Assessment of SBUV Profile Algorithm Using High Vertical Resolution Sensors

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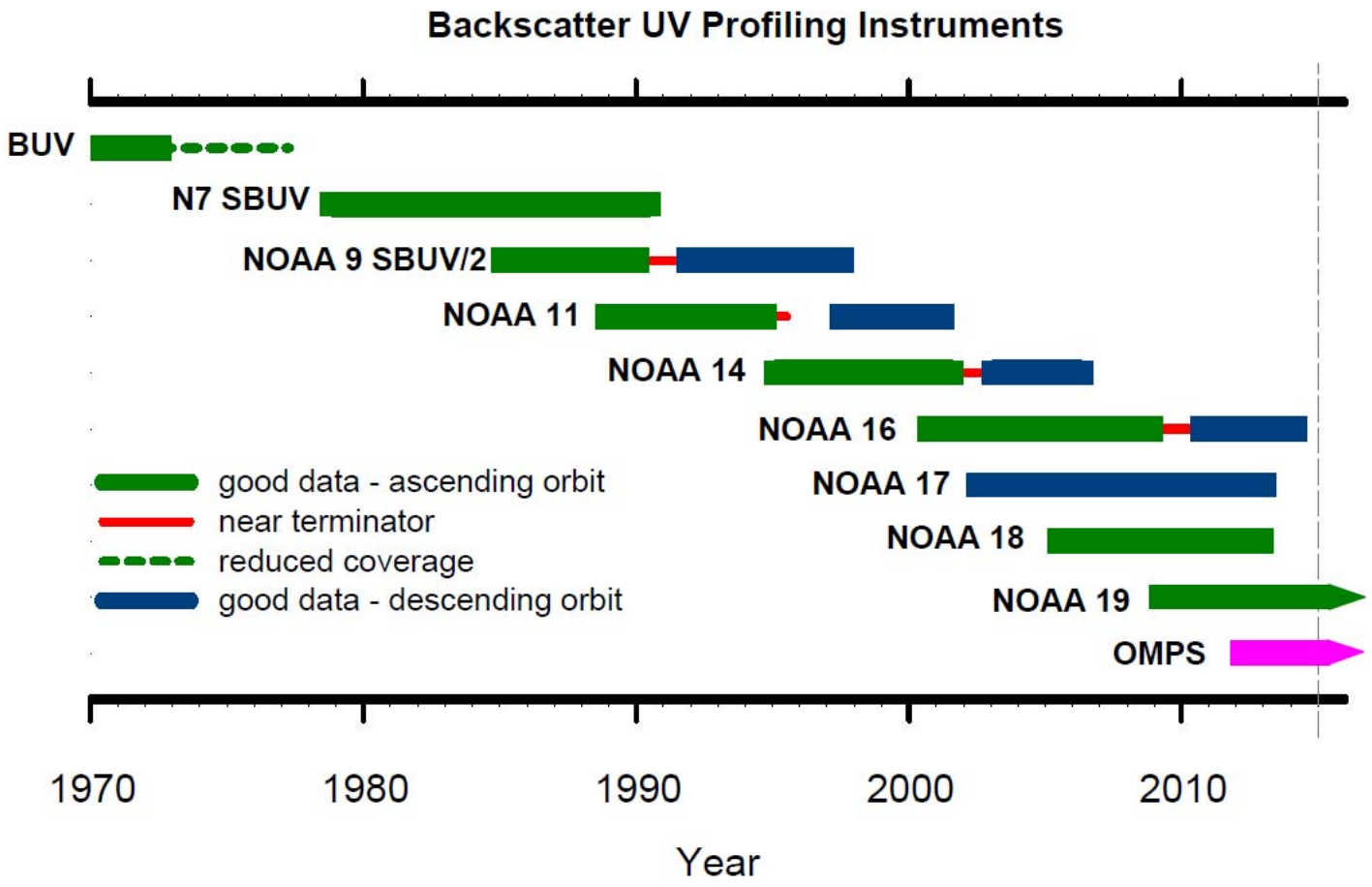
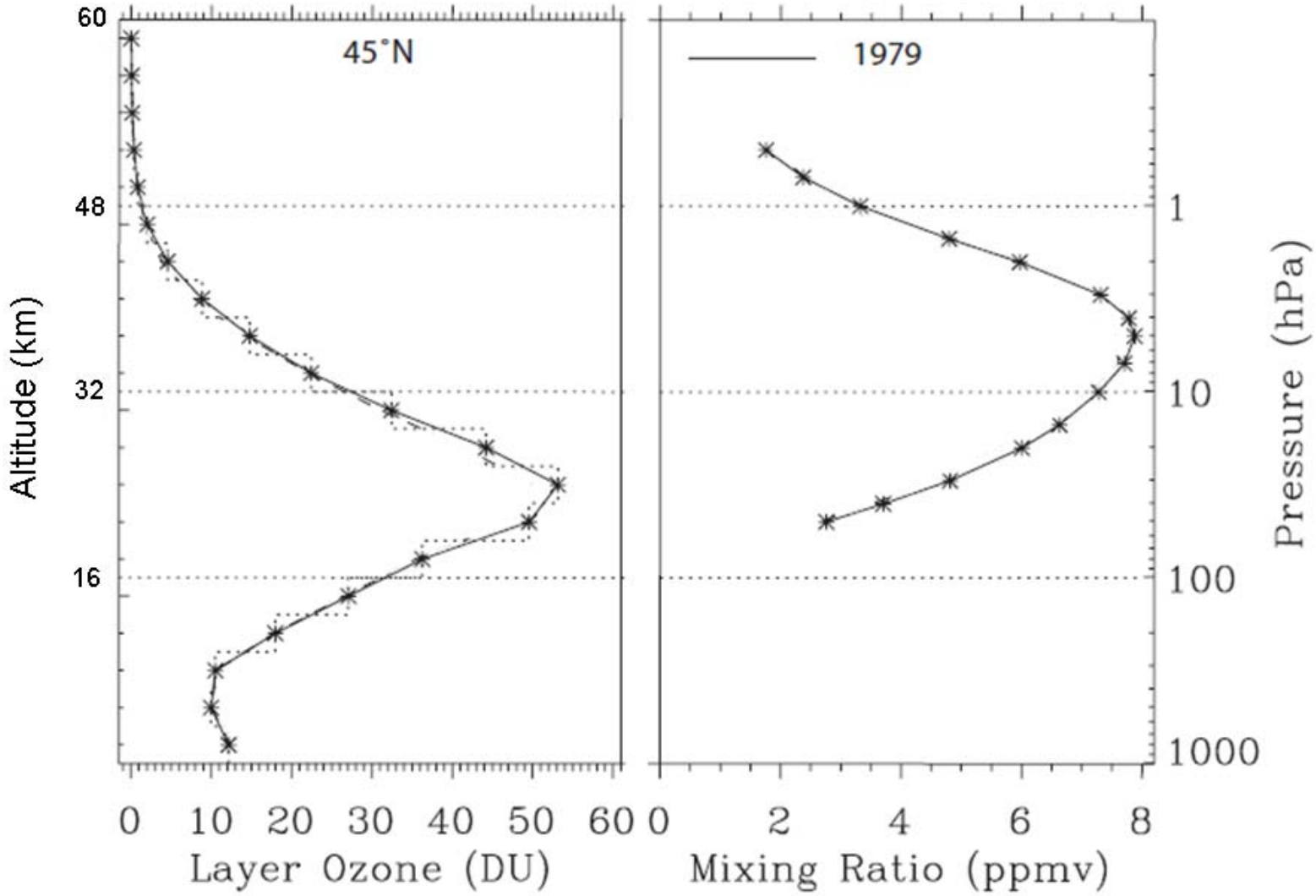
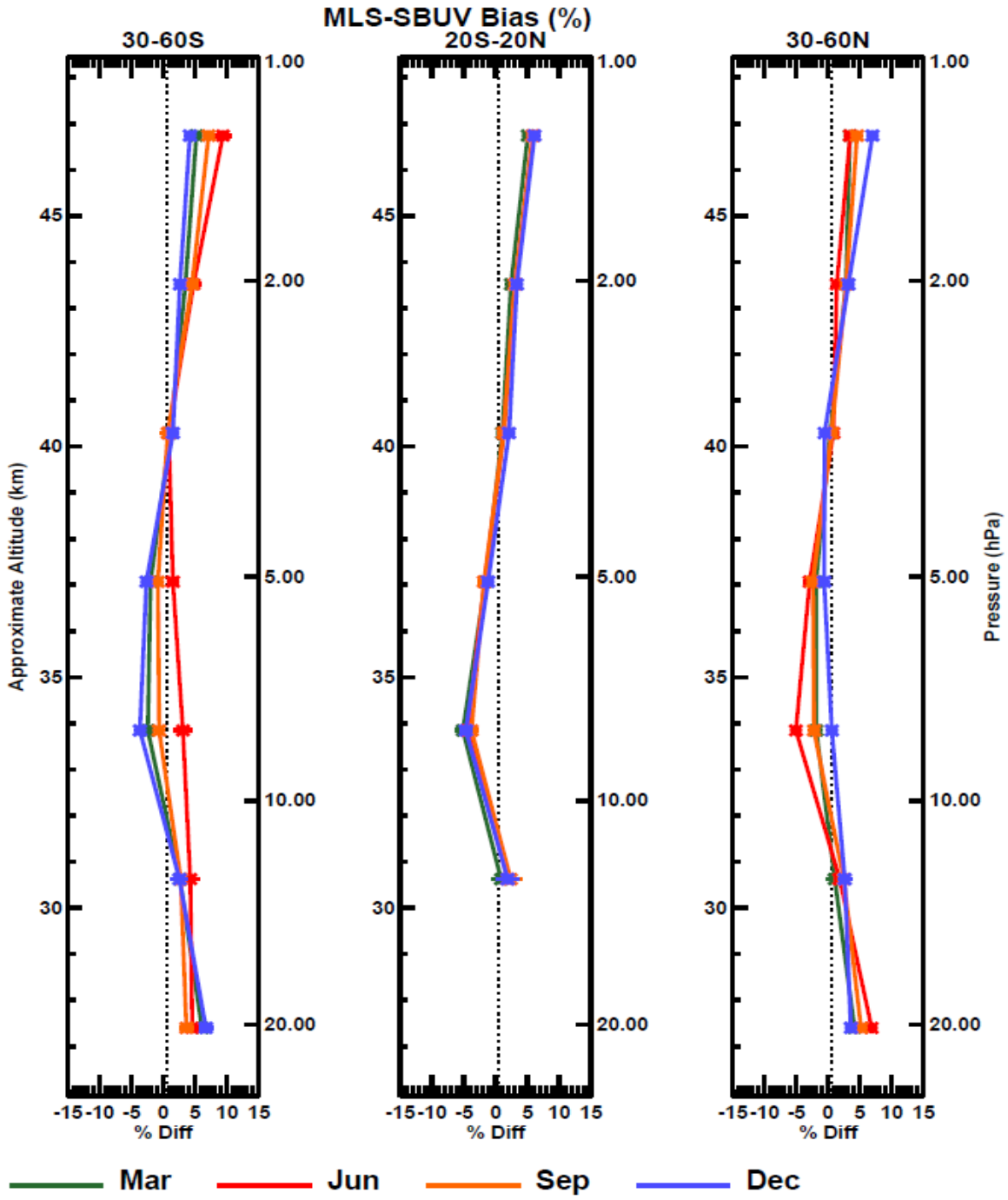


