Some Combo Comparisons to Data

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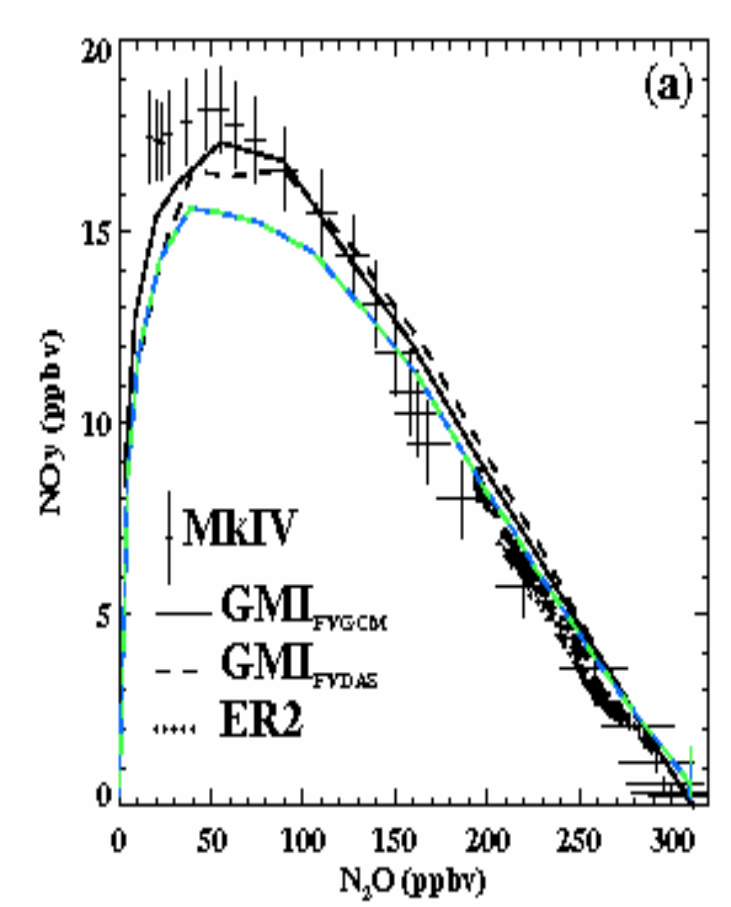
Combo = Combined Stratosphere/Troposphere Model

- **Domain - surface to .01 hPa**
- **Full stratospheric chemistry (NO_x, HO_x, ClO_x, BrO_x)**
- **Tropospheric chemistry and sources similar to GEOS CHEM**
- **5 year simulation with GCM winds from GEOS 4**
- **2+ year simulation with DAS winds from GEOS 4 DAS (2004-2006)**
- **Compare GCM-wind simulation with climatology and DAS-wind simulation with Aura data**

Combo Comparisons to MLS Data with GCM and DAS Winds for Stratosphere

NO_y vs N_2O Diagnostic



Update of the stratosphere model comparison in Douglass et al., 2004 (GMI-STRAT GCM and DAS winds).

The blue and green curves are from the present Combo DAS and Combo GCM simulations.

The data are from the MarkIV balloon flights and the ER-2 aircraft flights.

The difference between these and the earlier stratosphere simulations are mainly the FAST J vs the look-up table. The slope and peak differ slightly with the GCM and DAS giving the same results to within the line width.

