HCN update

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Analysis at Thule.

- ❑ Linelist (HIT08 vs HIT20 vs ATM20)
- ❑ WACCM v6 vs V7
- ❑ Sa (OE & Tik)

Retrieval code: sfit4 v1.0.18
Years (Thule): 2017-2019

Overview

Version	Description	Some Retrieval parameters
HIT08	HIT08	mw1: 3268.04 - 3268.40 cm^{-1} mw2: 3287.10 - 3287.35 cm^{-1} mw3: 3299.40 - 3299.60 cm^{-1} OPD:257 cm FLT: 2 OE Sa: 50% weighted as (Sa/sqrt(thickness) Profiles: HCN Columns: H2O C2H2 CO2 O3
HIT20	All HIT20	
ATM20	All ATM20	
WACCM V6	WACCM V6	
WACCM V7	WACCM V7	

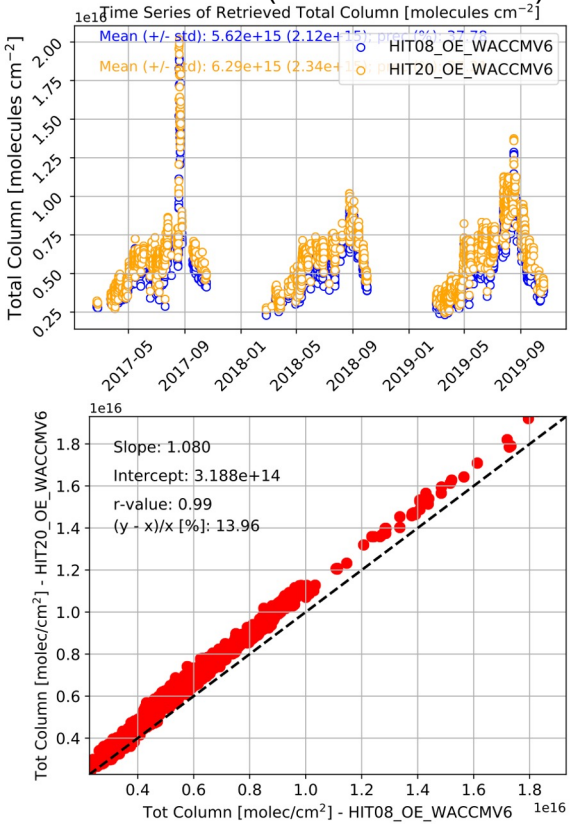
- Start from current NDACC retrieval strategy.
- Change retrieval method one aspect at a time.
- Analyze effect on RMS, DOFS, total column and profile
- Validation against other instruments is missing.

Summary

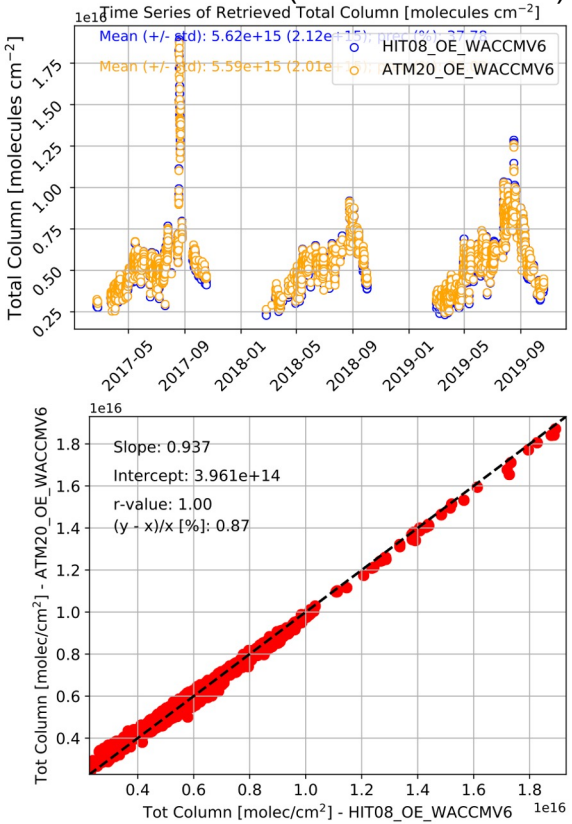
- HIT20 shows about 13-14% larger total/tropo columns than both HIT08 (and ATM20) but RMS does not change significantly (~1% better with HIT20).
- Less negative profiles retrieved with HIT20
- It would be nice to see more sites for HCN, especially given the differences in profiles for different settings/configurations.

Time Series: total Columns

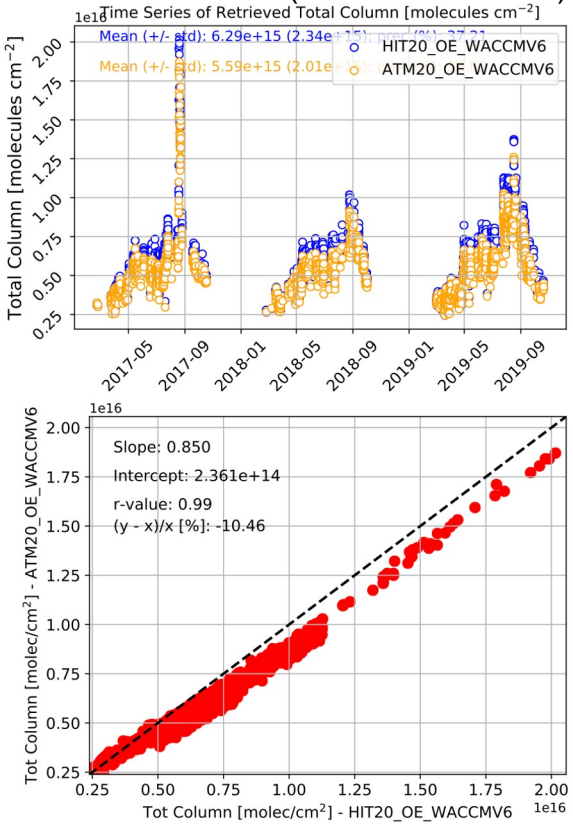
HIT08 vs HIT 20 (OE & WACCM V6)



HIT08 vs ATM20 (OE & WACCM V6)



