Long term trend of SABER carbon dioxide

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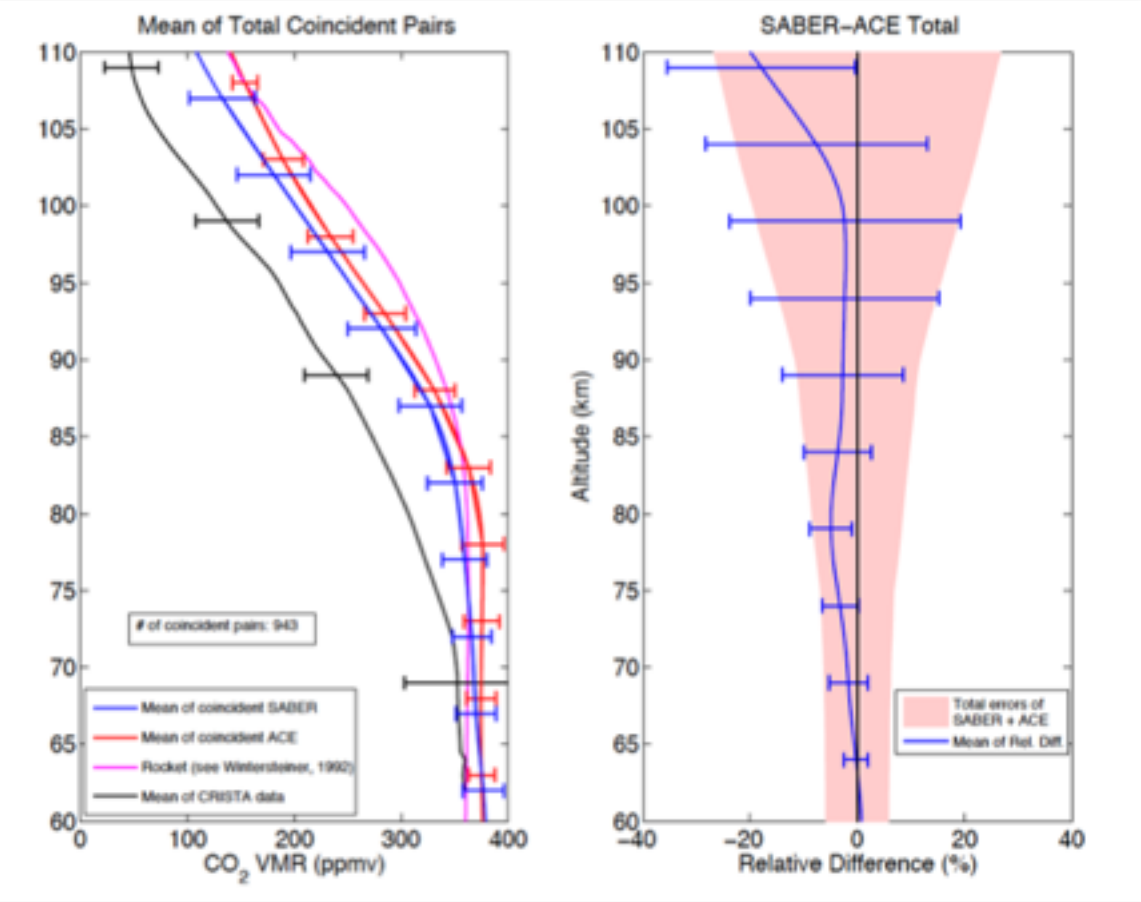
Overview