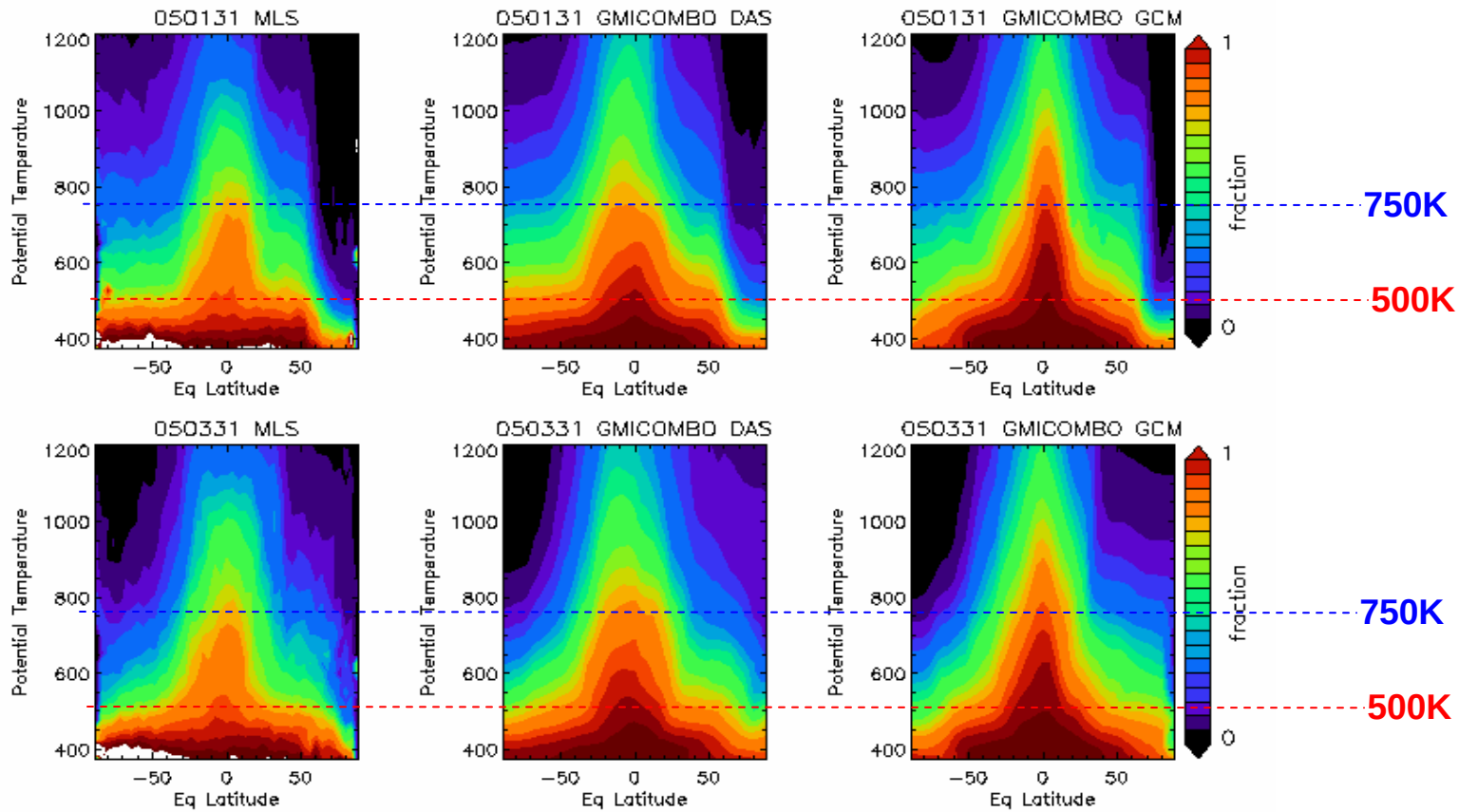
N_2O vs Latitude and Altitude

Latitude/Theta plots for N2O (January and March) show that the isolation and descent in the NH polar vortex are better represented in GMI-DAS than in previous DAS simulations, but not as well as in GMI-GCM.