HIT20 vs ATM20 (OE & WACCM V6)



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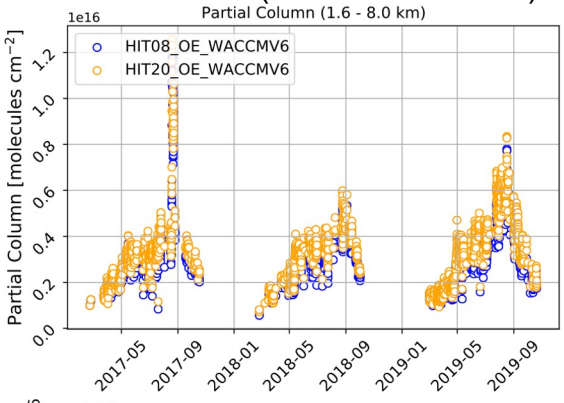
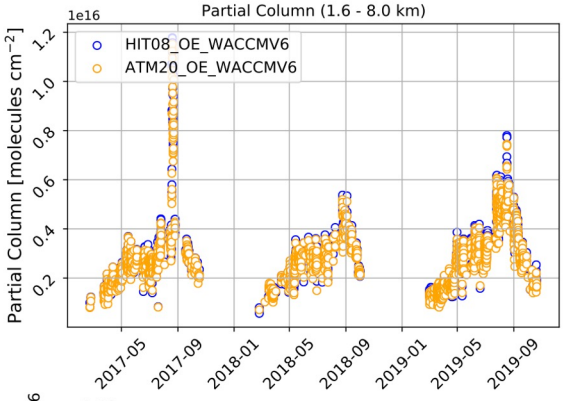
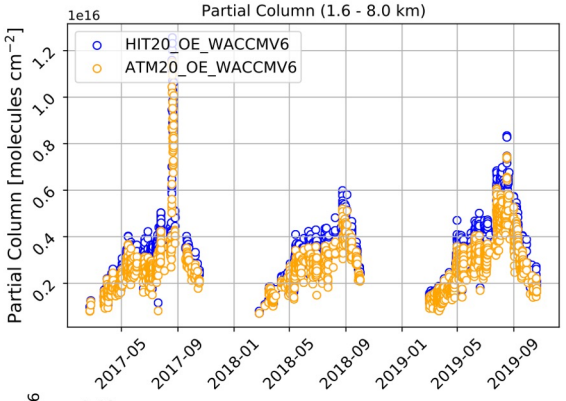
HIT20 shows about 13% larger total columns than both HIT08 and ATM20

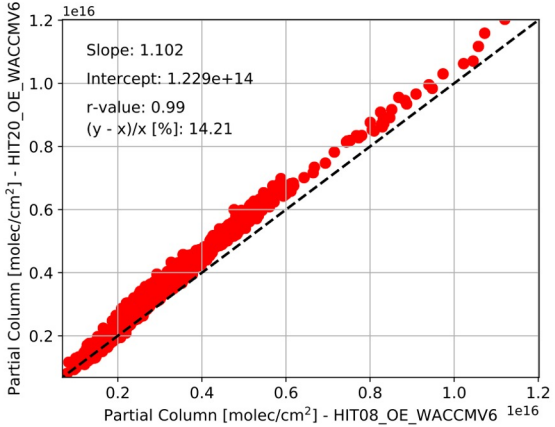
Time Series: Tropospheric Columns

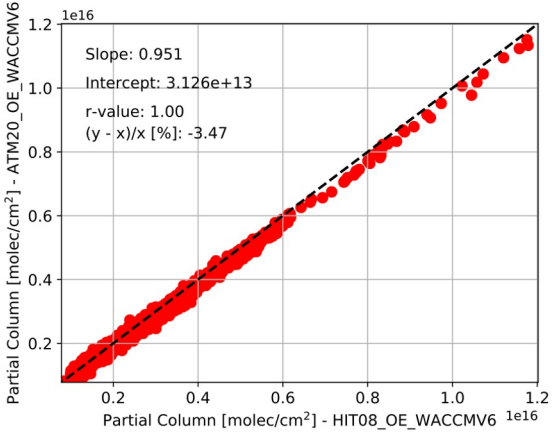
HIT08 vs HIT 20 (OE & WACCM V6)

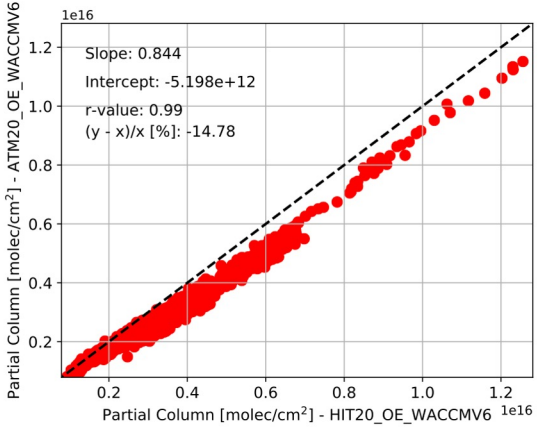












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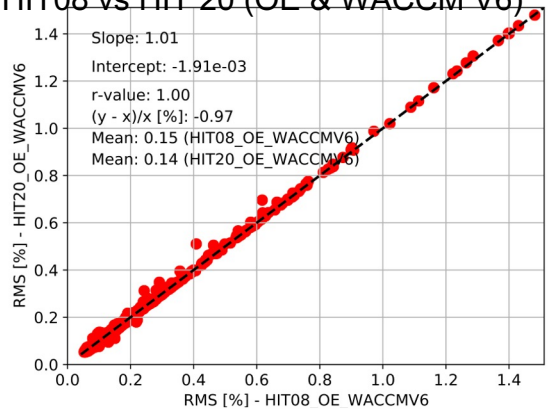
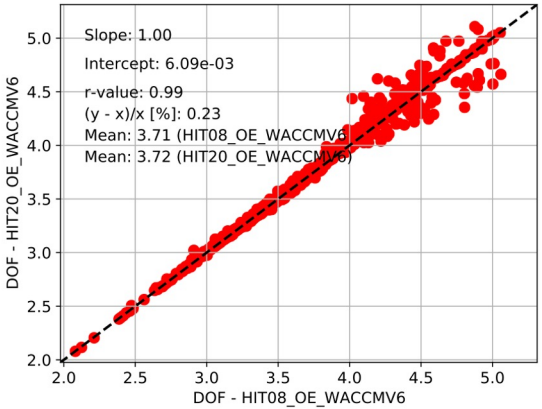
HIT20 shows about 14% larger trop columns than both HIT08 and ATM20

