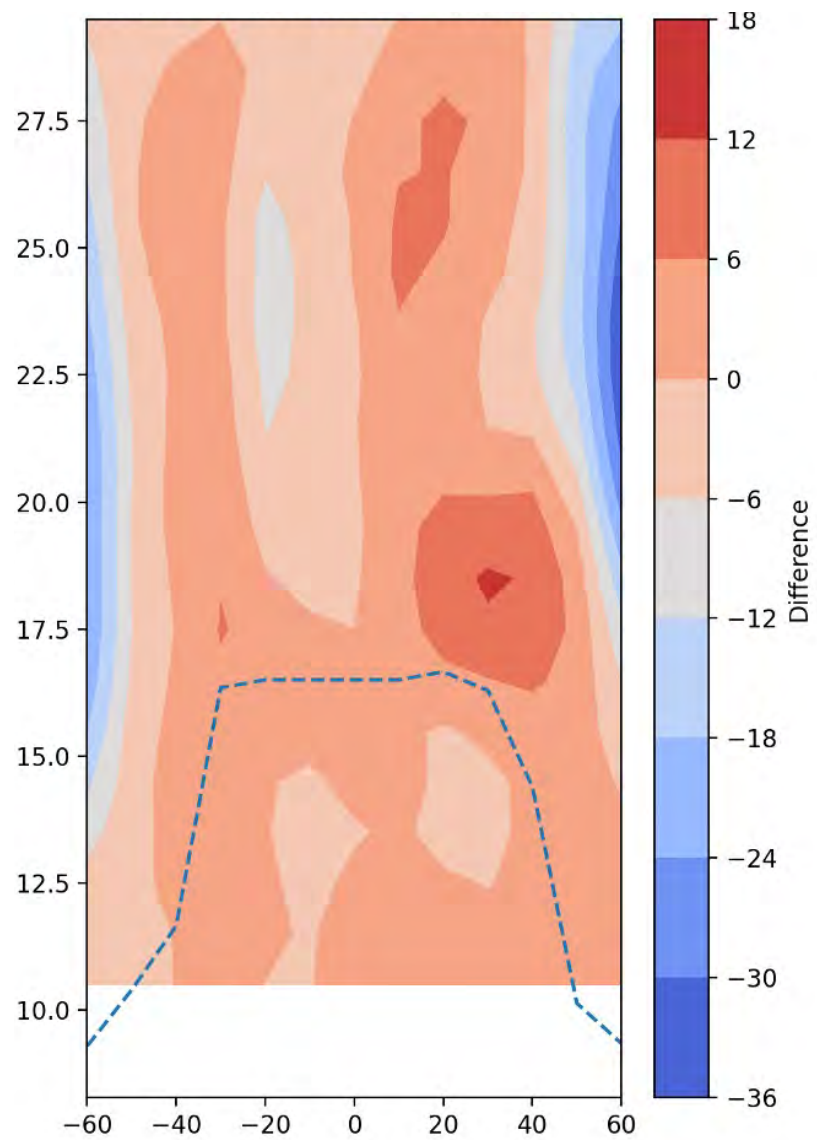
(a) CH<sub>4</sub> difference between inside (20E-120E) and outside