MLS DATA **Combo-DAS** **Combo-GCM**

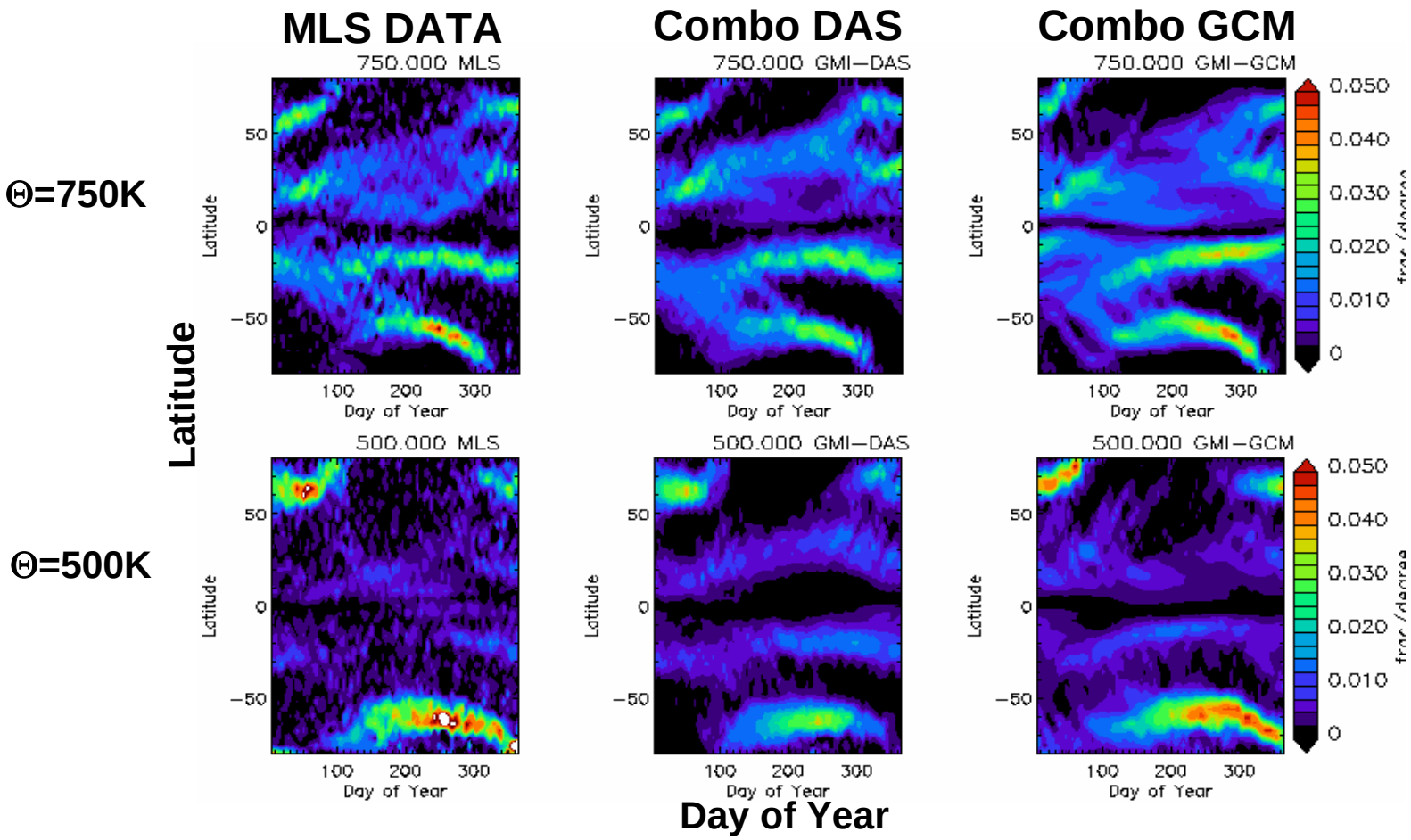
Jan 31 2005

Mar 31 2005

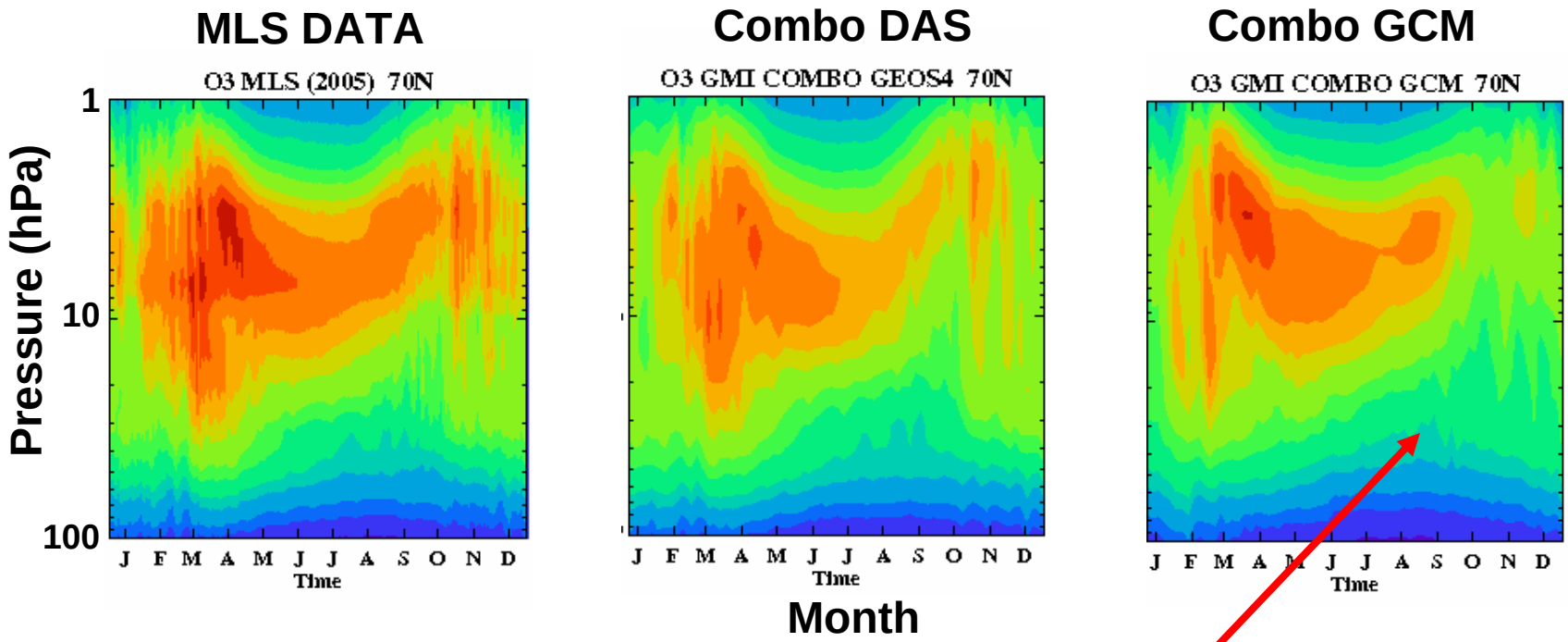


N_2O Horizontal Gradients

The horizontal gradients of N2O with respect to equivalent latitude on potential temperature surfaces from GMI-DAS and GMI-GCM reproduce the basic features of