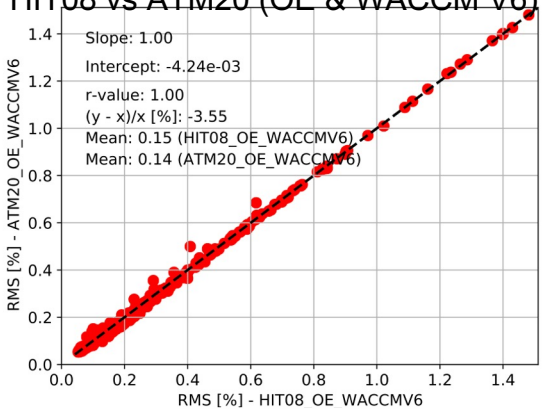
RMS and DOF

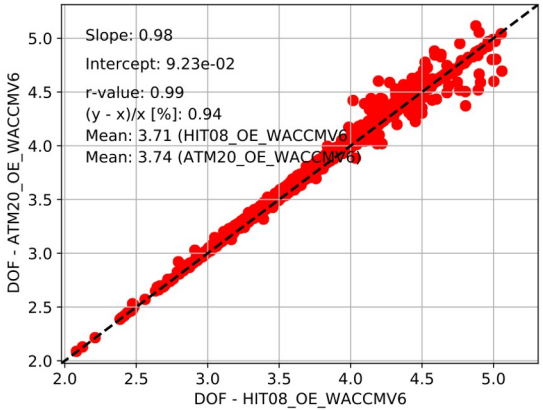
HIT08 vs HIT 20 (OE & WACCM V6)



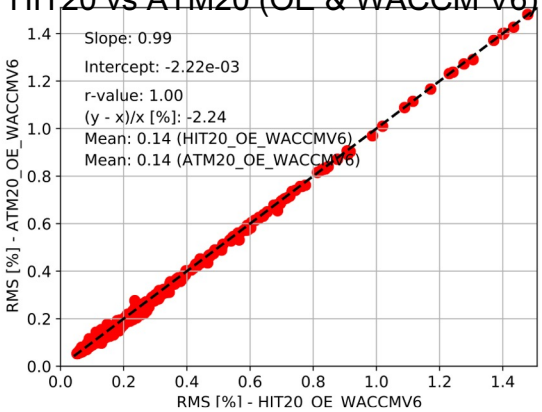


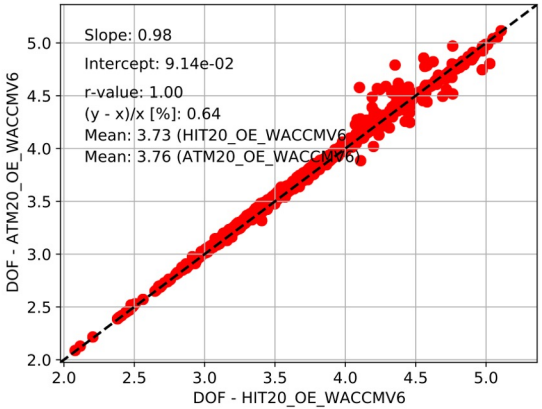
HIT08 vs ATM20 (OE & WACCM V6)





HIT20 vs ATM20 (OE & WACCM V6)





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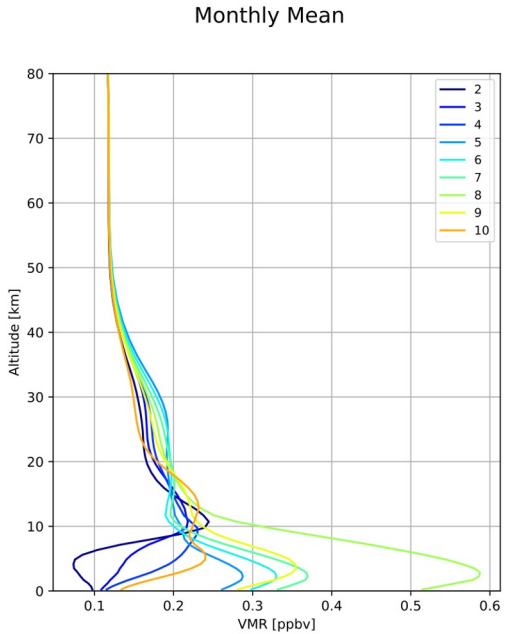
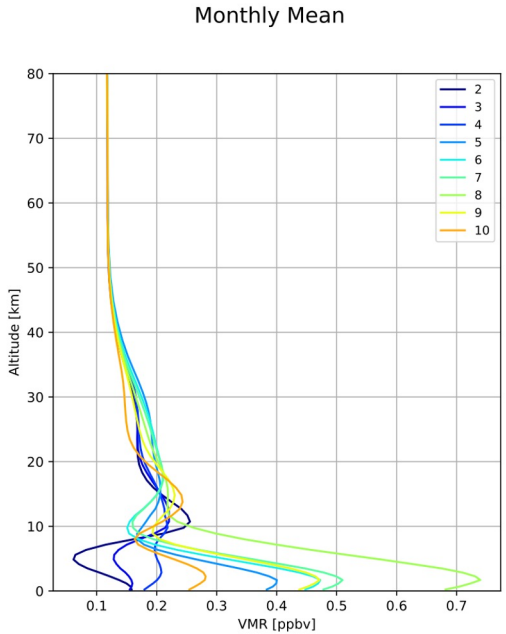
No significant difference in RMS (~1% better with HIT20 and ATM20)