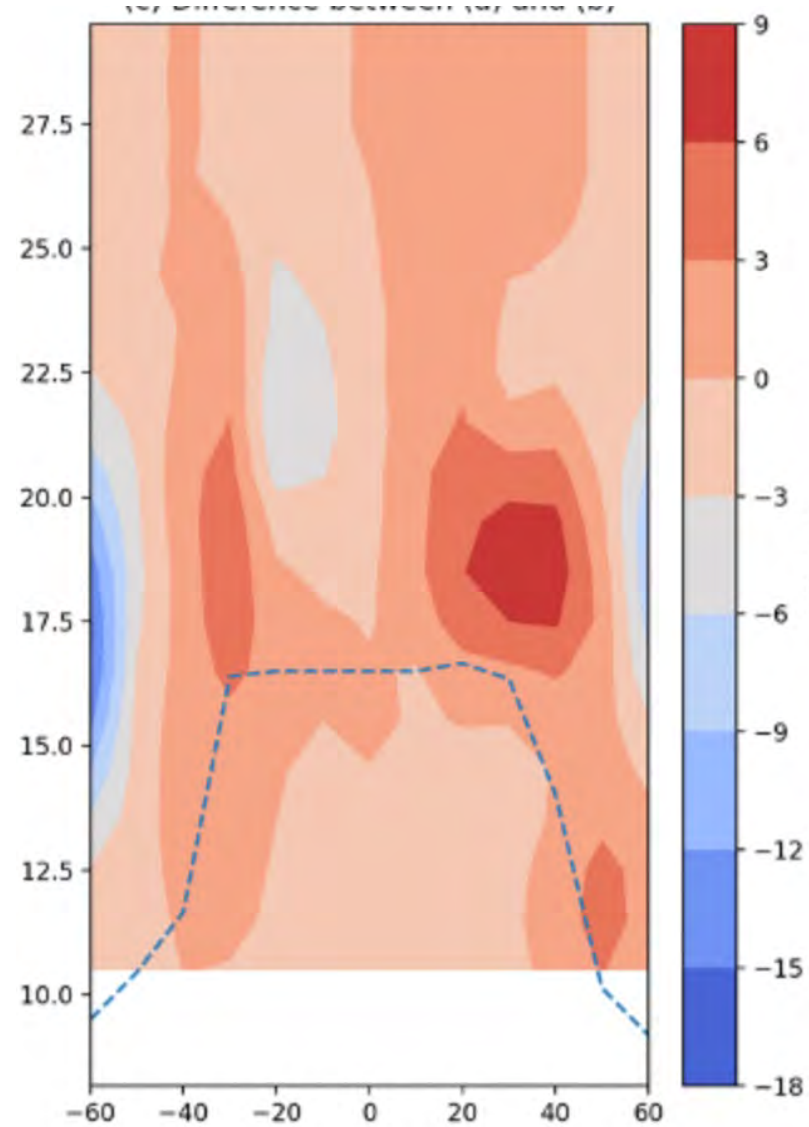
(b) CO difference between inside (20E-120E) and outside