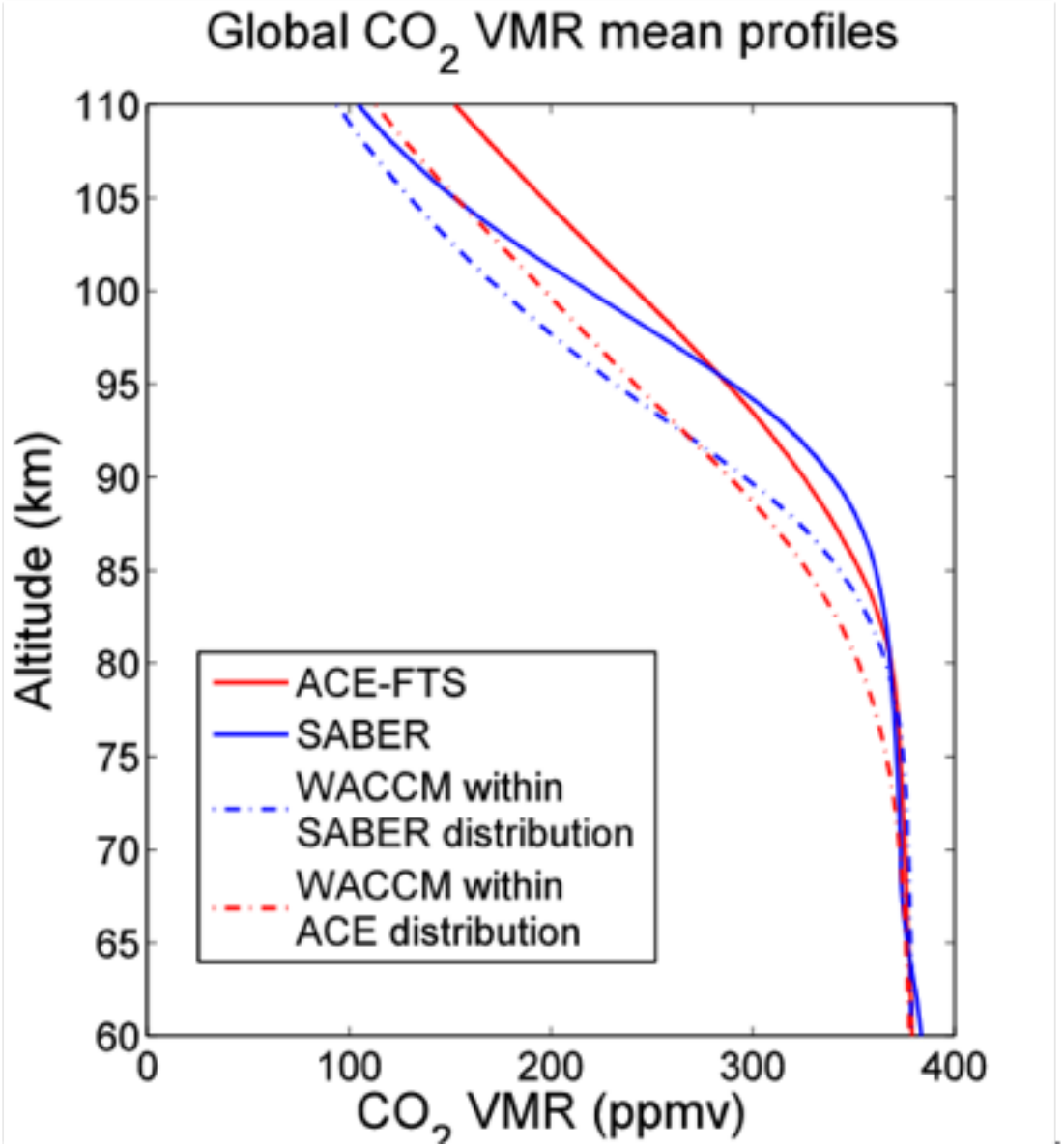
- SABER CO2 data (2002-2014)
- CO2 data is now available to the public in the form of daily NetCDF files via ftp at ftp://saber.gats-inc.com/Version2_0/Level2C/
- Increasing CO2 abundance in the upper atmosphere (2002-2014)

Validation of SABER CO2 with ACE-FTS

Rezac et al. JGR, to be submitted, [2015]

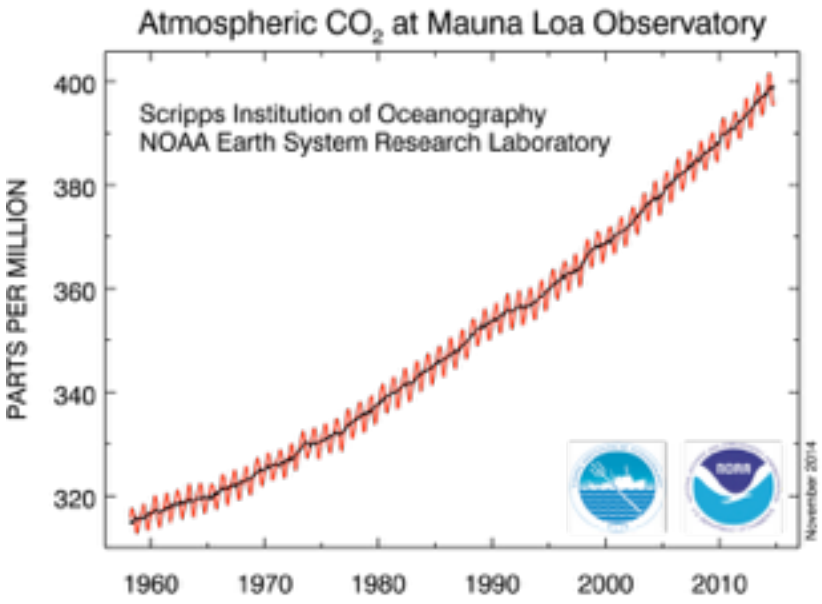
CO2 departs from well-mixed due to the lack of turbulence above 80 km