the MLS observations. The polar vortex barriers tend to be stronger in MLS N2O and in the GMI-GCM than in GMI-DAS



Zonal Mean Ozone vs Month and Pressure Altitude at 70ºN



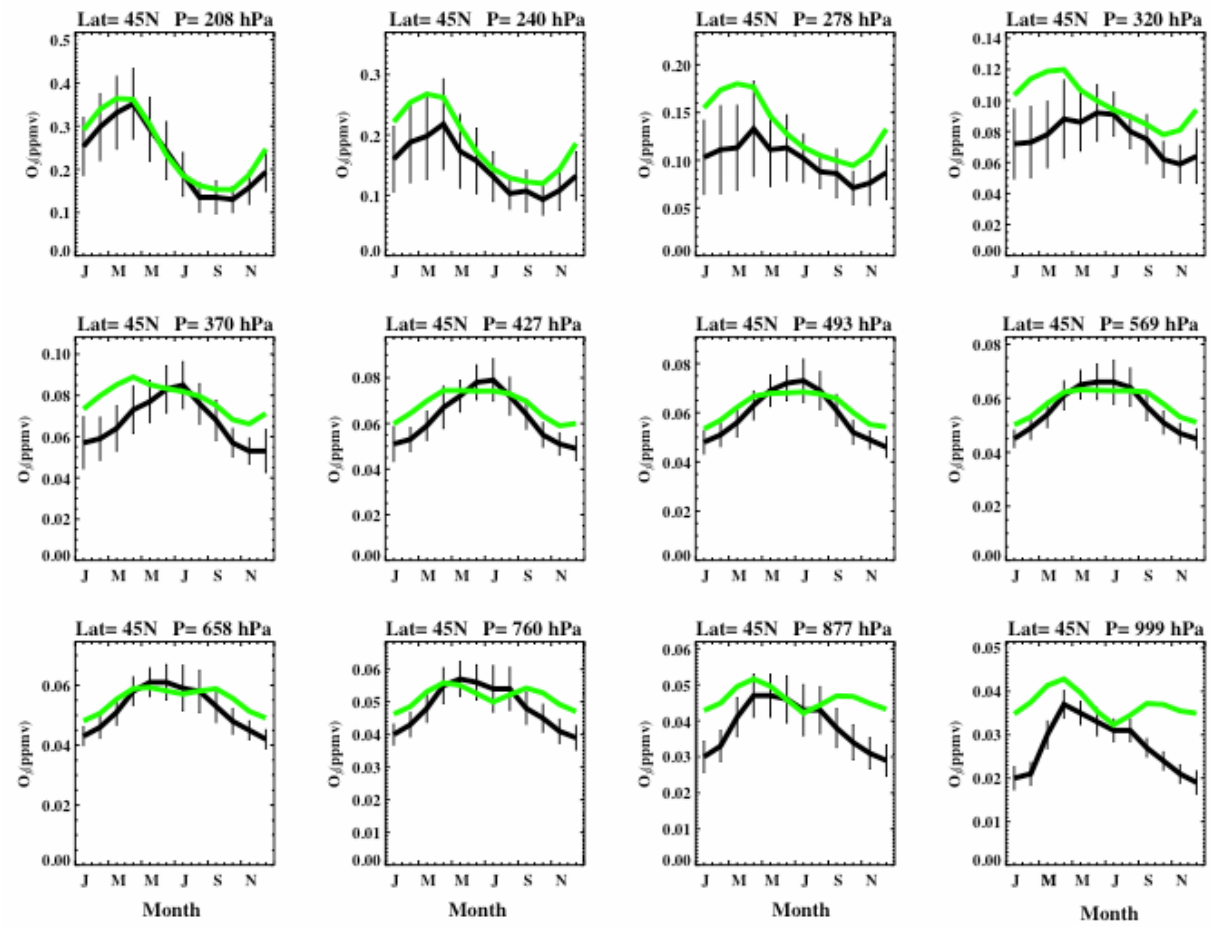
GCM reaches lowest concentration in fall - longstanding issue of north polar seasonal cycle (from Polaris Mission).