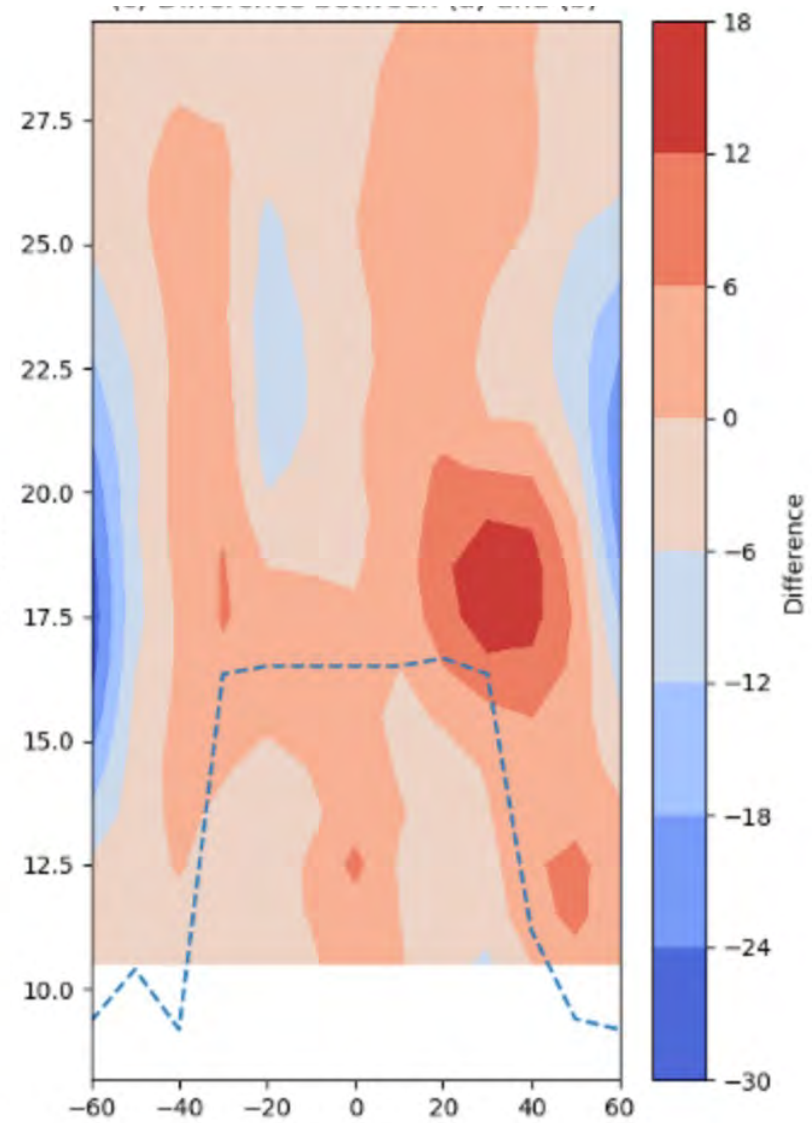
# CCl2F2



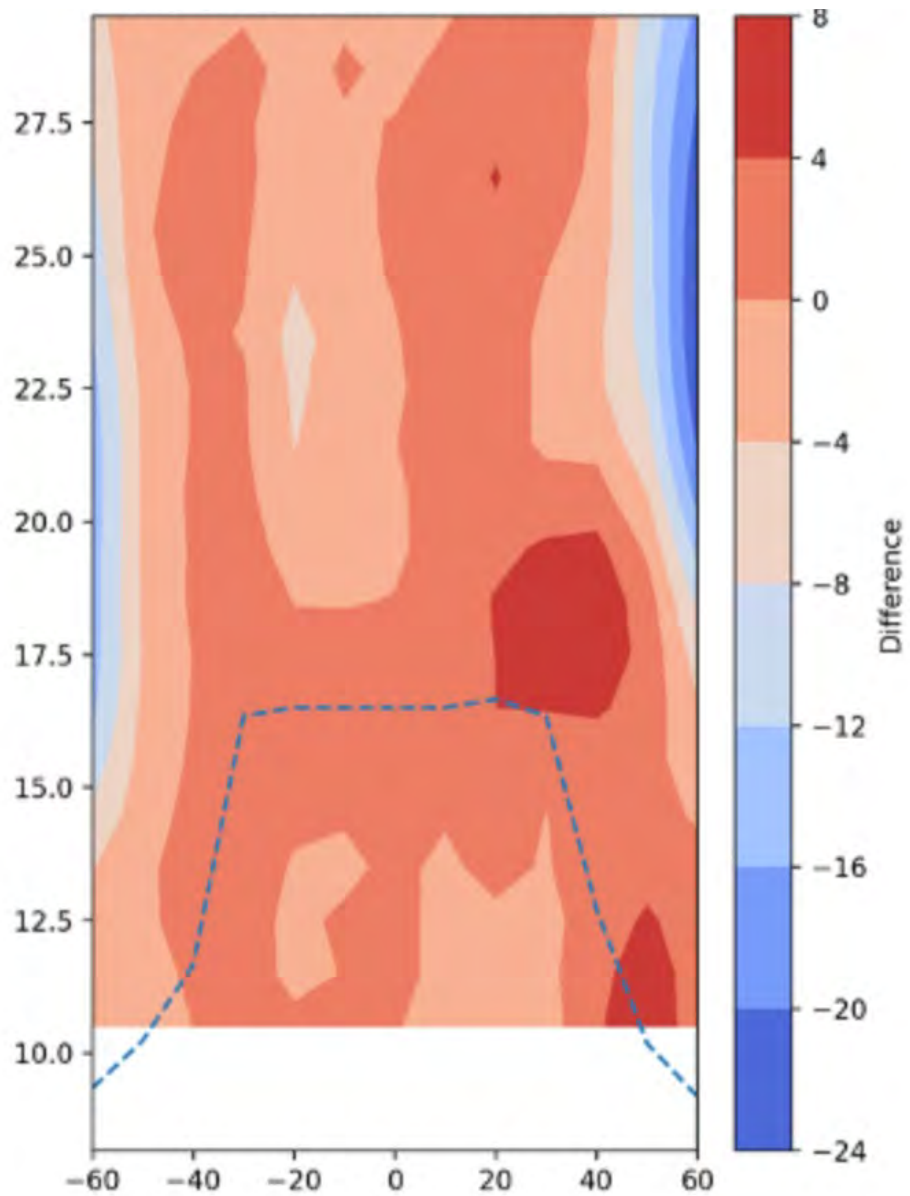
# CCl3F



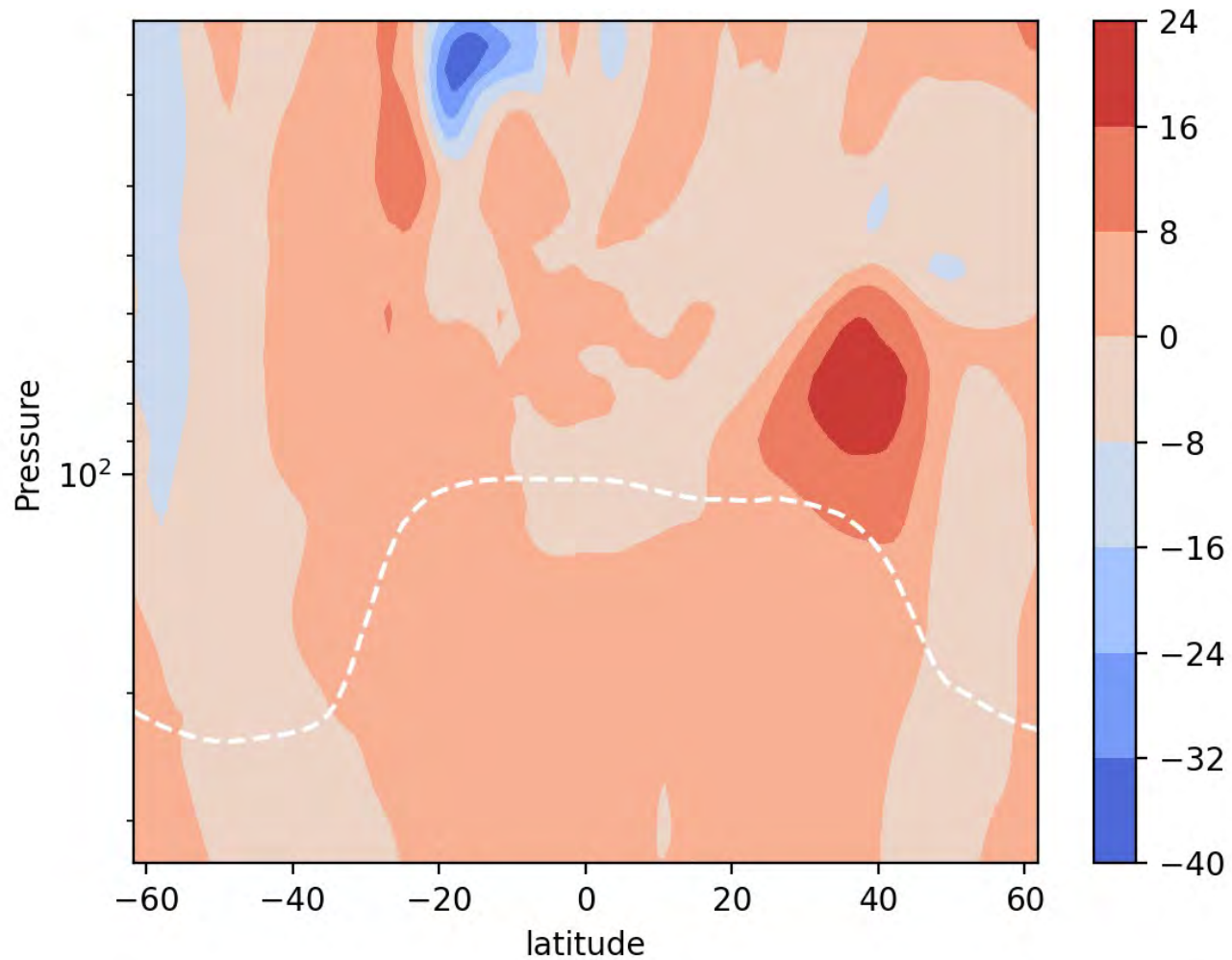