Profiles

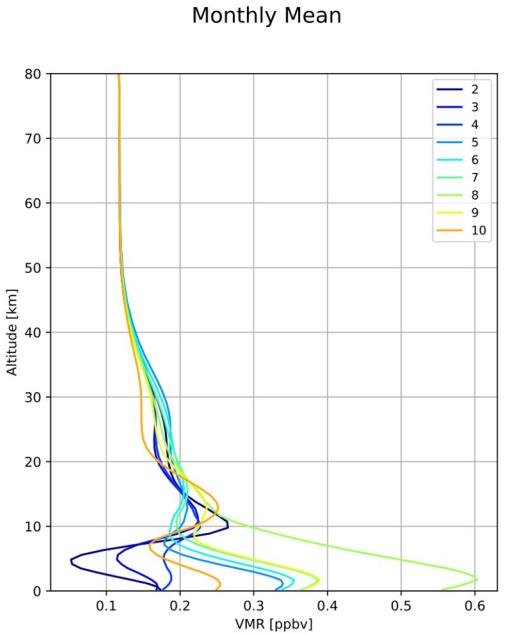
HIT08 (OE & WACCM V6)



HIT20 (OE & WACCM V6)

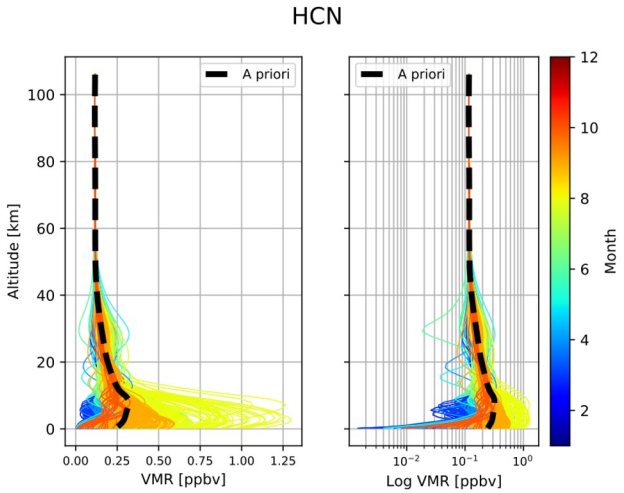


ATM20 (OE & WACCM V6)

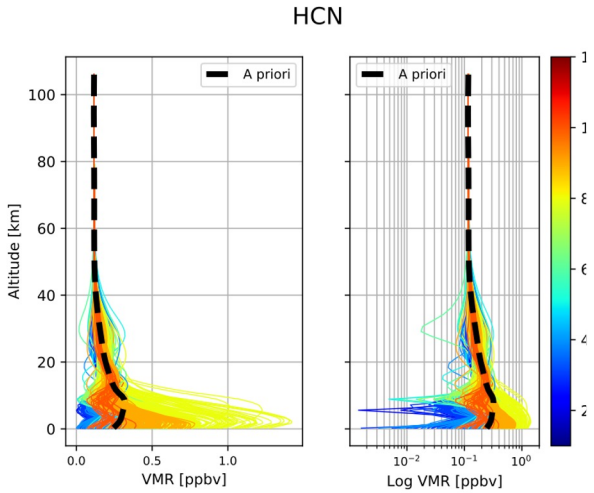


Profiles

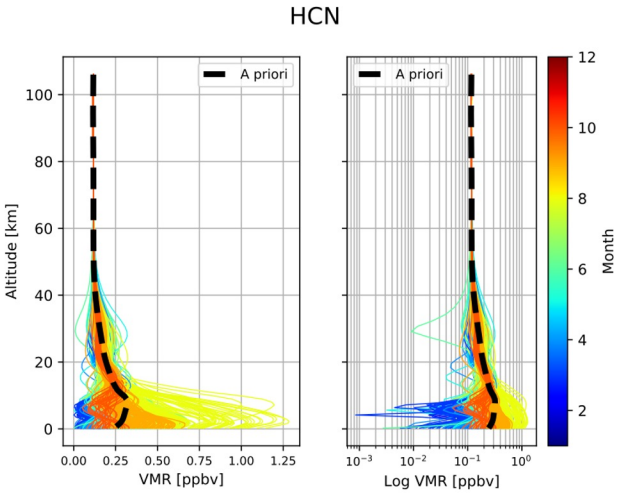
HIT08 (OE & WACCM V6)



HIT20 (OE & WACCM V6)



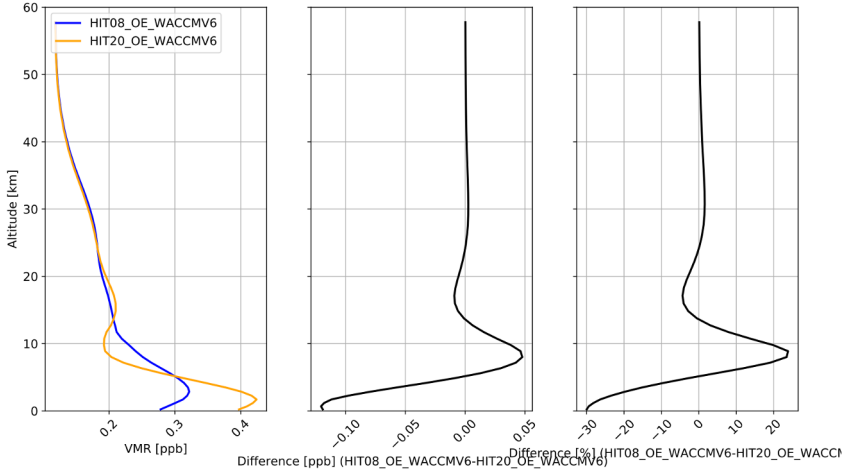
ATM20 (OE & WACCM V6)



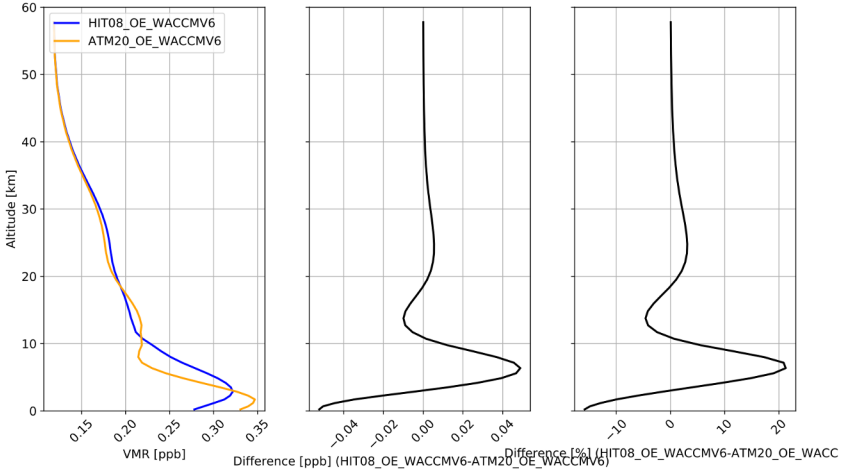
83 Neg PC (hit08, waccmv6, oe)
28 Neg PC (hit20, waccmv6, oe)
33 Neg PC (atm20, waccmv6, oe)
29 Neg PC (hit20, waccmv6, tk)
87 Neg PC (hit20, waccmv7, oe)