Combo comparisons to Ozone Climatology for lower stratosphere and troposphere

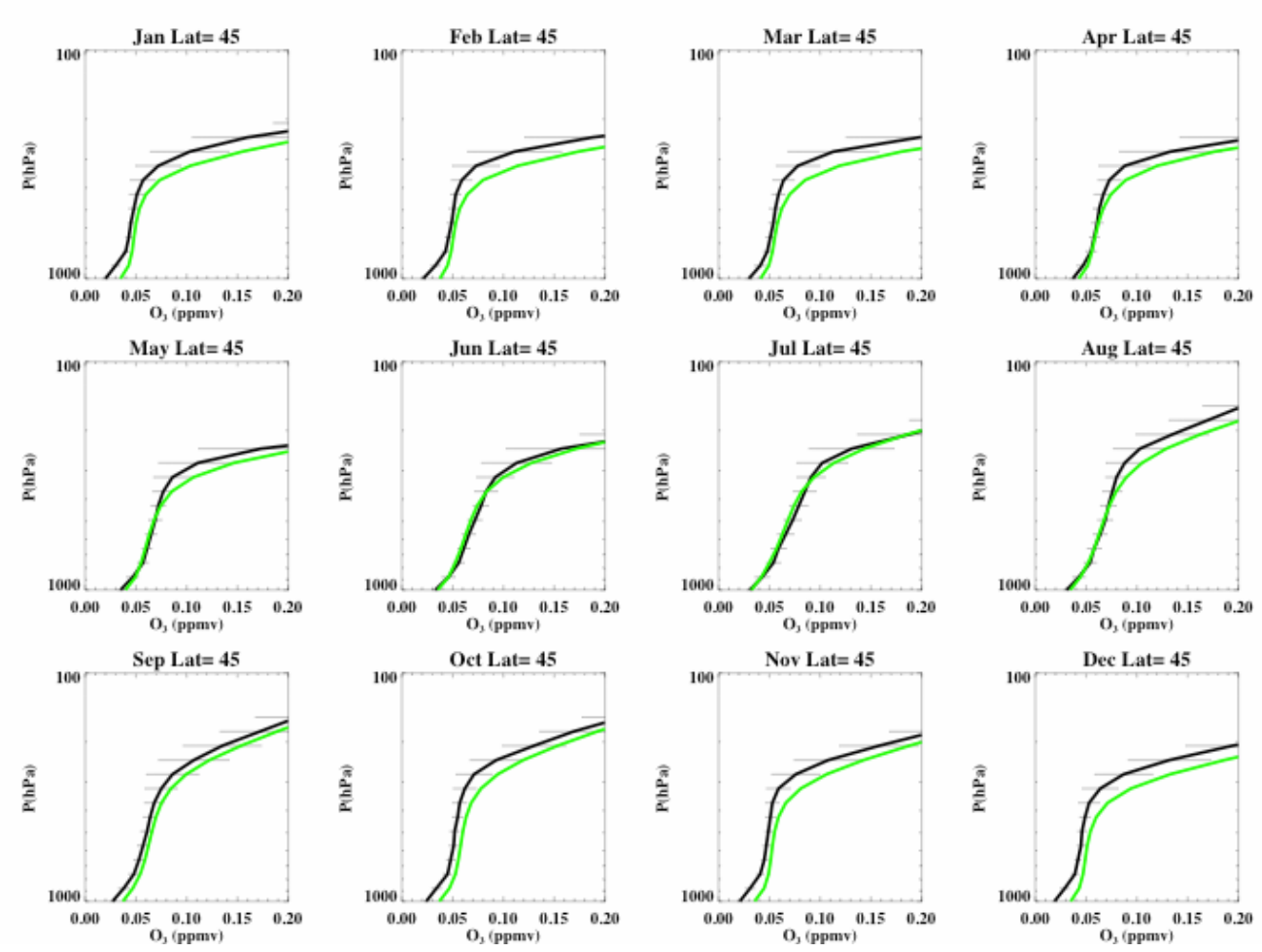
Ozone vs Month at 45ºN

Green - Combo GCM simulation:

Black McPeters, Logan, Labow climatology (ozonesondes)