SBUV data from a series of 9 instruments reprocessed with coherent calibration – version 8.6



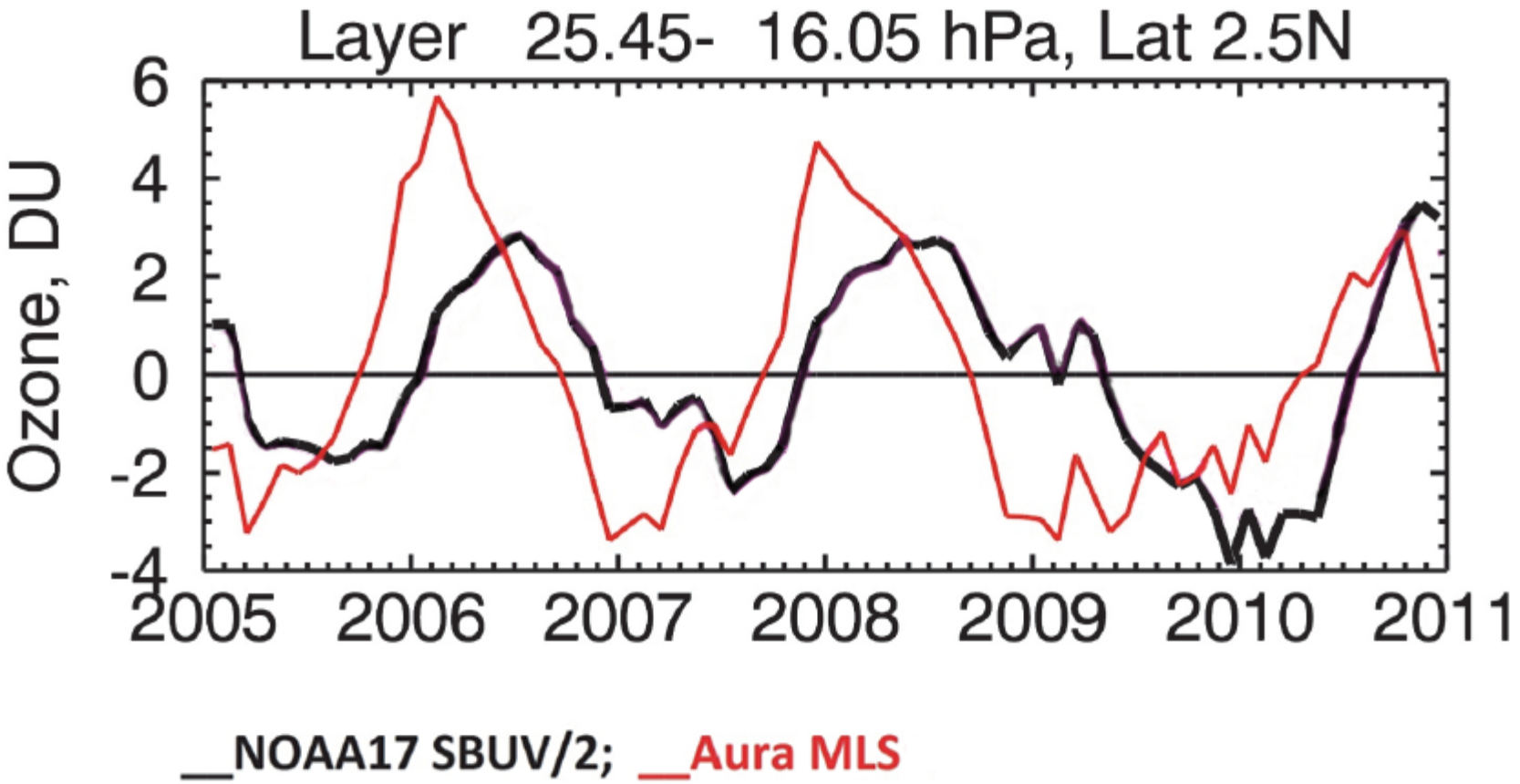
SBUV retrieval layer structure (20 layers)
(*much finer than actual resolution*)