Profiles

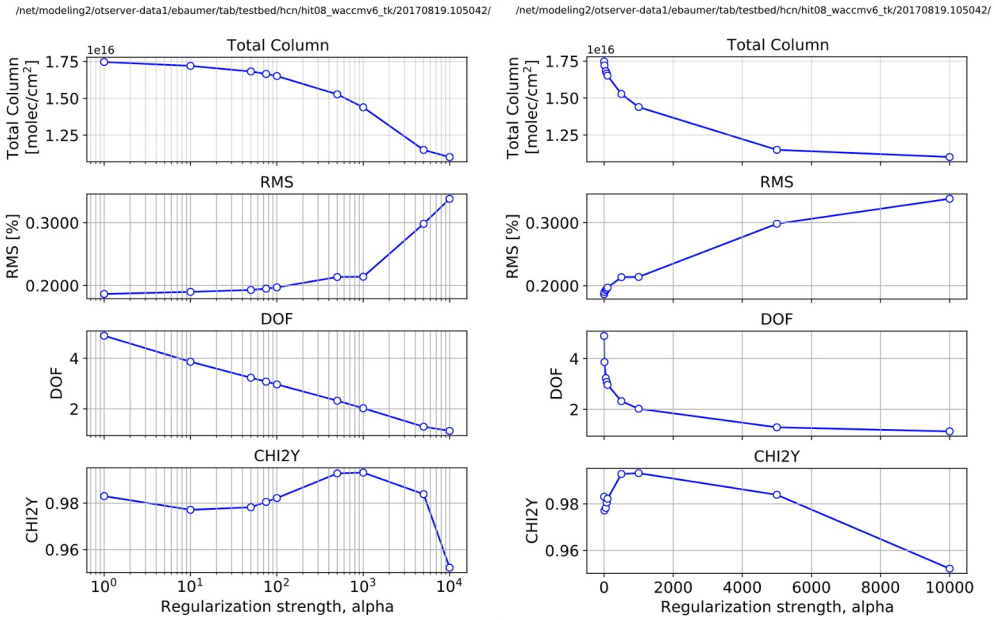
HIT08 vs HIT 20 (OE & WACCM V6)

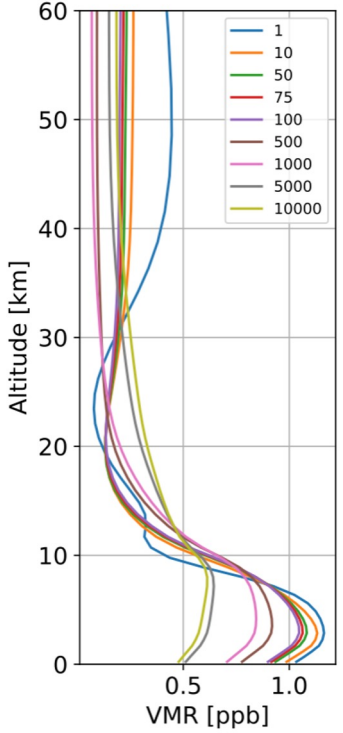


HIT08 vs ATM20 (OE & WACCM V6)



Tik Optimization

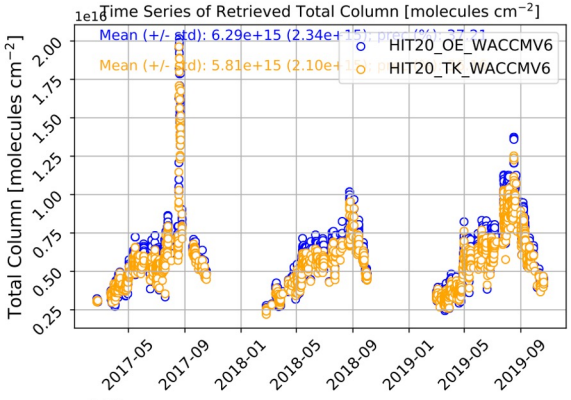


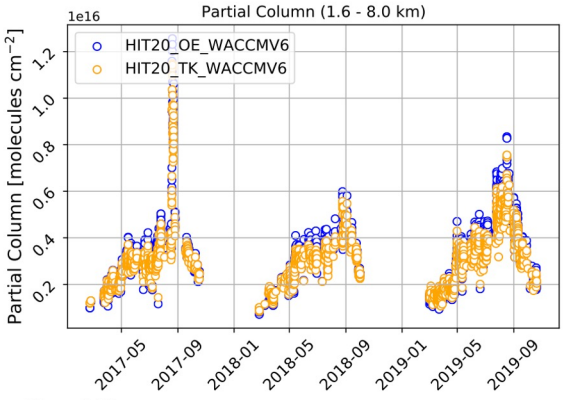


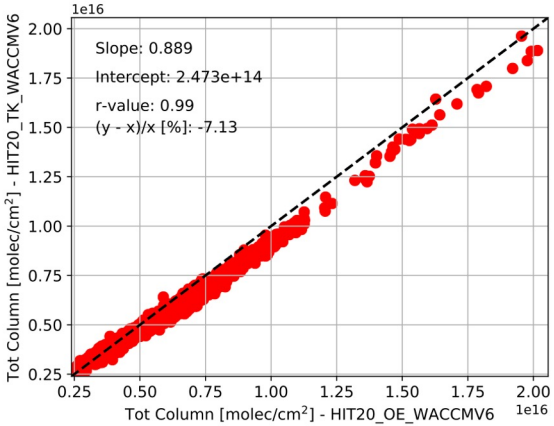
OE
RMS: 0.1907
DOF: 3.36
CI_2_Y: 0.977
TC:1.7197E16