# OCS

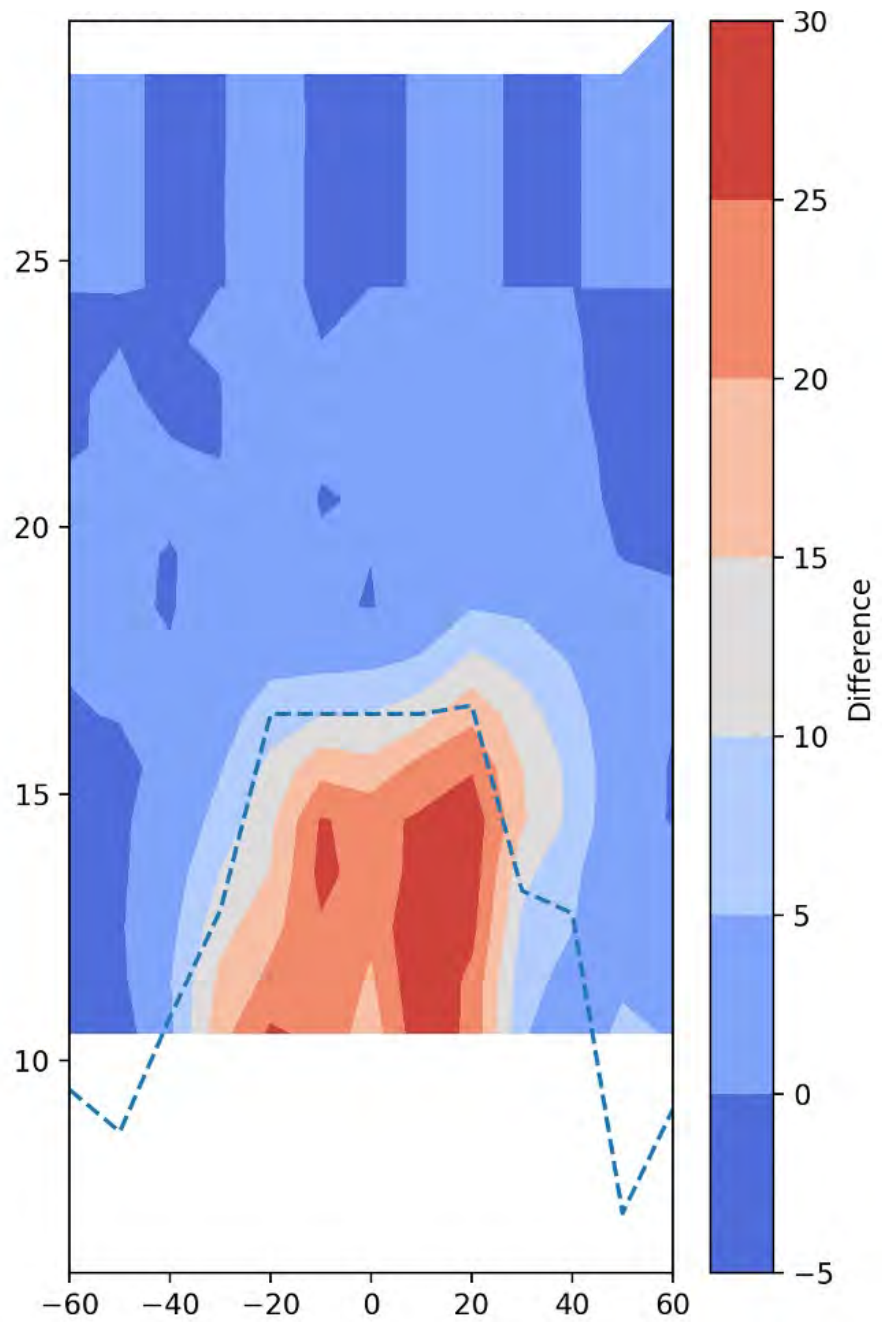


# ACE-FTS N2O

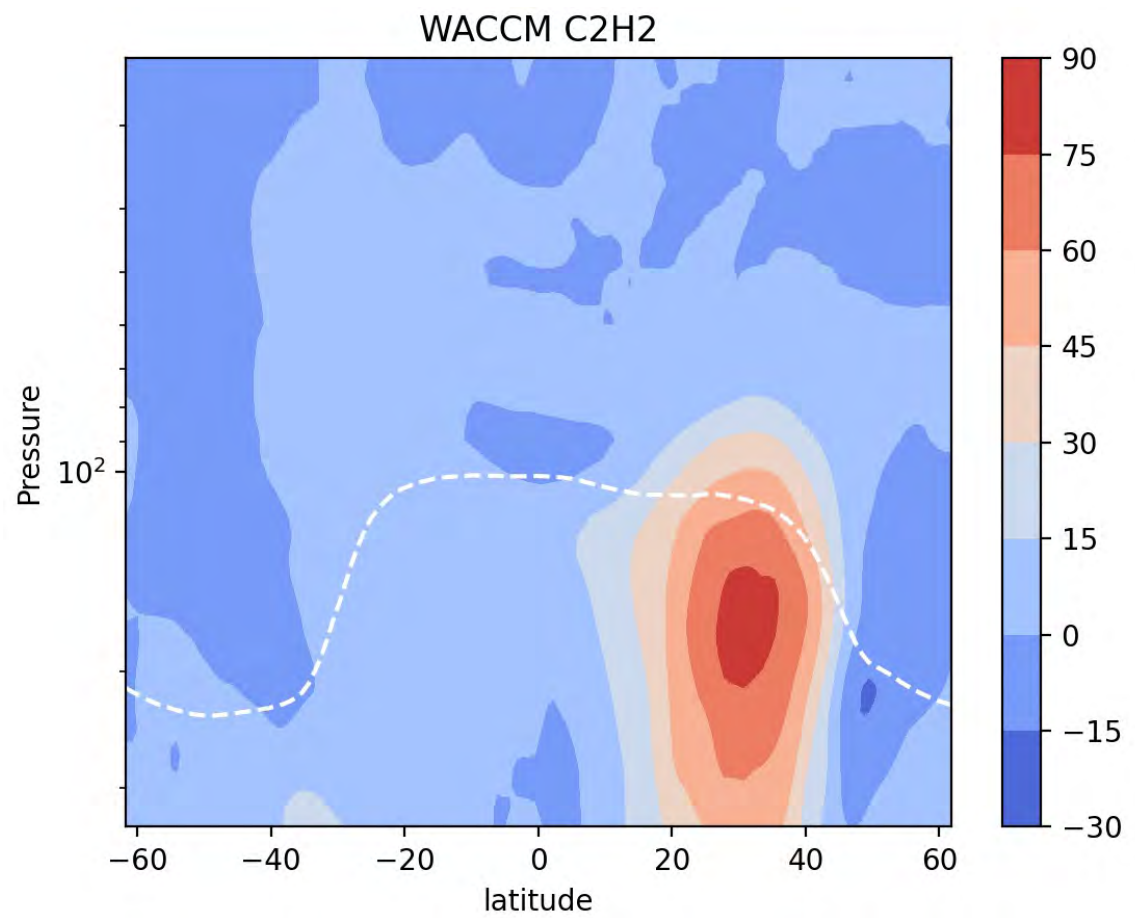


# WACCM N2O



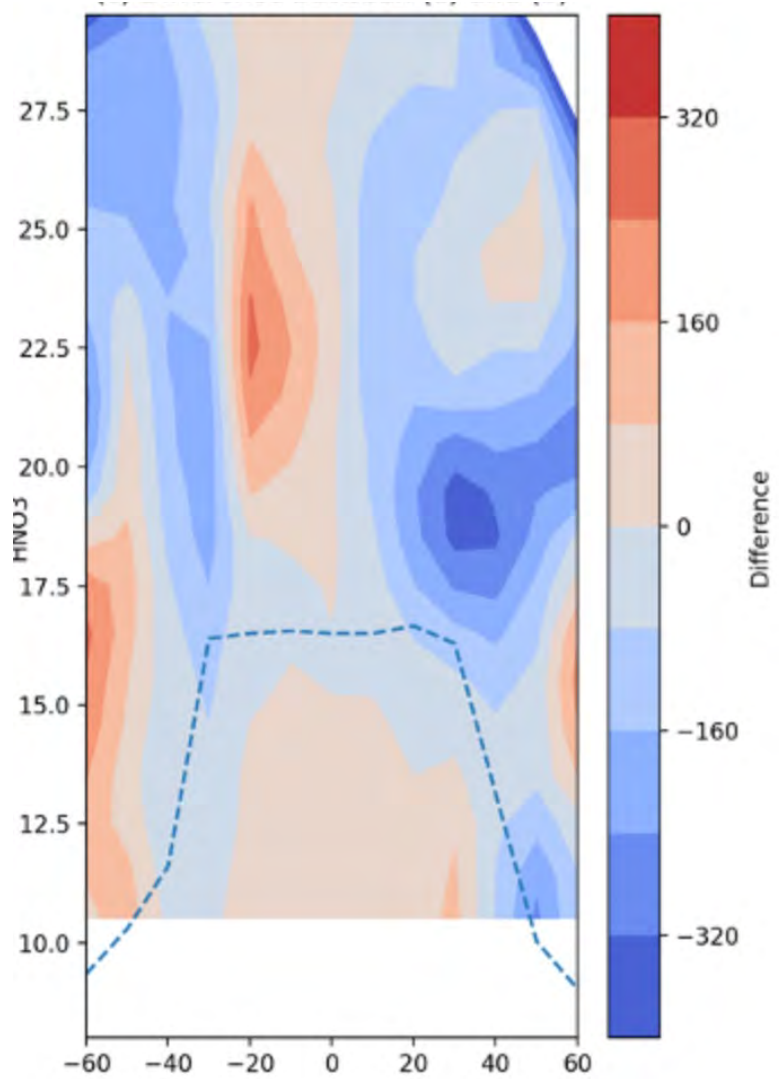