Global CO_2 VMR mean profiles
Altitude (km)
110
105
100
95
90
85
80
75
70
65
60
0
100
200
300
400
CO_2 VMR (ppmv)
ACE-FTS
SABER
WACCM within SABER distribution
WACCM within ACE distribution

Long-term changes in CO2 abundance in the upper atmosphere

Keeling curve

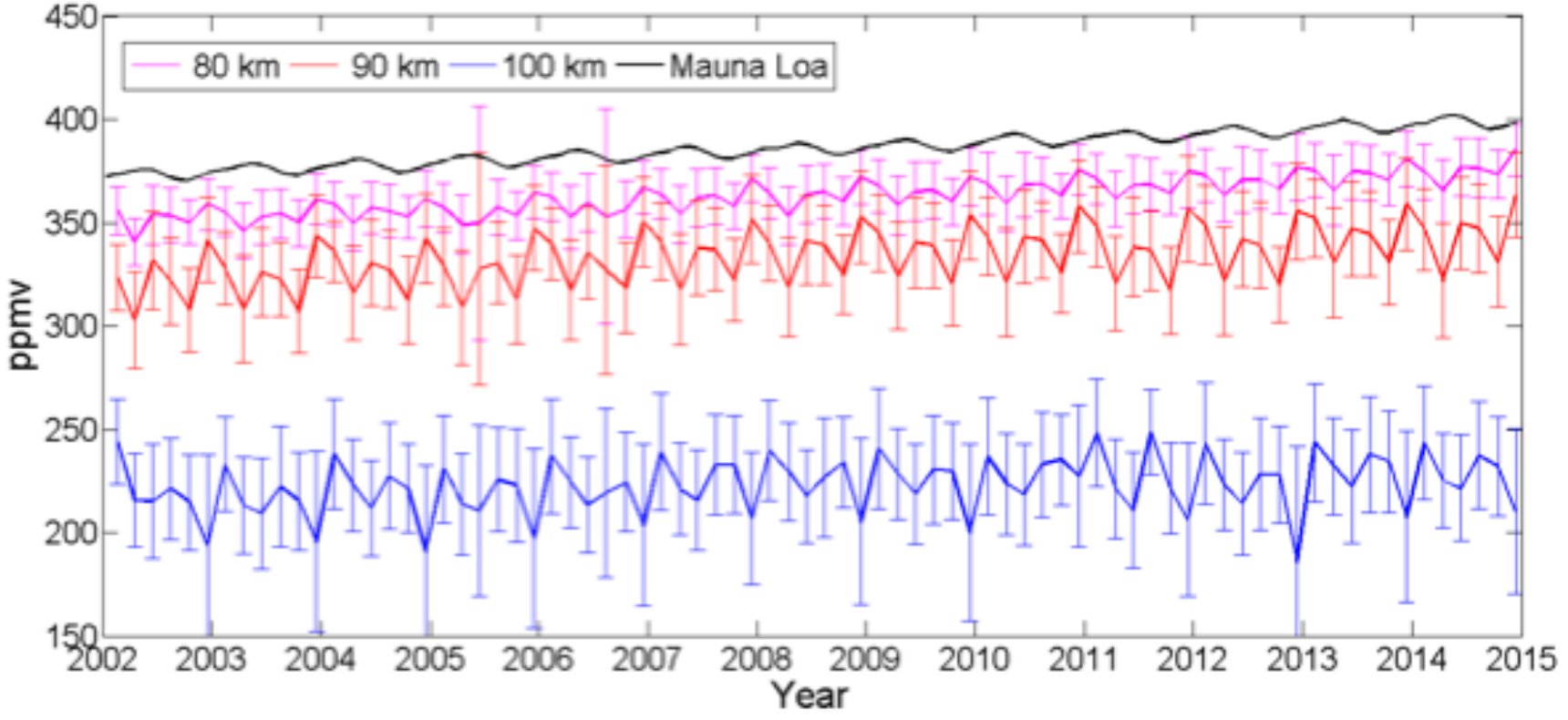