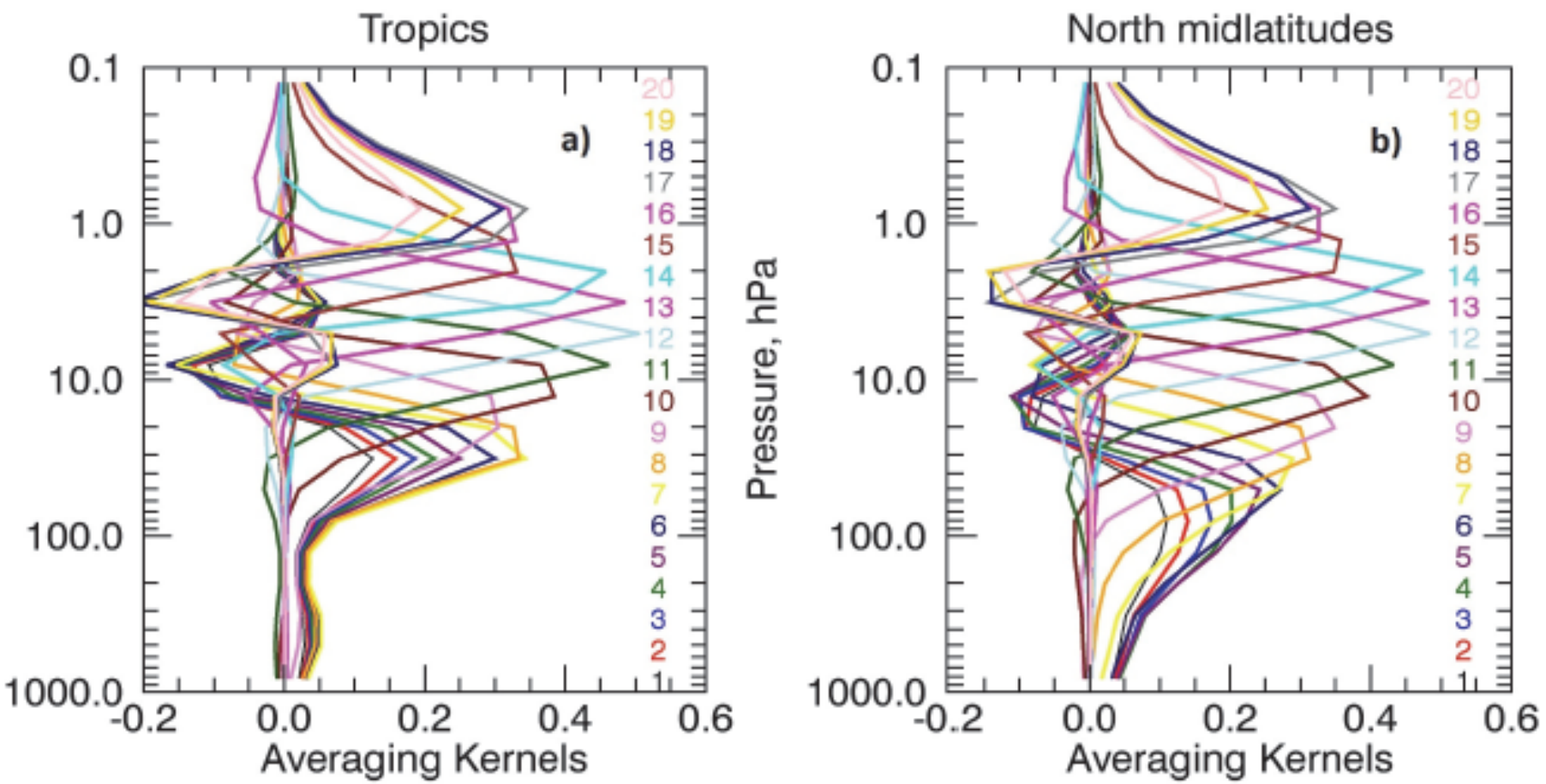


Compare with MLS

Agreement usually within ±5% at all altitudes and seasons.

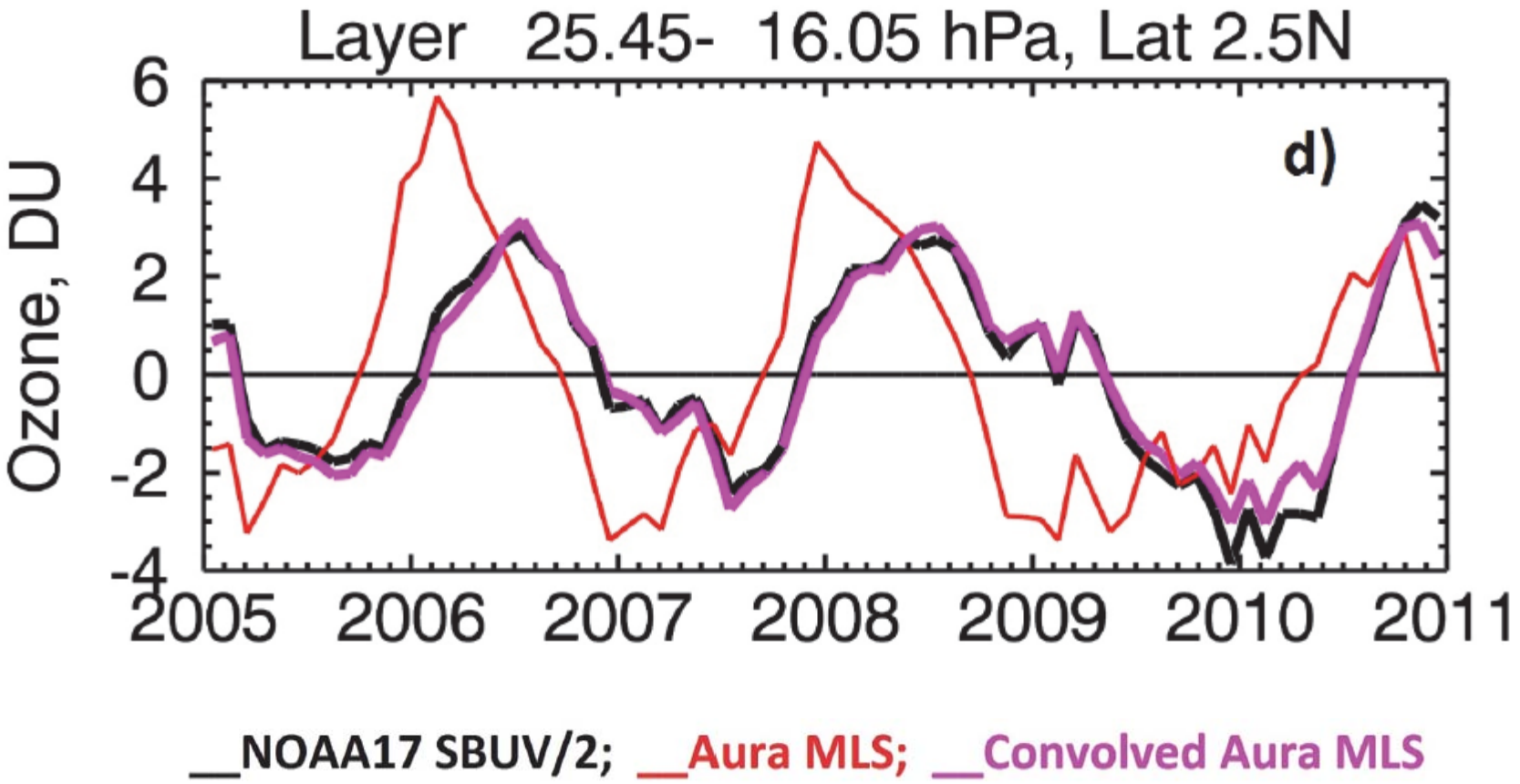
Compare with MLS
SBUV Smoothing error - Quasi-Biennial Oscillation