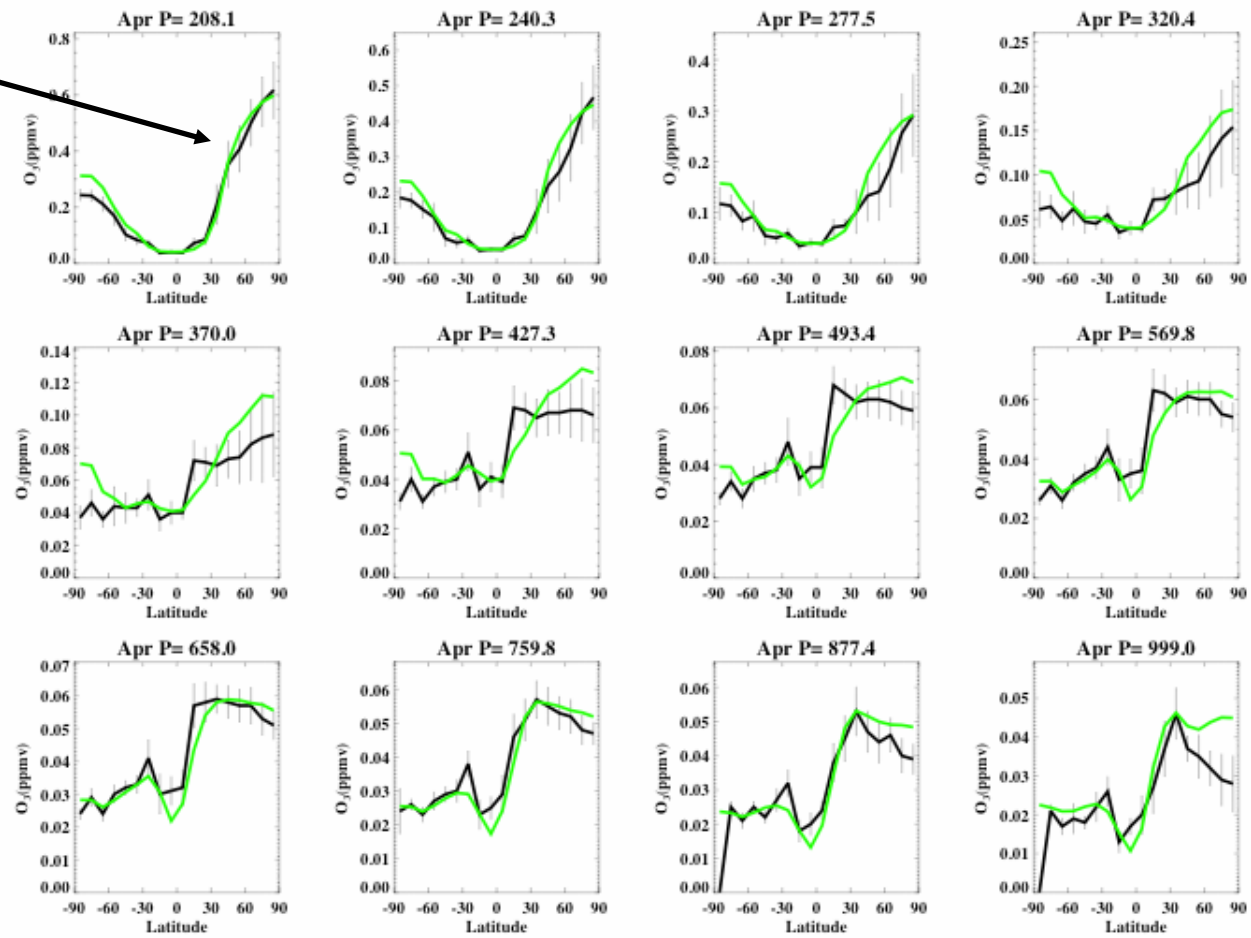


Ozone vs Pressure Altitude at 45ºN

