Validation of MLS HCN: status report

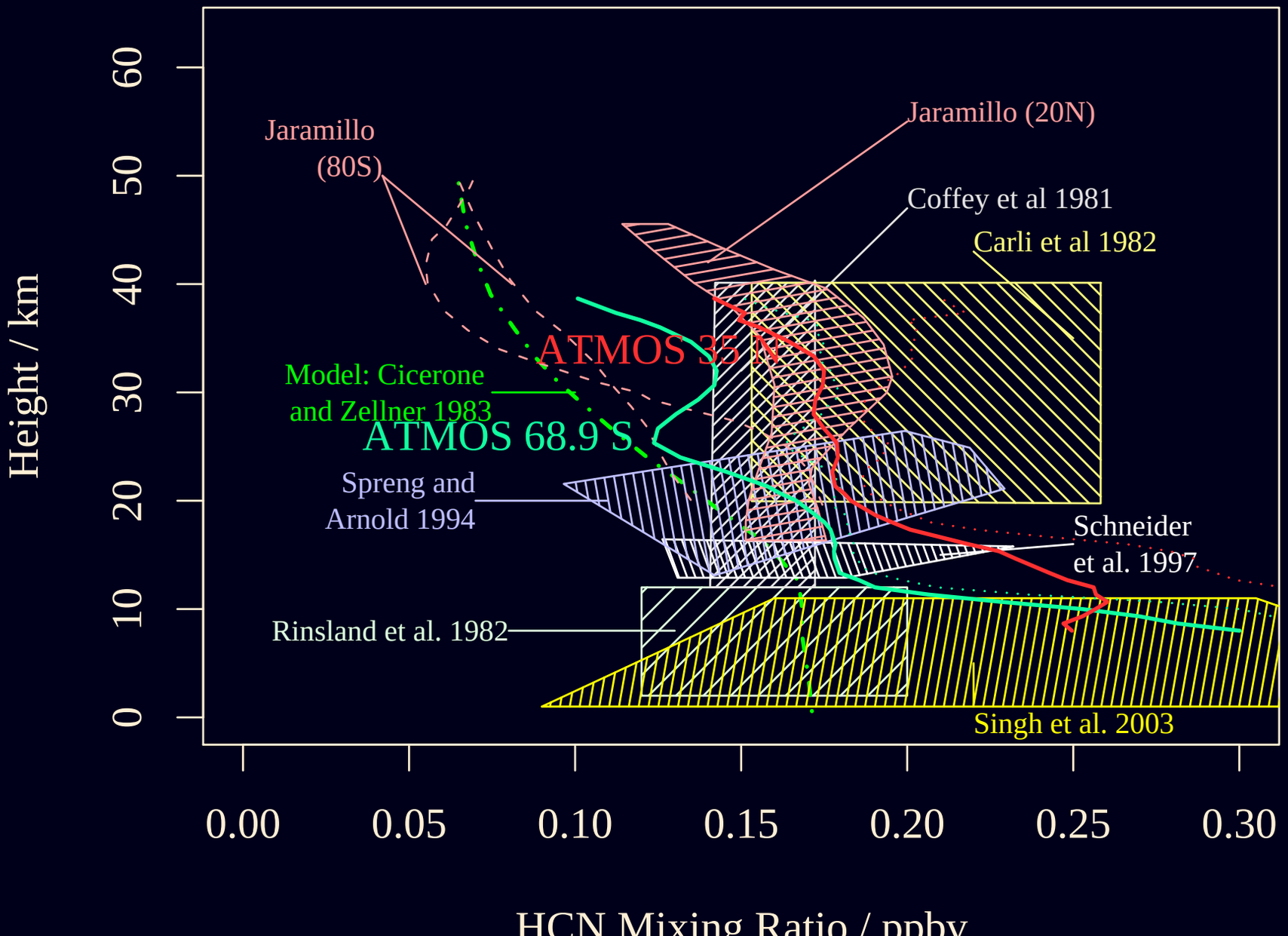
Hugh C. Pumphrey, Carlos J. Jimenez

P. Bernath, K. Walker, C. Boone (ACE Team)
G. Toon (Mk IV P.I.)
Holger Bremer (ASUR team)
With thanks to the MLS teams
at Edinburgh and JPL