C<sub>2</sub>H<sub>2</sub>

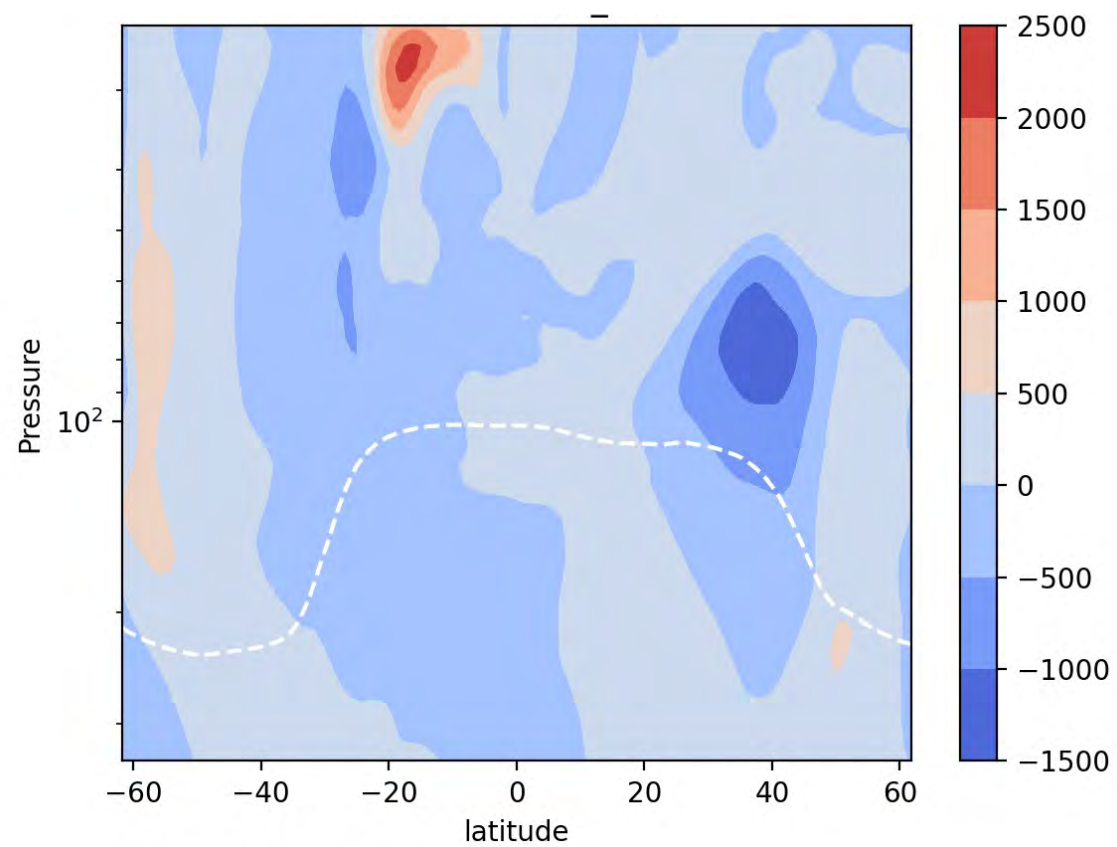




# ACE-FTS HNO<sub>3</sub>



# WACCM HNO<sub>3</sub>



# Conclusions

- During ACCLIP, CH<sub>4</sub> reaches 2200 ppbv at UT, the high methane airmass are from northeast China
- ACE-FTS CH<sub>4</sub> measurements fit well with ACCLIP CH<sub>4</sub>, but large deviation for CO
- Biggest CH<sub>4</sub> anomaly is above anticyclone poleward, while CO anomaly is inside