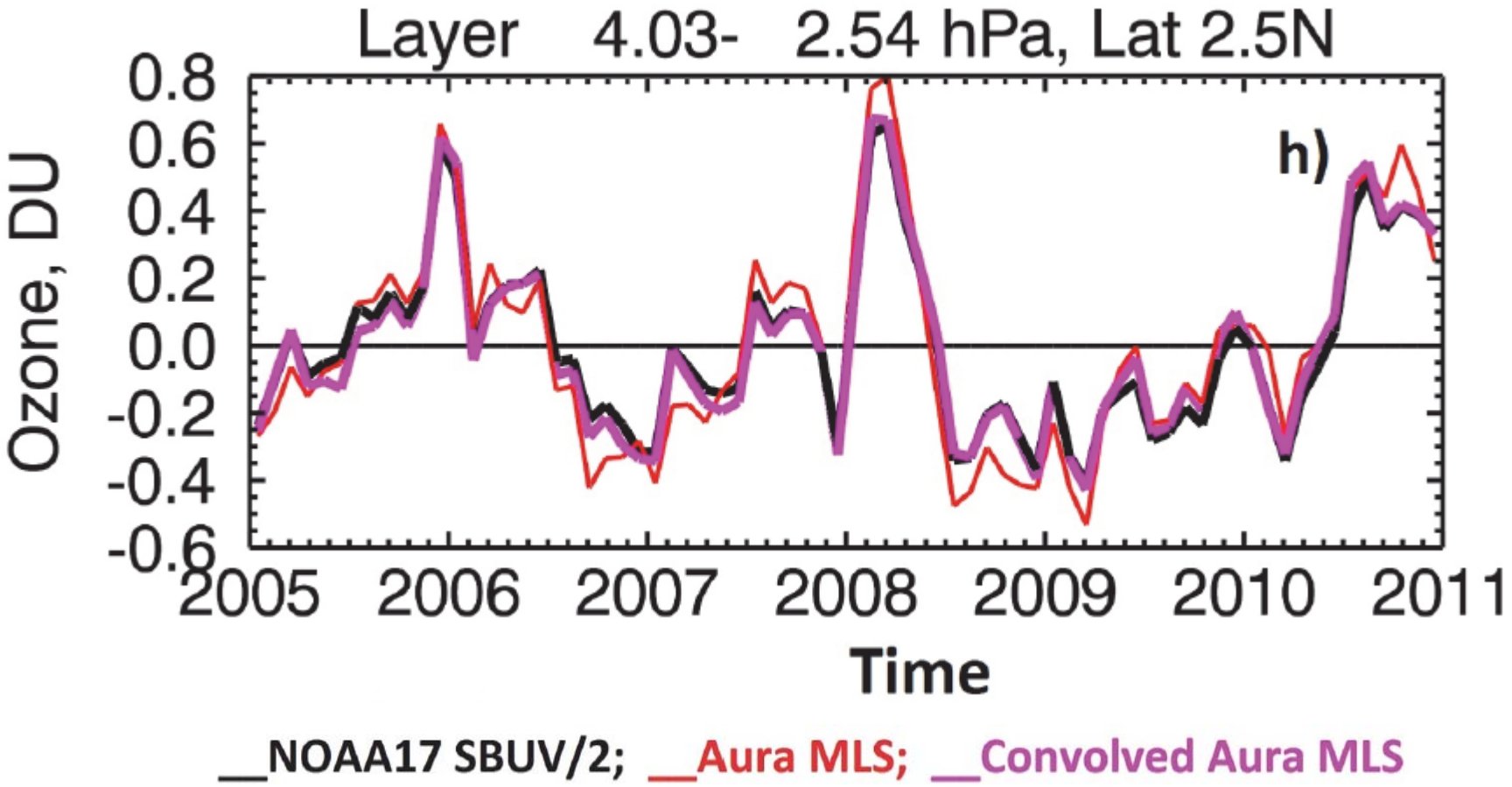


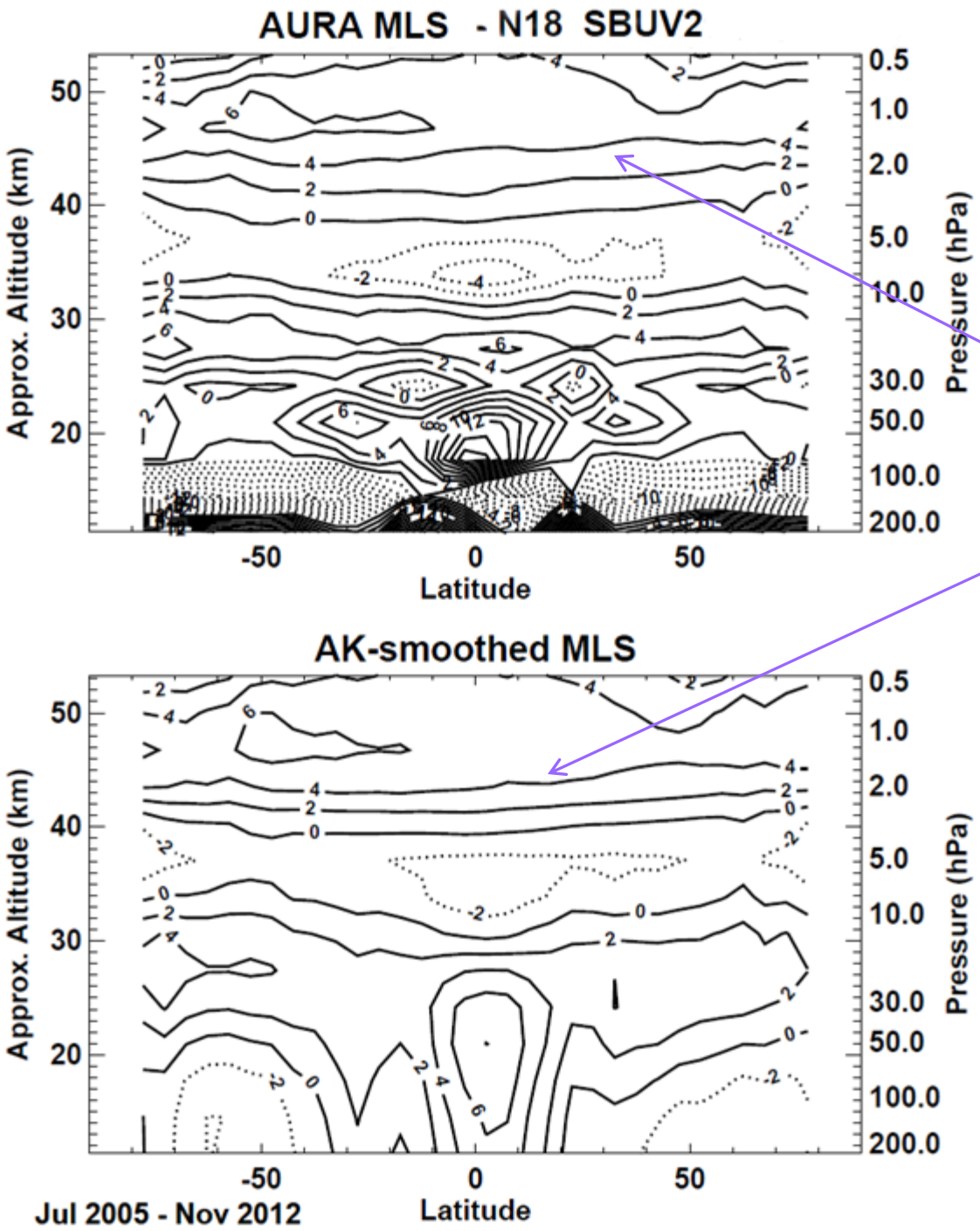
Typical SBUV Averaging Kernels for (a) the tropics and (b) northern middle latitudes. Different colors correspond to individual layers, (layer numbers are indicated on the right).