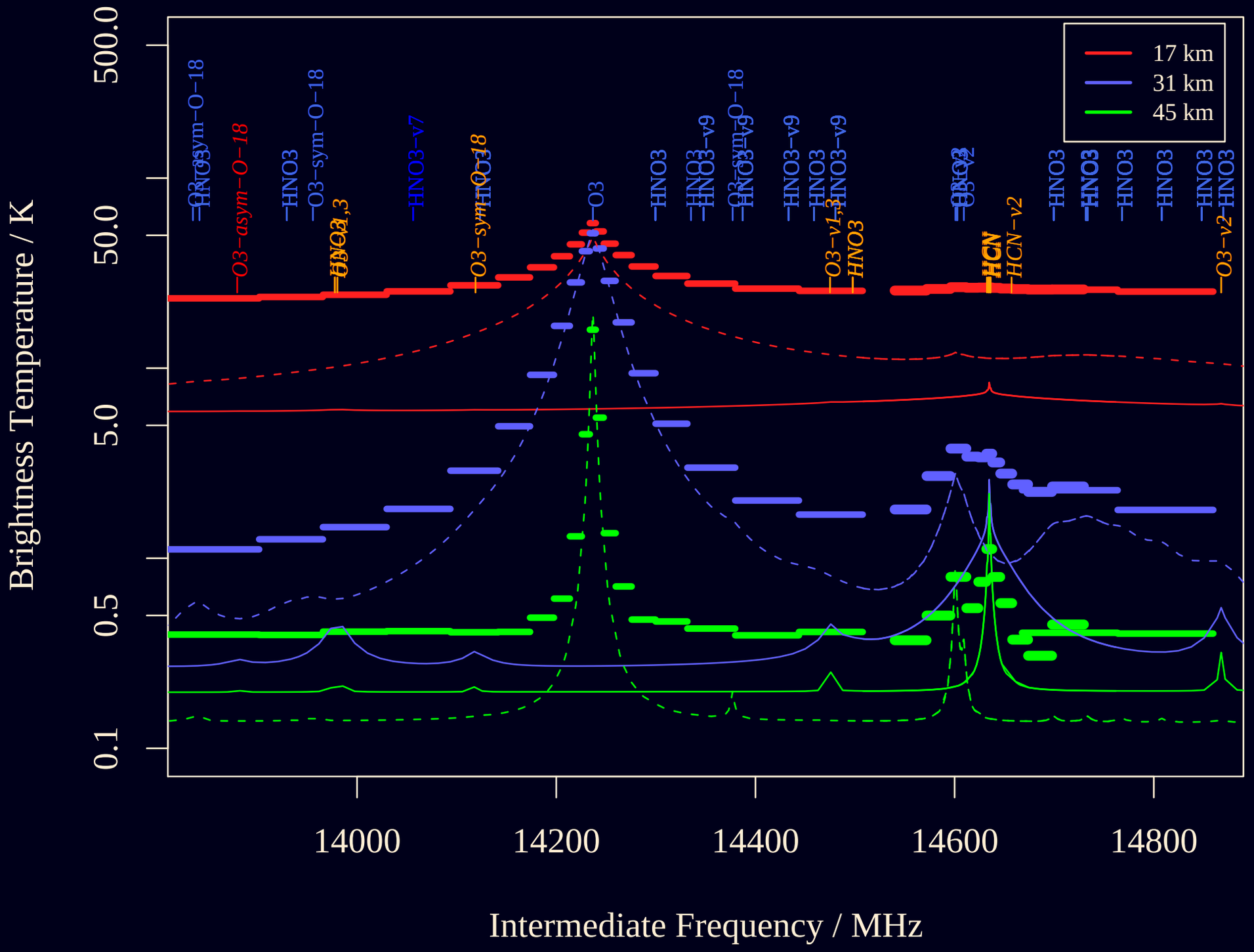
September 16, 2005

HCN: What we knew before Aura

HCN is a tropospheric source gas: in the middle atmosphere it decreases with height and latitude.