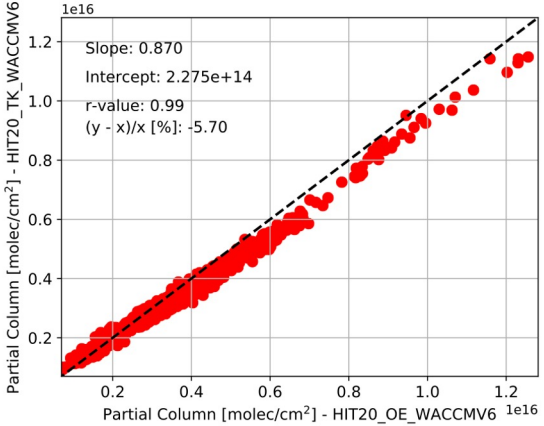
With an alpha of 90 we get 3.0 DOF for the same retrieval test case.

Time Series: total/tropospheric Columns



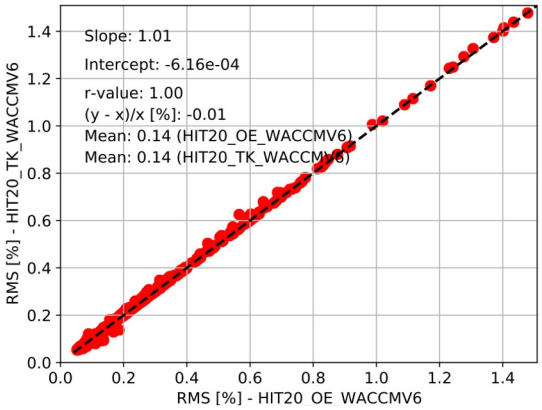


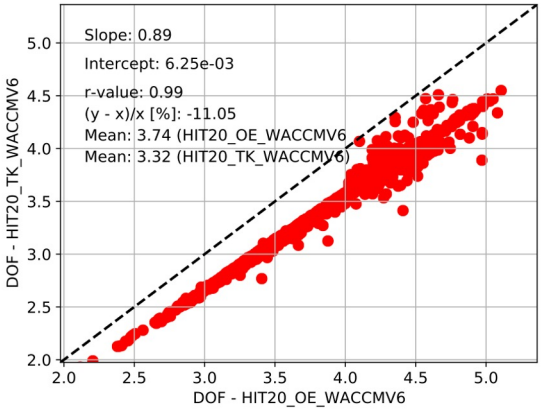


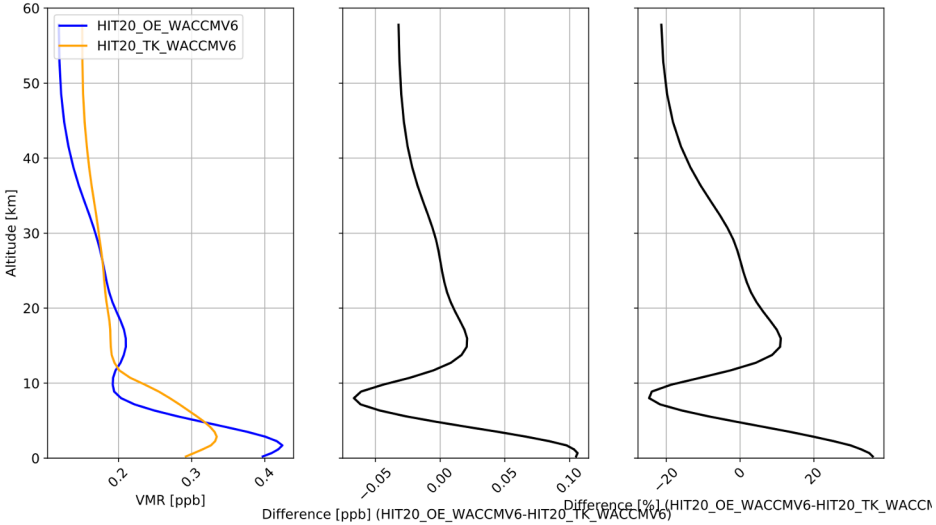