SBUV averaging kernel applied to MLS produces similar QBO pattern

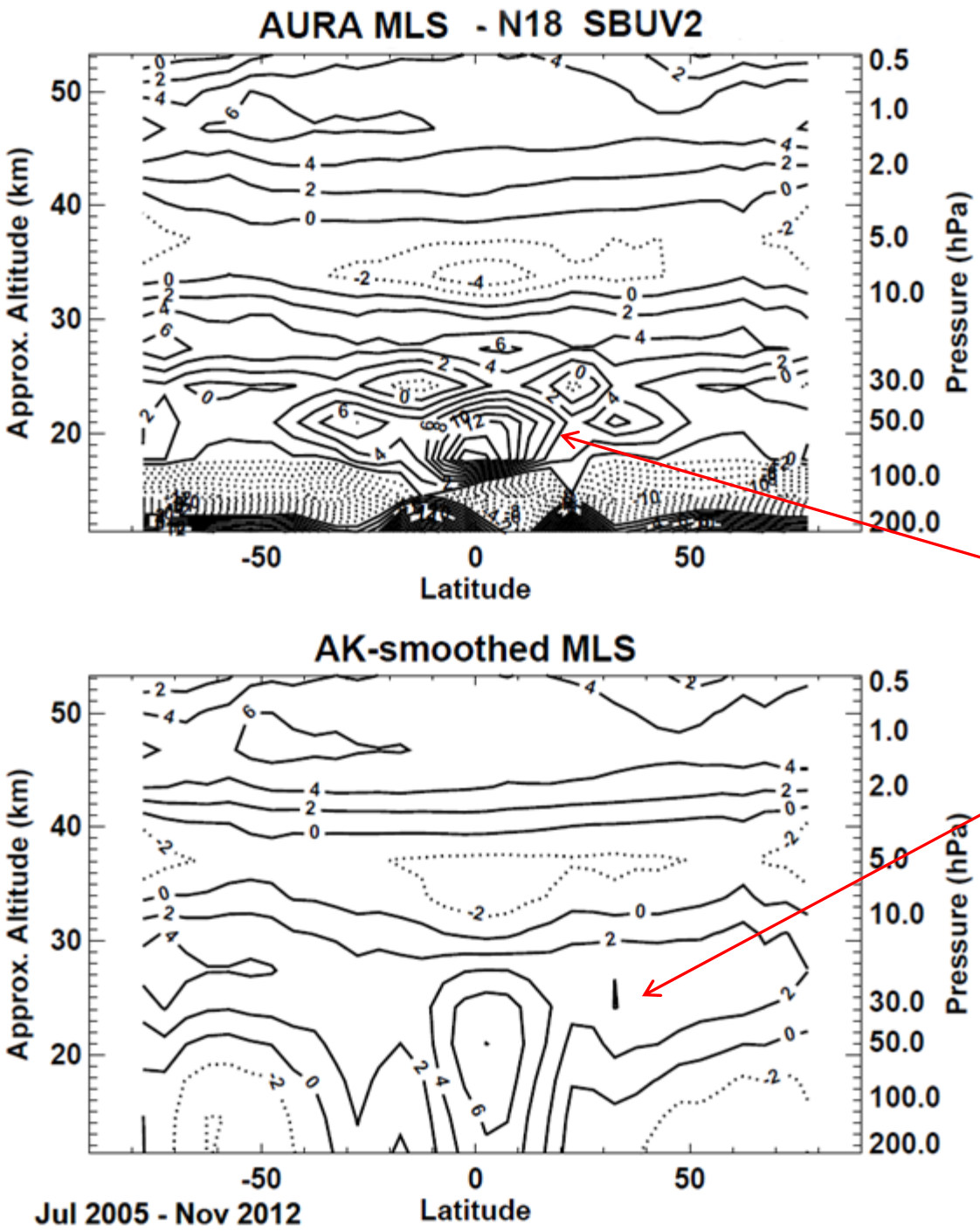


In upper stratosphere averaging kernel not needed



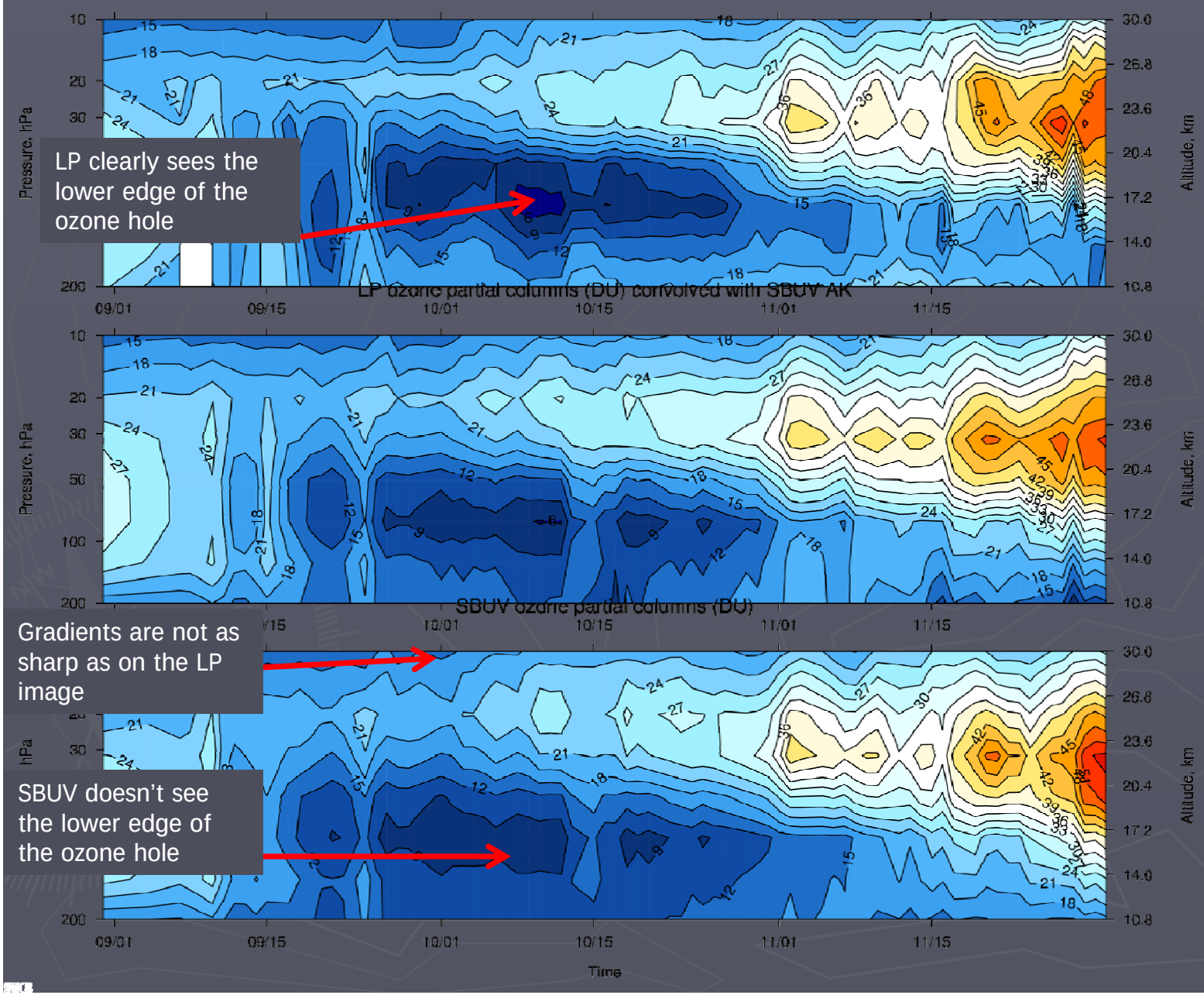


Agreement with MLS is good in the upper stratosphere



Large differences due to smoothing error below 16 hPa

Compare with NPP Limb Profiler