The MLS measurement of HCN



Retrievals of HCN

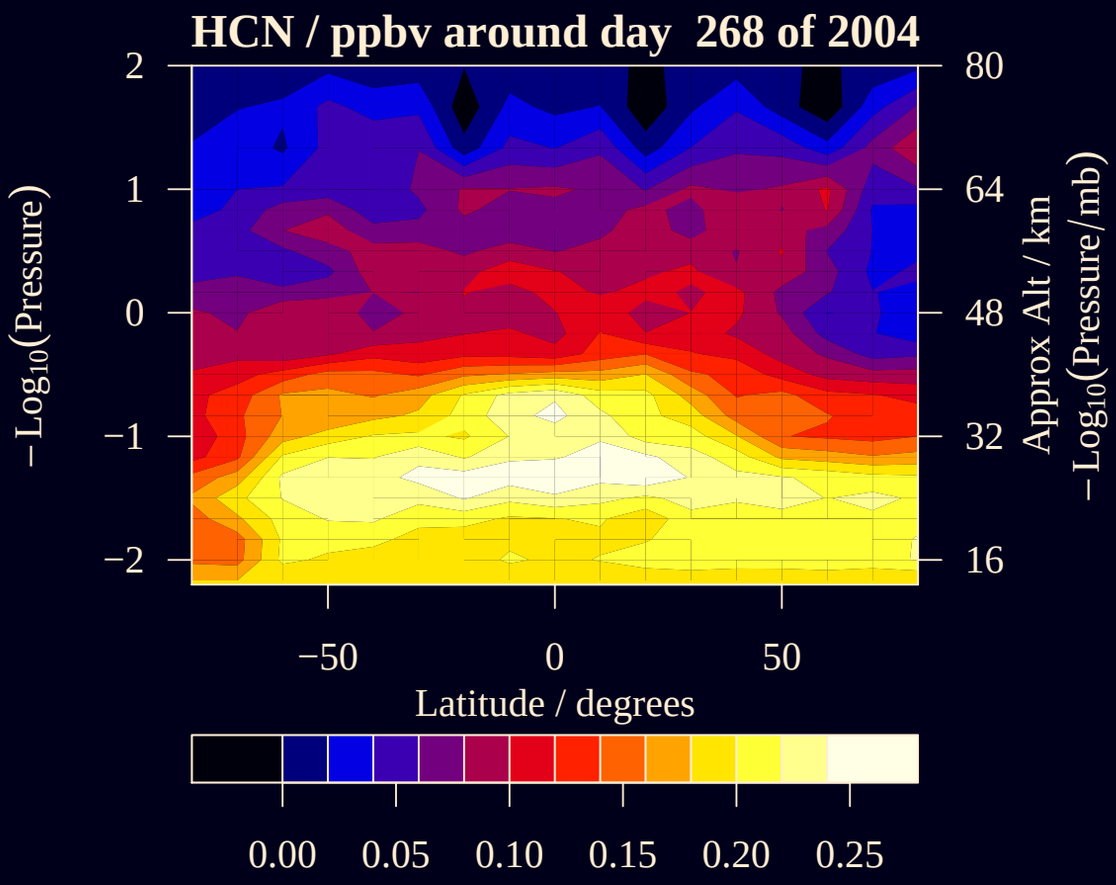
There are two separate retrievals of HCN shown in subsequent slides:

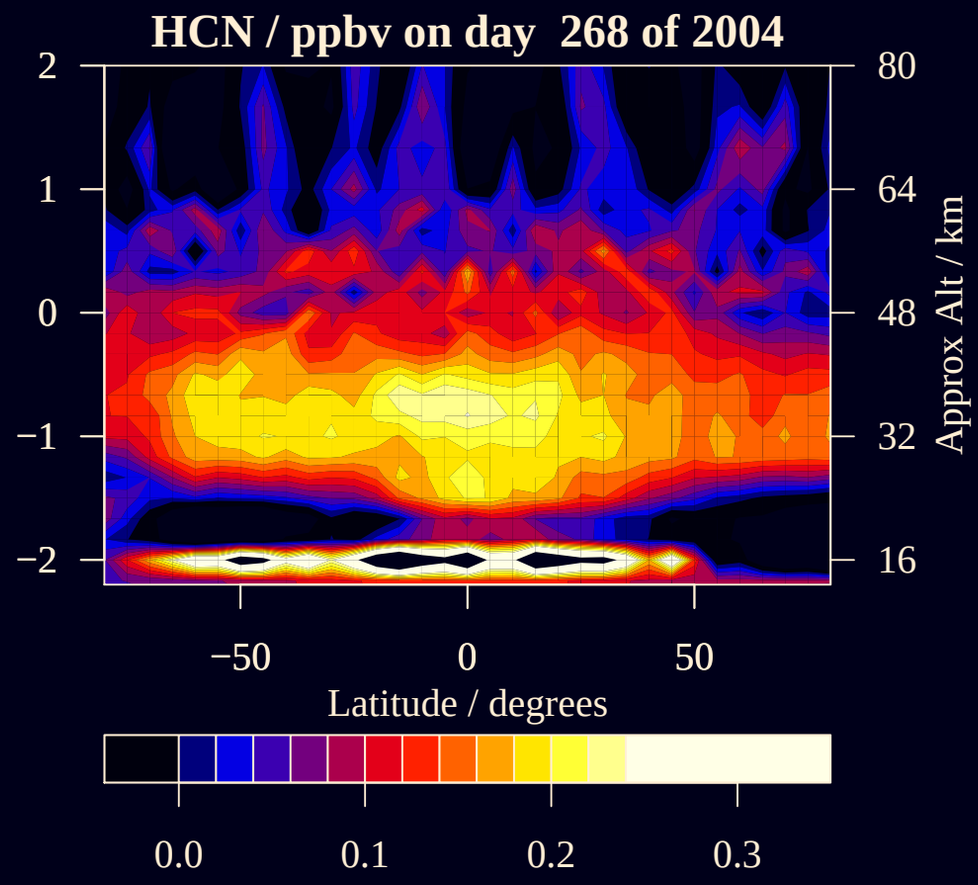
- The standard V1.5 product
  - 3495 profiles per day
  - Usable between 10 mb and 1 mb (32 km and 48 km)
  - Very noisy
- An offline weekly zonal mean product
  - Radiances binned into 7-da7, 10°latitude bins
  - HCN profiles retrieved from those average radiances (along with O_3, HNO_3, Temperature)
  - HCN usable between 31 and 0.1 mb (24 km and 64 km)