Emmert et al., Nature Geo, 2012

Trend in SABER CO2

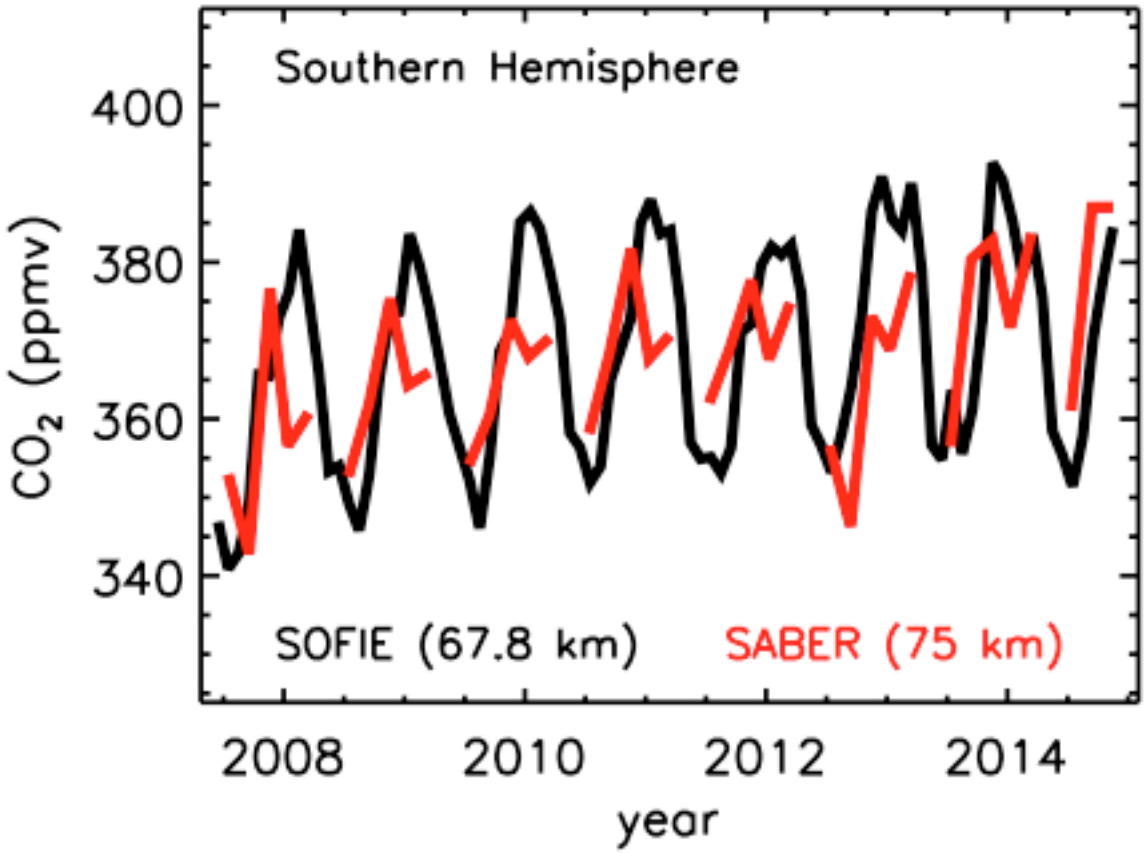
~2 ppmv/year below 80 km or 5% per decade

Yue et al., GRL, under review



James Butler, director of *NOAA*'s Global Monitoring Division,
"you validated our observations"