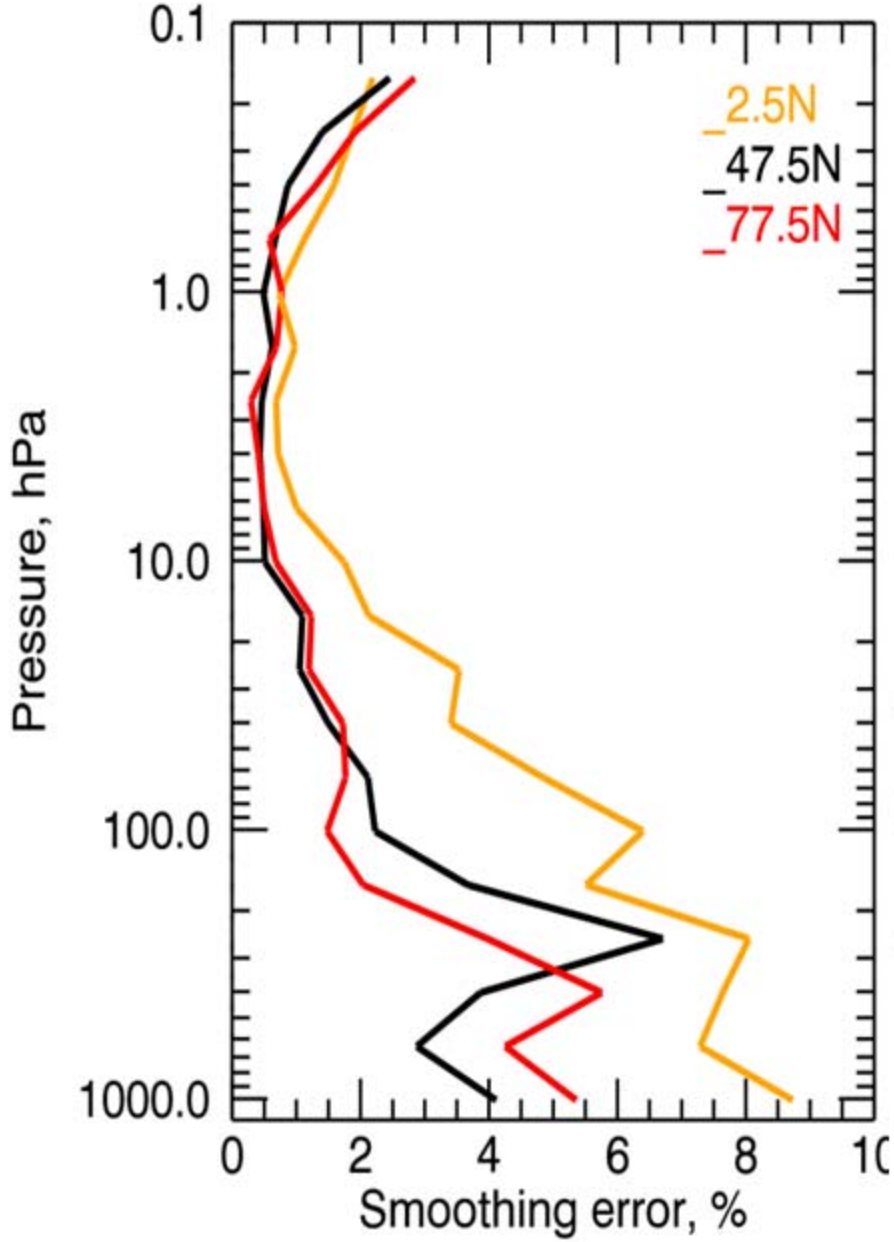


LP in DU/layer

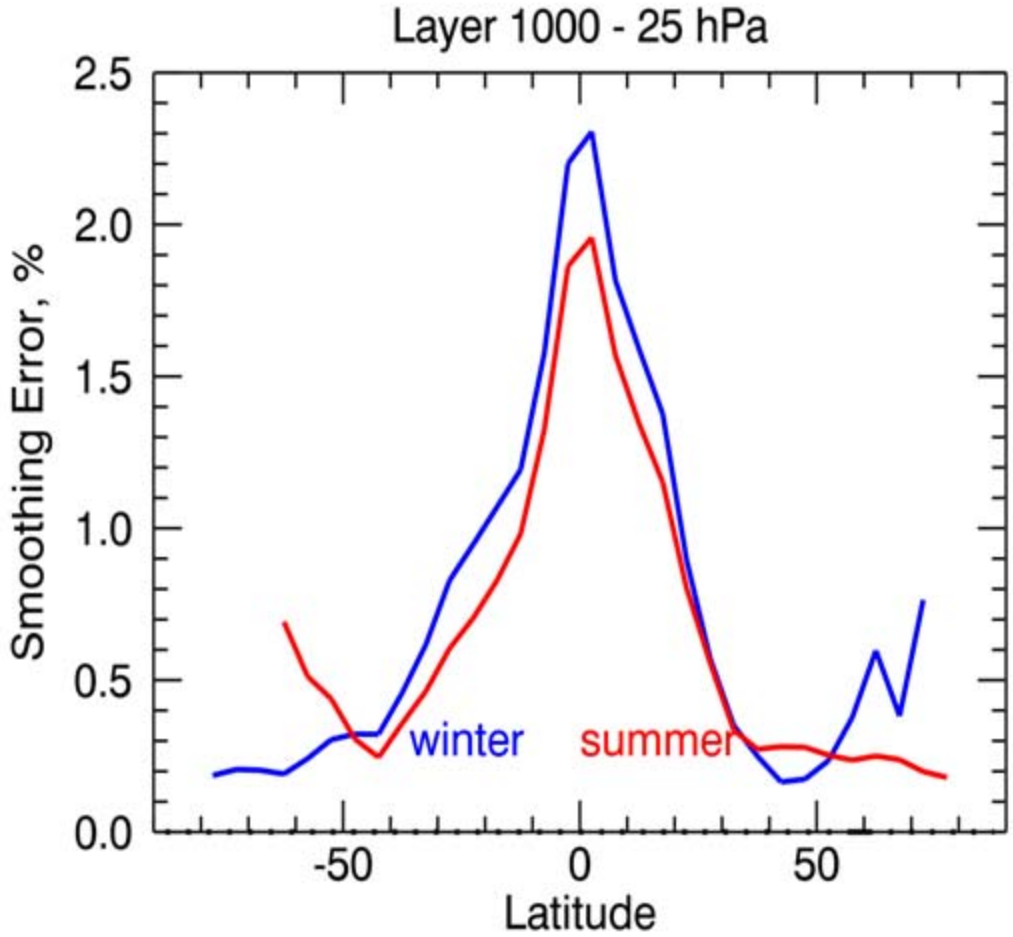
LP in DU/layer convolved with SBUV AK

SBUV in DU/layer

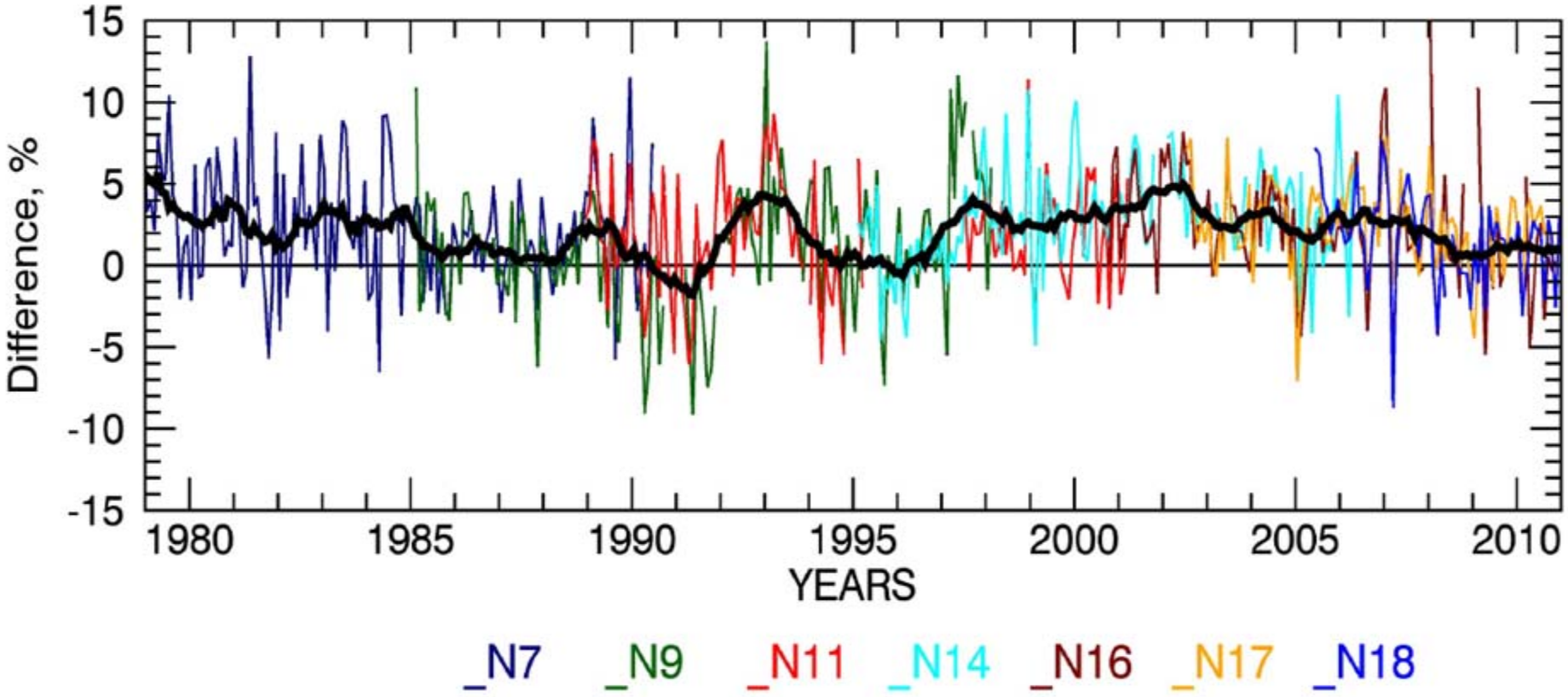
Profile Smoothing Error



Total Ozone Smoothing Error < 1%
Individual Layer Smoothing Error 1% to 8%
Smoothing Error for Layer Data ~ 2%