The available correlative data

- Historic data (shown on earlier slide)
- ASUR — A mm-wave instrument flown on the DC-8 during PAVE
- ACE-FTS — An Infra-red Fourier transform solar occultation instrument on the Canadian SCISAT-1 satellite
- Mk IV — An Infra-red Fourier transform solar-absorption spectrometer flown on a balloon

MLS HCN: Does it look like a tropospheric source gas?

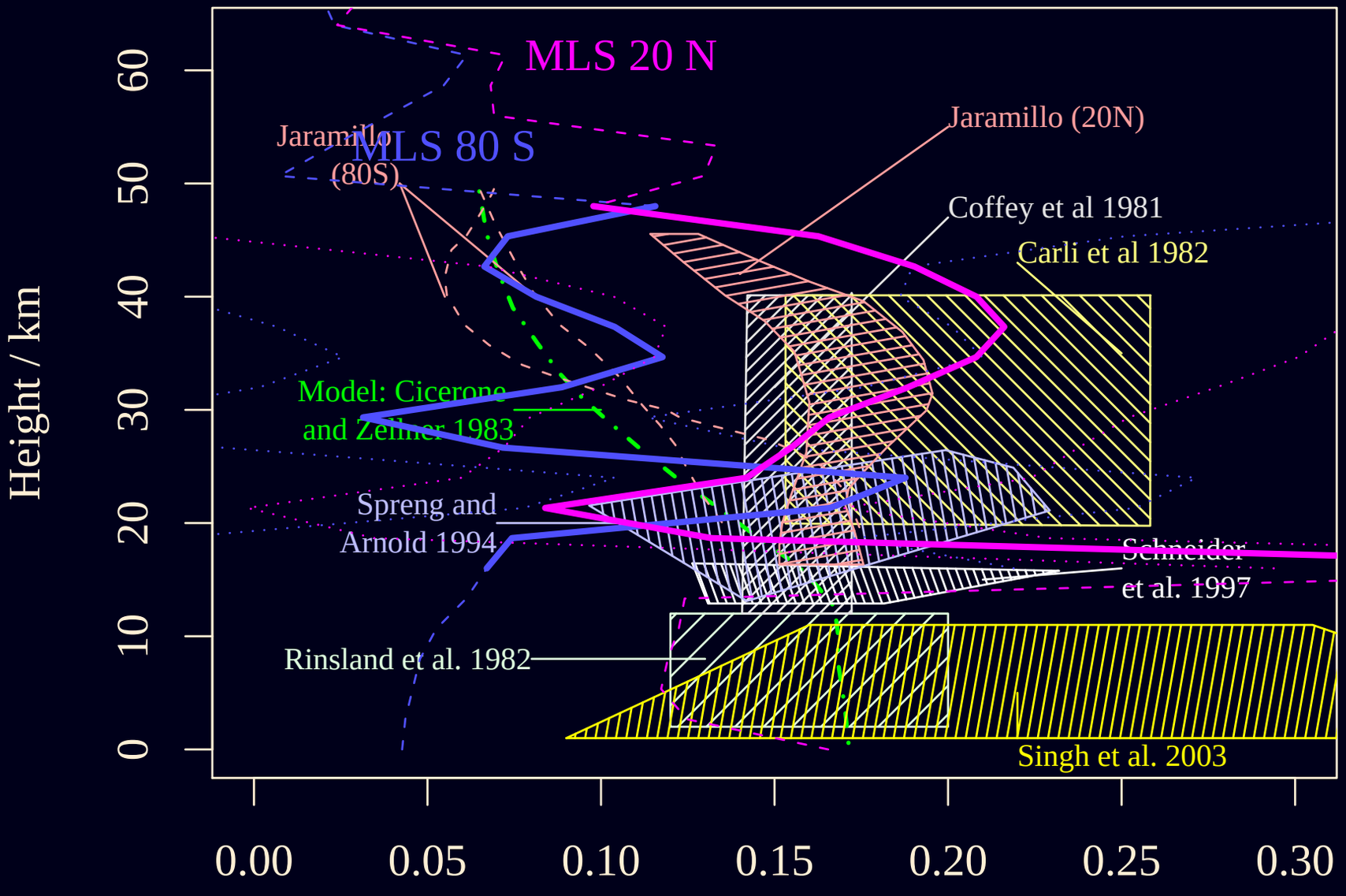




- Should decrease with height and latitude
- Weekly zonal mean (left) reasonable between 24 and 80 km
- V1.5 (right) reasonable between 32 and 48 km

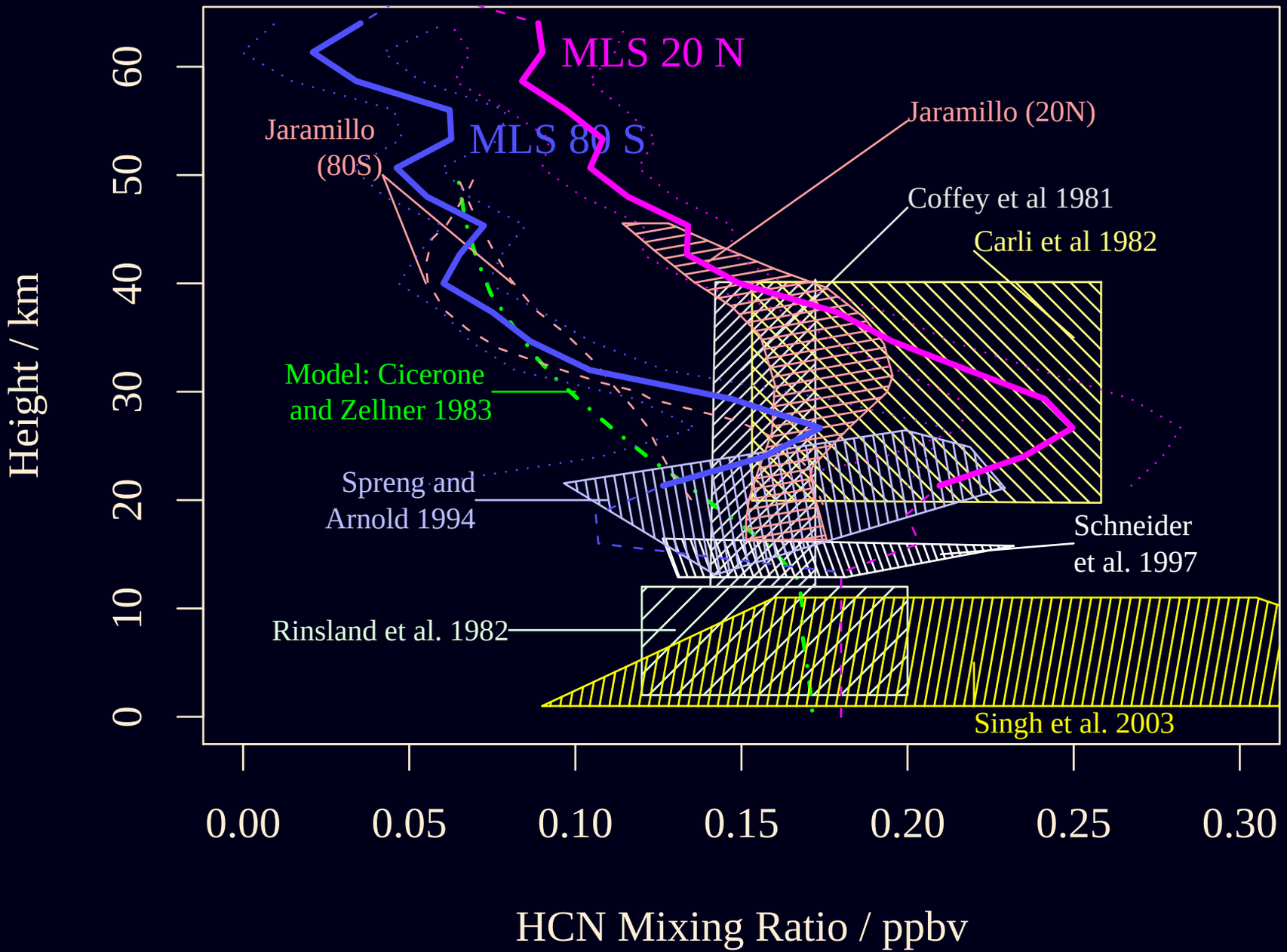
MLS (V1.5 production data) vs historic data

Agreement is not good. But at least between 32 and 48 km the mixing ratio decreases with height and latitude.