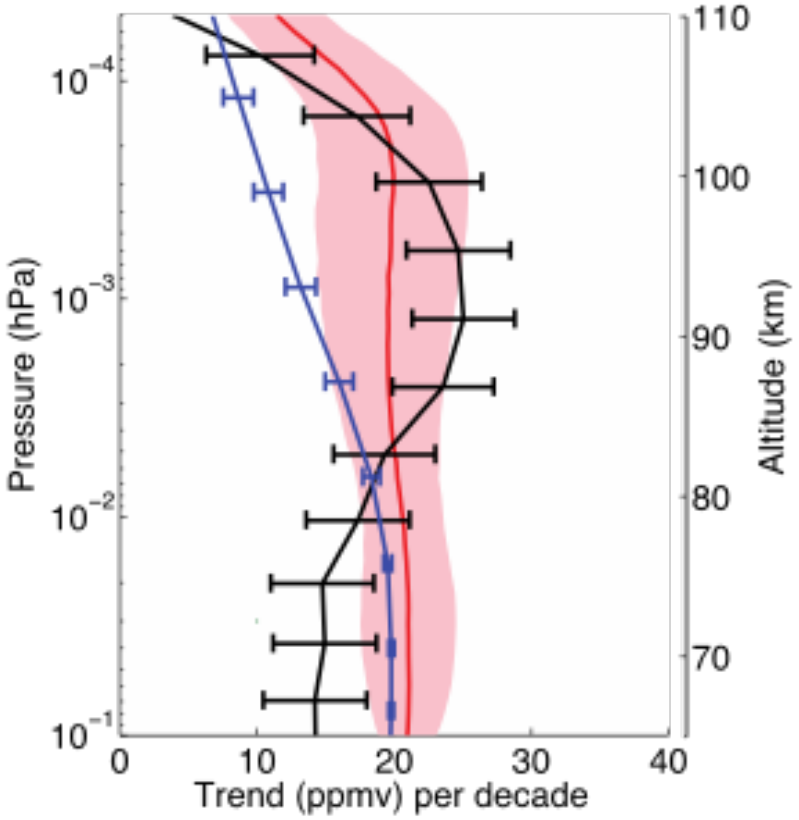
Cross-validation of CO2 in both SABER and AIM/SOFIE at high latitudes



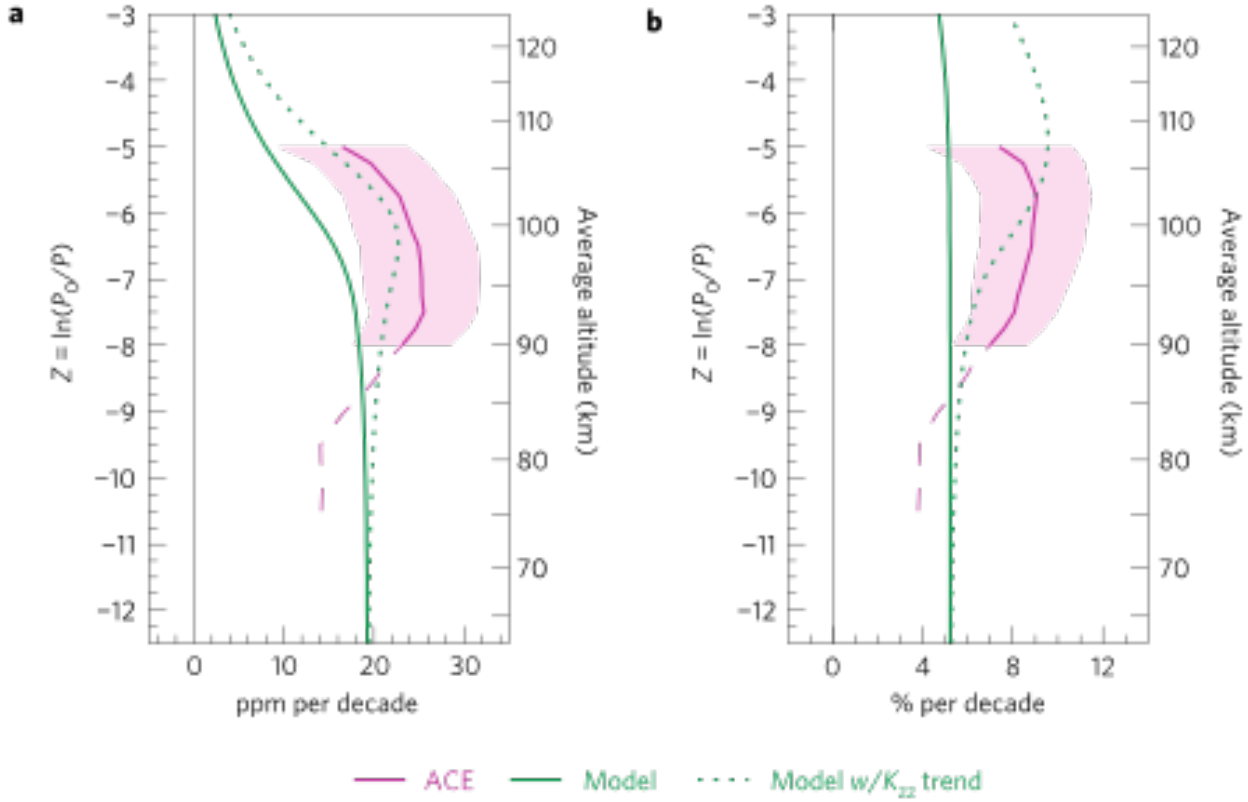
Courtesy of Mark Hervig

CO2 trend depends on altitude

faster than any model predictions,
but WHY?