TK shows about 5-7% smaller total/trop columns than OE

RMS/DOF and profiles



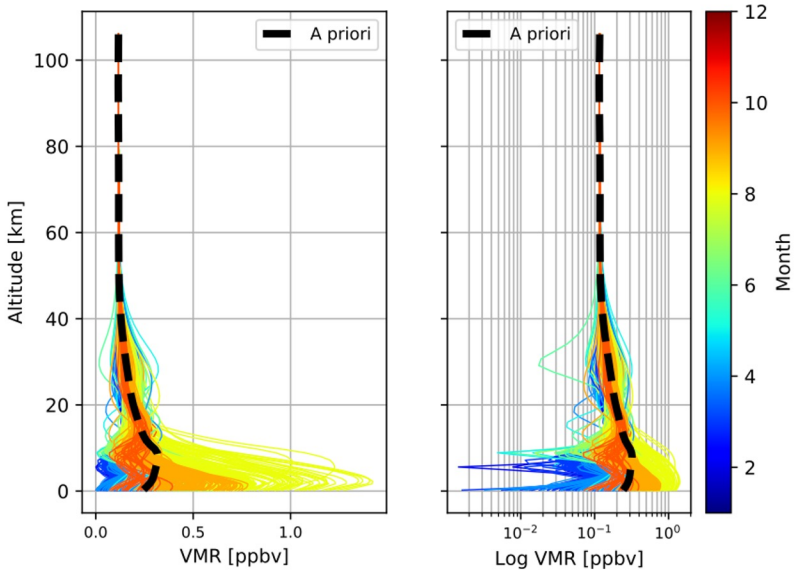




Profiles

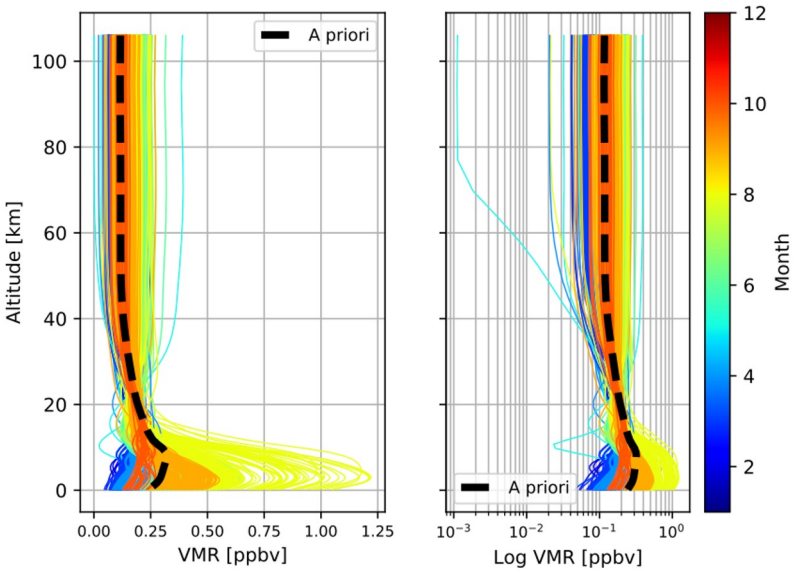
OE (HIT20 & WACCM V6)

HCN

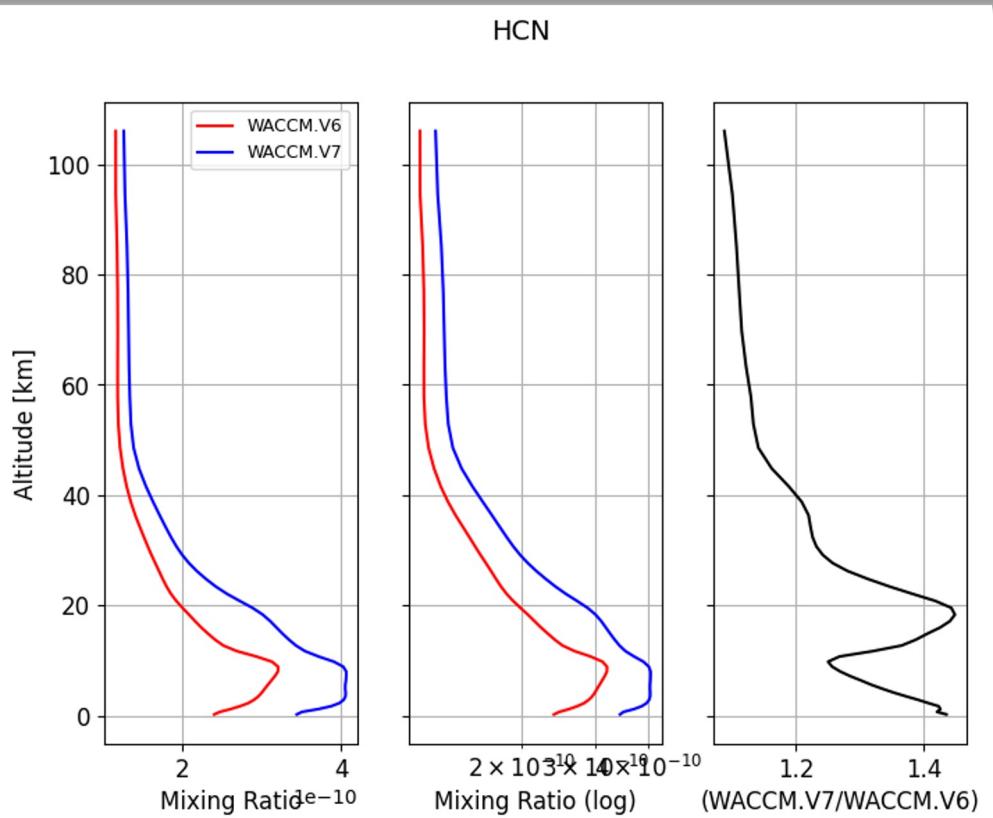


TK (HIT20 & WACCM V6)