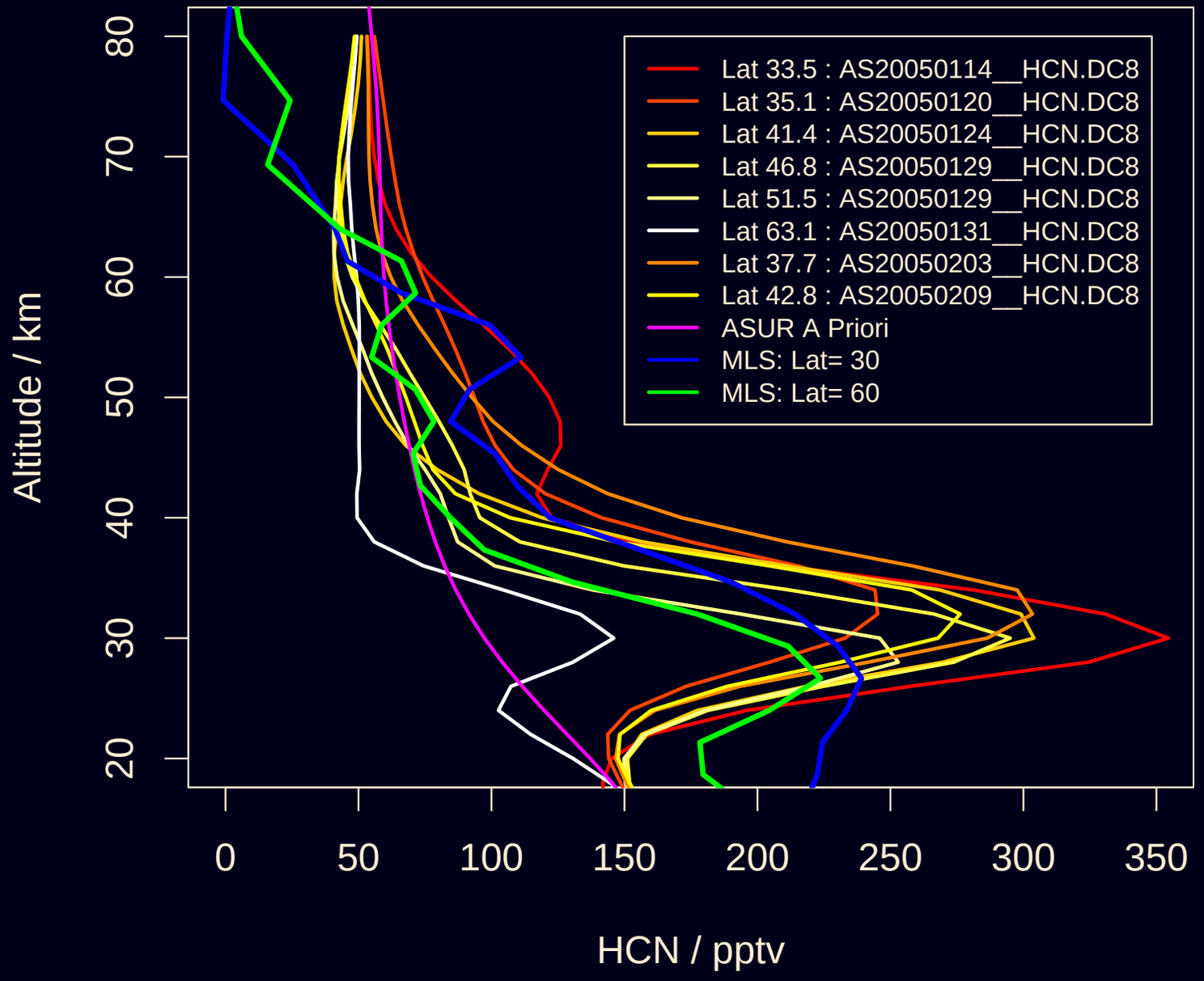
MLS (offline weekly ZM) vs historic data