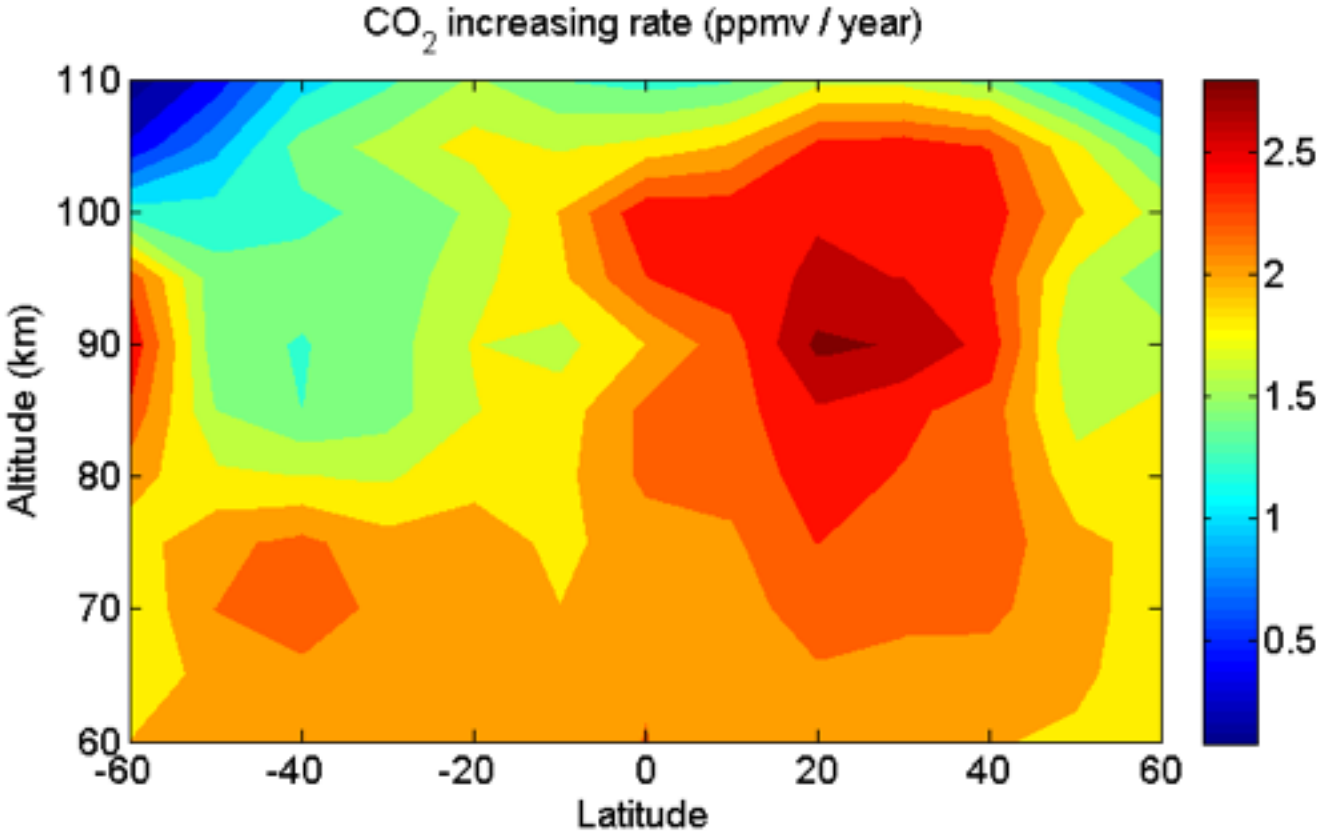
If we increase the eddy diffusion in the upper atmosphere by 30%, we can achieve larger CO2 trend [Garcia et al., in preparation]. But is it realistic?



Emmert et al., Nature Geo, 2012

Latitudinal distribution of trend
(northern hemisphere > southern hemisphere)

We are far above the CO2 source and sink



Conclusions

- Simultaneous two-channel retrieval of T(p) and CO2 mixing ratio (2002-2014)
- SABER CO2 is consistent with ACE CO2 within measurement uncertainty.
- Long term trend in CO2 is obvious and consistent with lower atmosphere measurements.
- Larger trend in observations compared to models