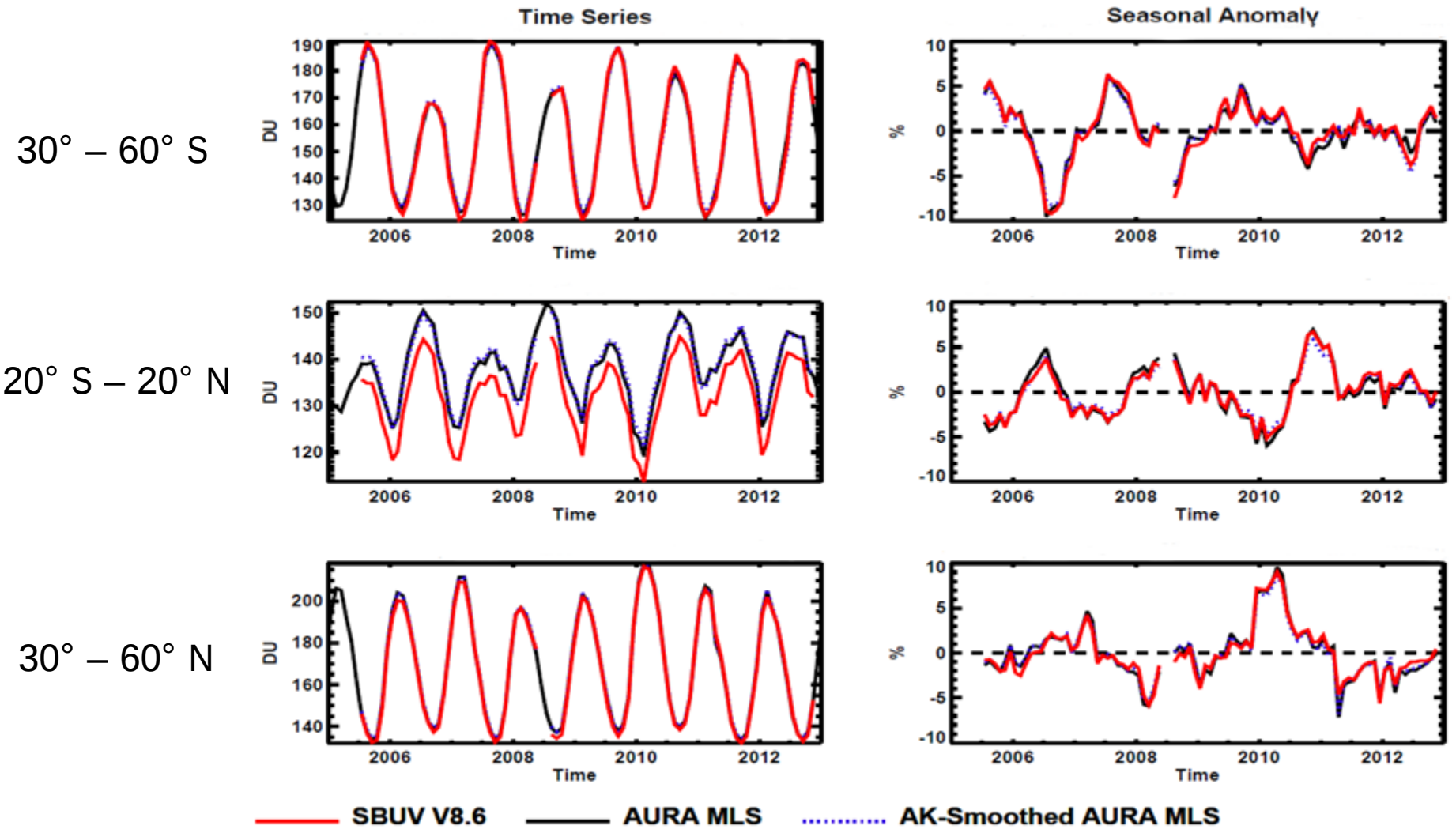
We recommend using large layers for SBUV in lower stratosphere and upper troposphere



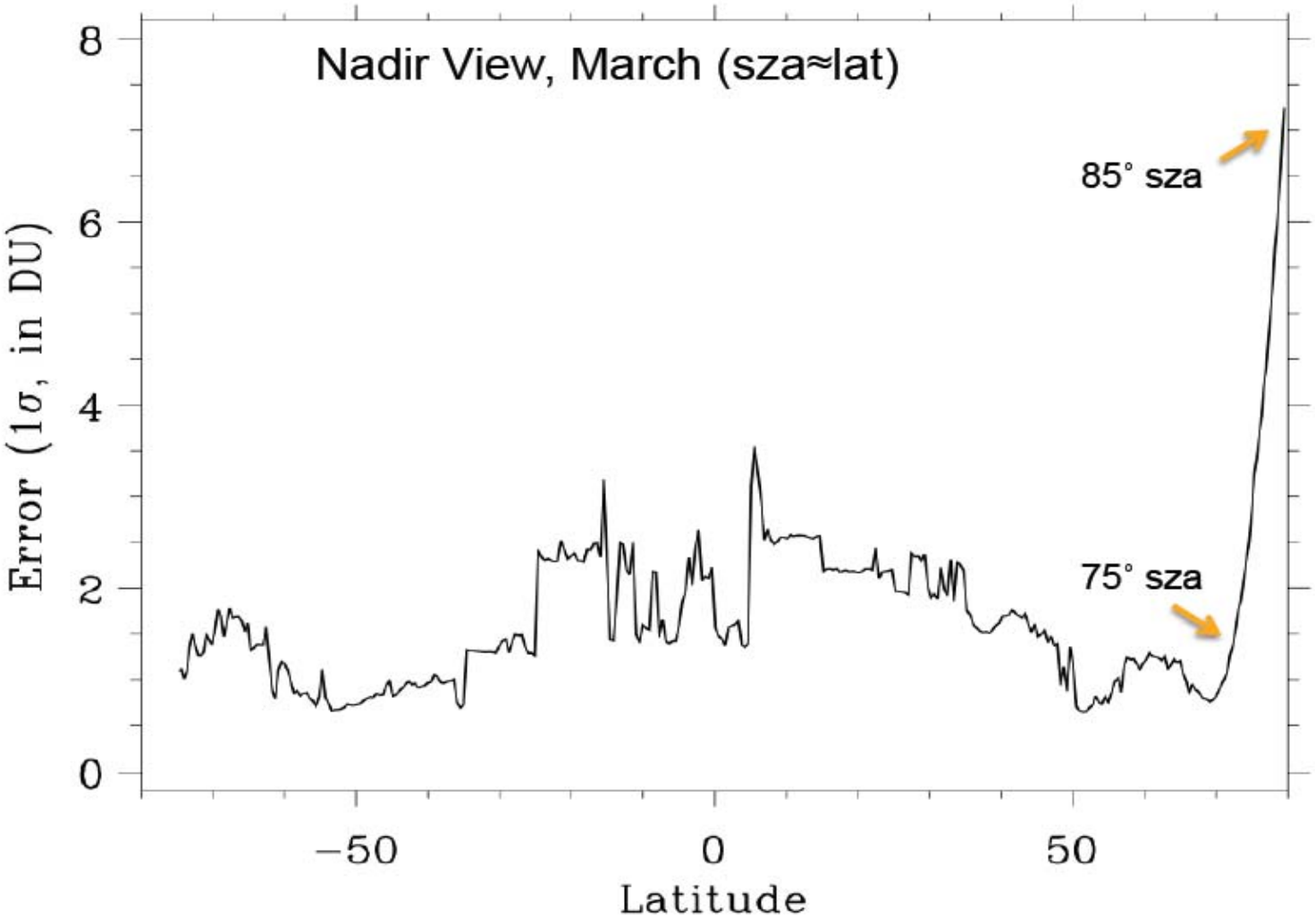
SBUV vs 4 mid-latitude sonde stations: 0 – 24 km layer

(Lindenberg, Hoehnpeissenberg, Boulder, Payerne)

Combined tropospheric layers agree with MLS:
254 – 16 hPa in tropics
254 – 25 hPa at mid and high latitudes



Profile Shape Error in TOMS Total O_3



Estimated using ozonesonde climatology (mean & covariance)

Conclusions

- SBUV agrees well with high resolution instruments in middle and upper stratosphere
  - Above 20 km, there is virtually no benefit from adding wavelengths or increasing measurement precision.
- Disagreement in lower stratosphere / troposphere is a result of low SBUV vertical resolution
  - Averaging kernel brings agreement
  - Additional wavelengths may give a bit more profile information in troposphere
- Total column ozone shape error significant SZA>80°