Agreement better than V1.5, but a bit suspicious between 20 and 30 km

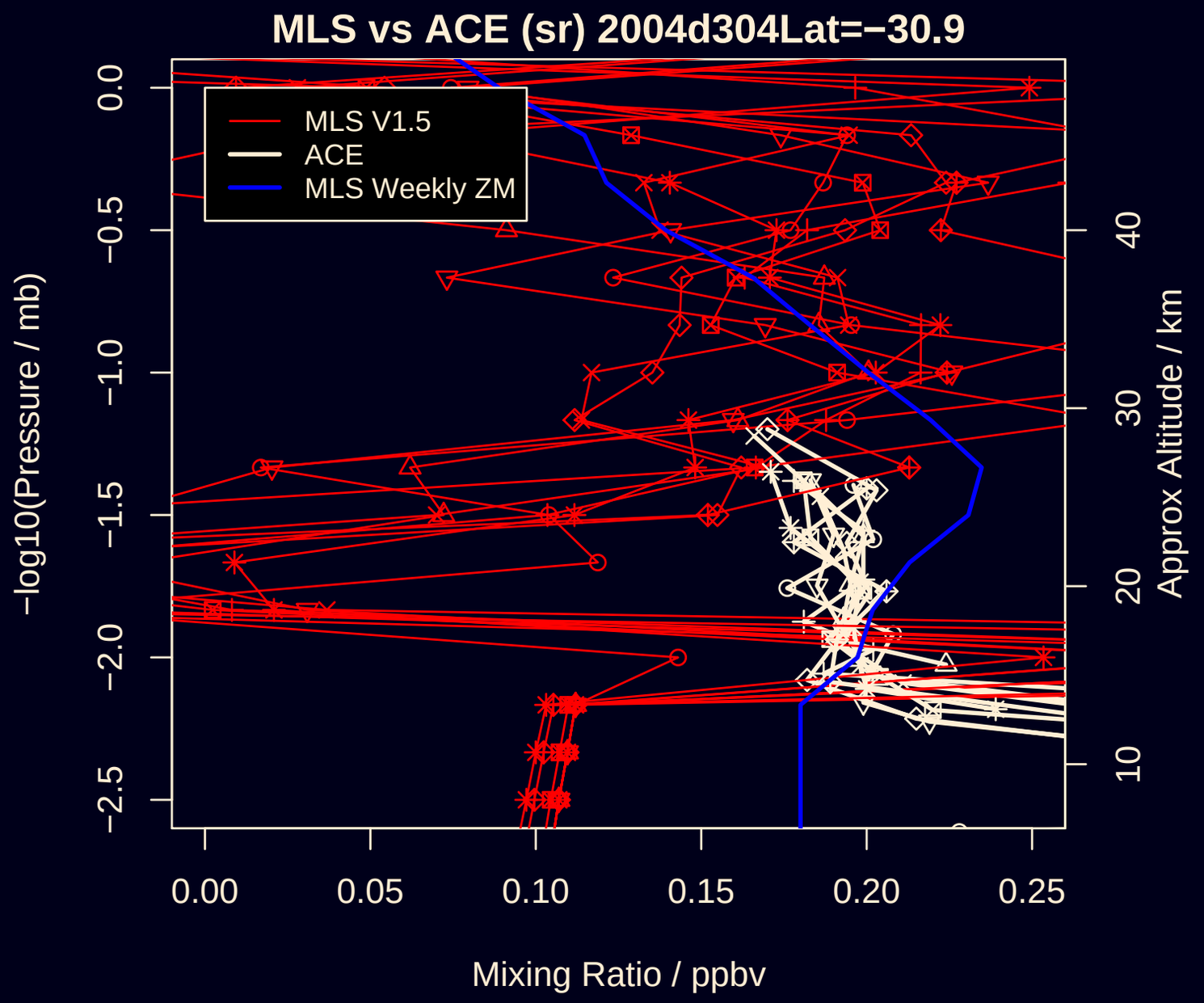


MLS (Weekly ZM) vs ASUR (Data from PAVE campaign)

HCN decreases with height and latitude for both instruments. Both have large peak in lower stratosphere, but the peak in the ASUR data is bigger.