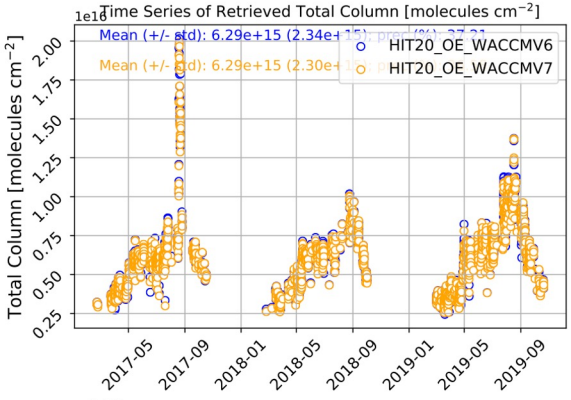
HCN

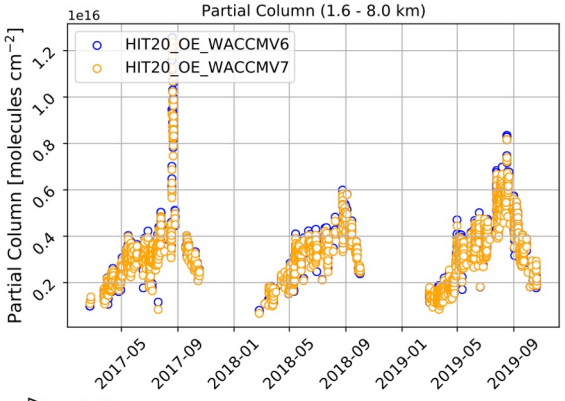


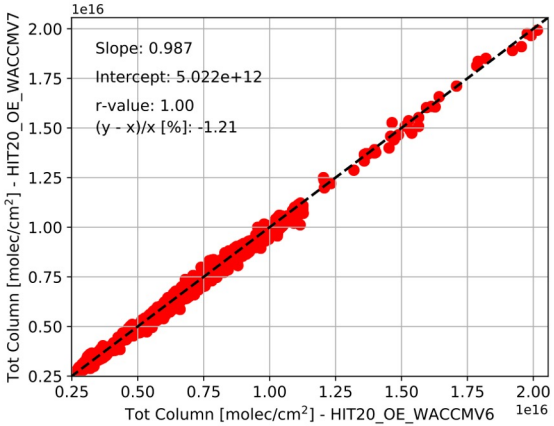
Apriori Profiles

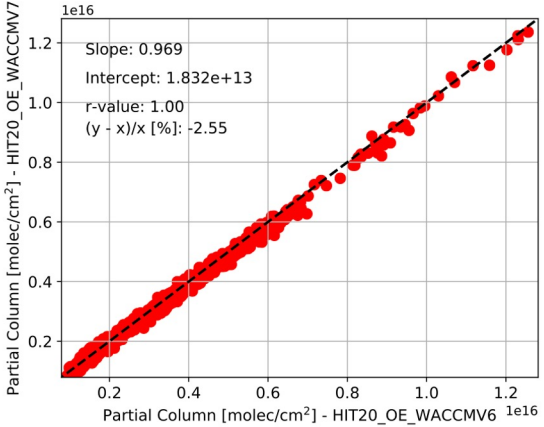


Time Series: total/tropospheric Columns

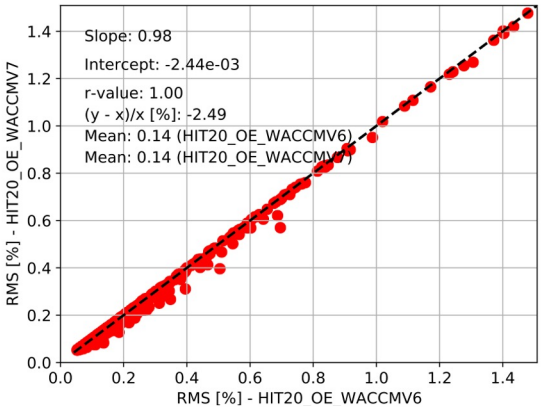


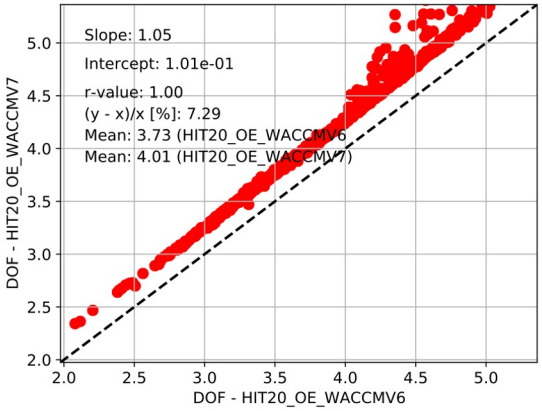


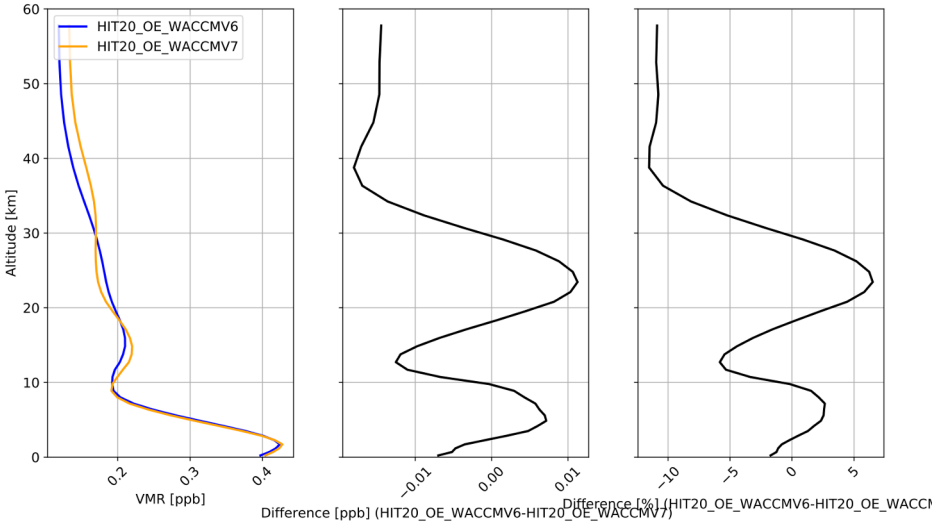




RMS/DOF and profiles



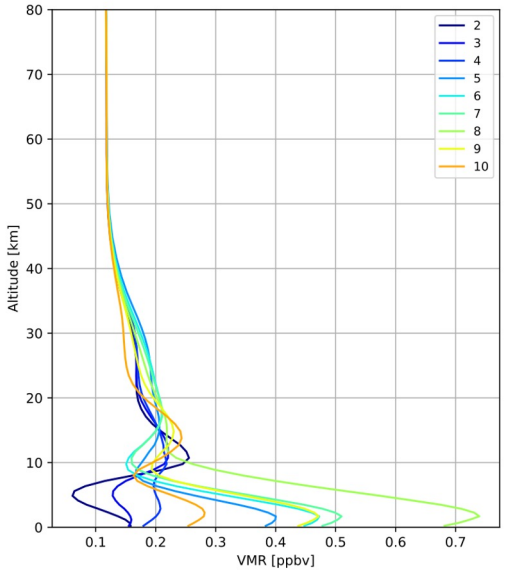


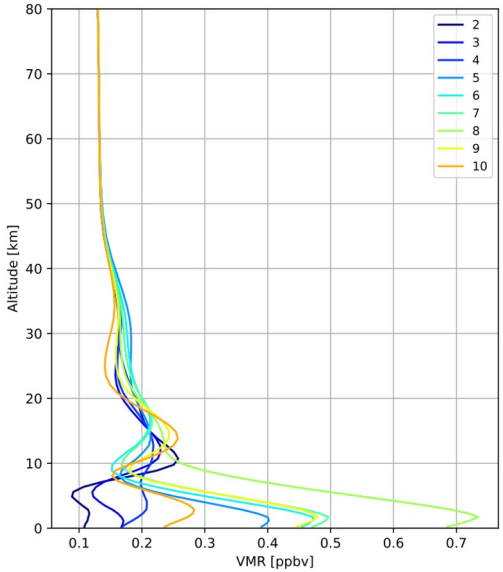


Profiles

WACCM V6 (OE & hit20)

Monthly Mean



WACCM V7 (OE & HIT20)

Monthly Mean