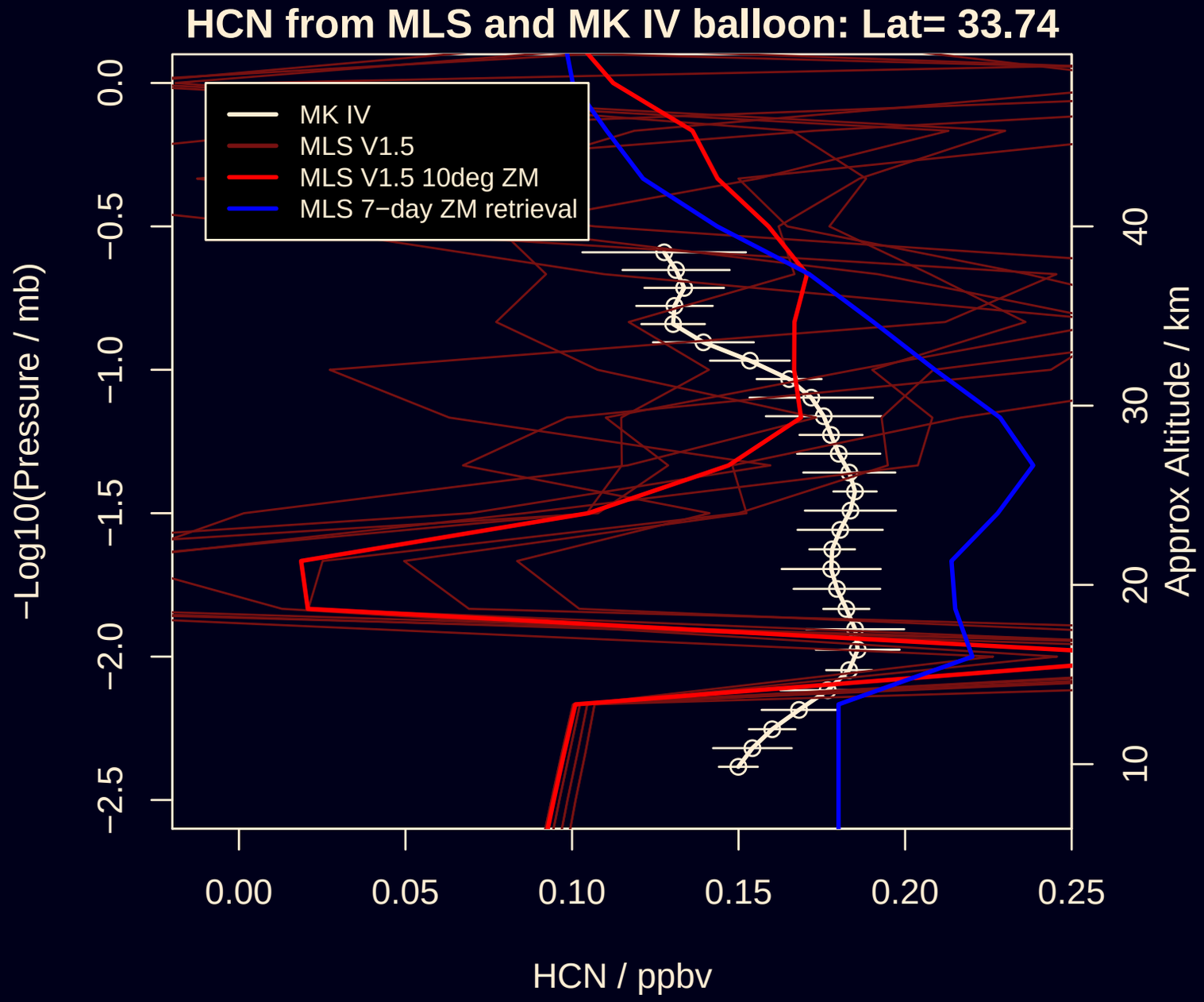
MLS vs ACE


MLS vs ACE (sr) 2004d304Lat=−30.9
MLS V1.5
ACE
MLS Weekly ZM
−log10(Pressure / mb)
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
Approx Altitude / km
10
20
30
40
0.00
0.05
0.10
0.15
0.20
0.25
Mixing Ratio / ppbv

MLS vs MkIV

MLS V1.5 has little useful overlap with MkIV, but shows a positive bias

MLS Weekly ZM retrieval appears to biased positive by 0.05 ppbv



Conclusions

- Offline weekly zonal mean retrievals
  - MLS HCN is roughly in line with the historic and co-located data but tends to show a positive bias, especially between 20 and 30 km
  - Appears to behave as a tropospheric source gas between 24 and 64 km
- V1.5 Single-profile retrievals
  - Very noisy
  - Reasonable values (again perhaps with positive bias) in very limited altitude range: 32-48 km
  - Large systematic errors in lower stratosphere
  - Quality of weekly ZM product implies potential to improve standard product in next release