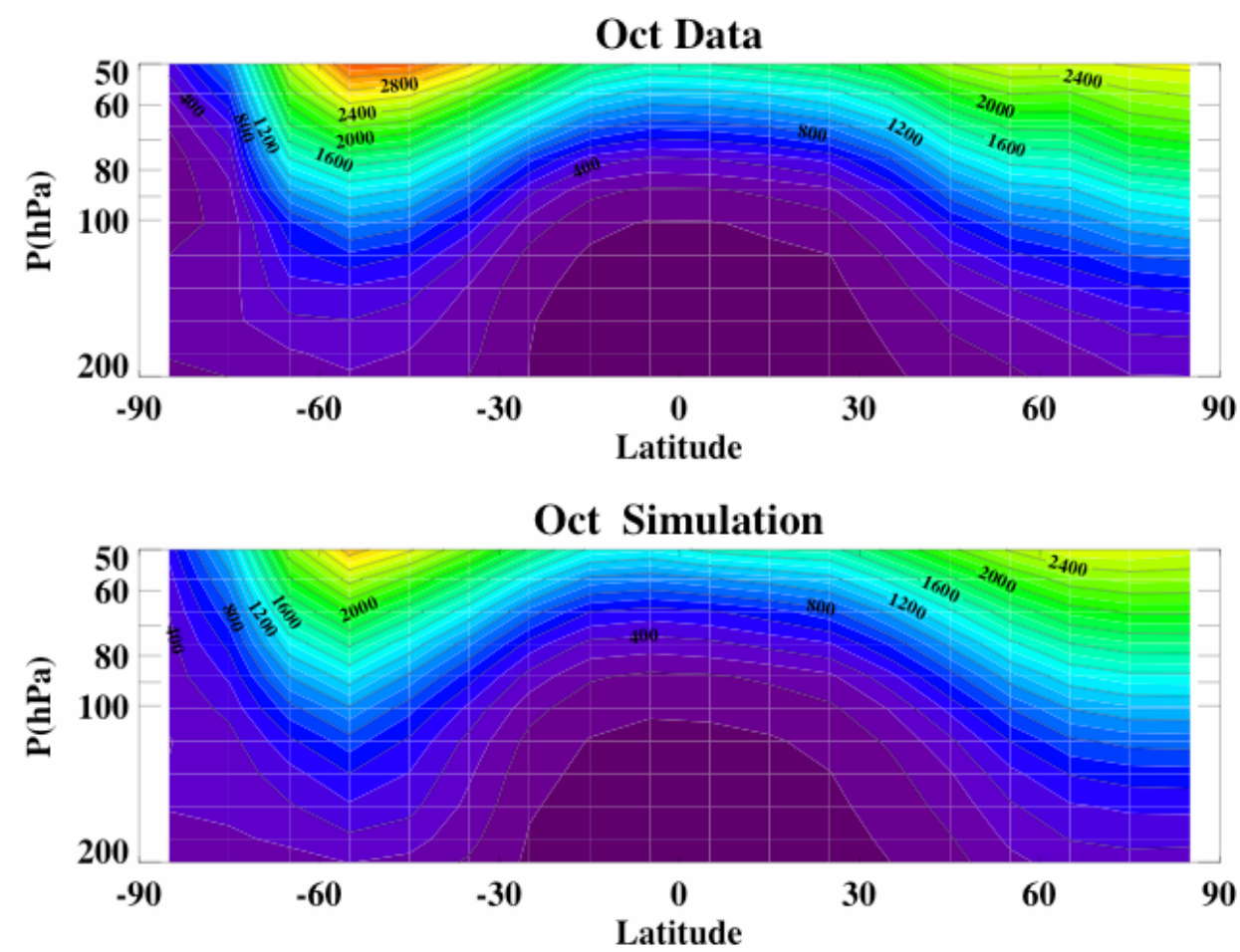


Ozone vs Latitude for April

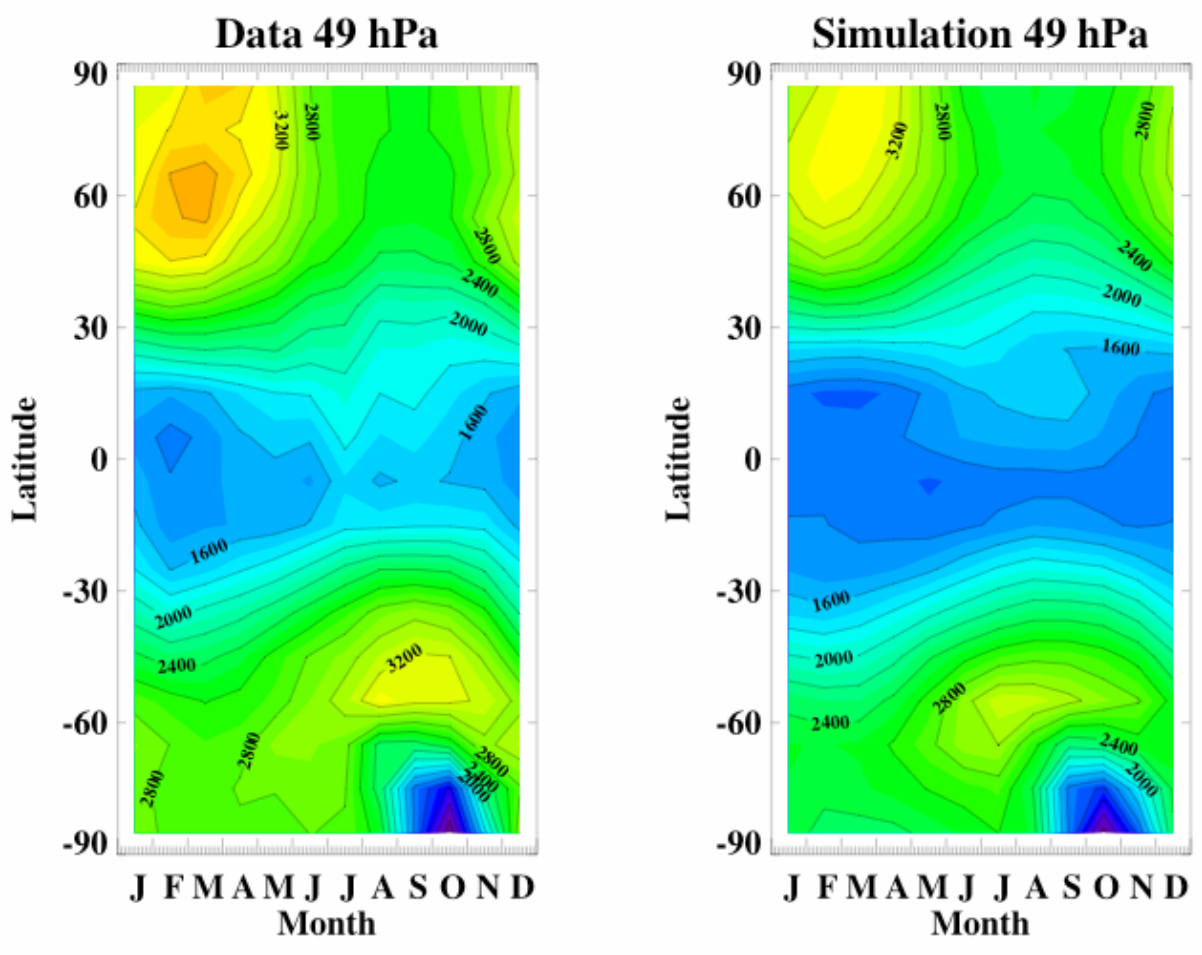
Agreement is best at levels nearest the stratosphere, even at high latitudes.



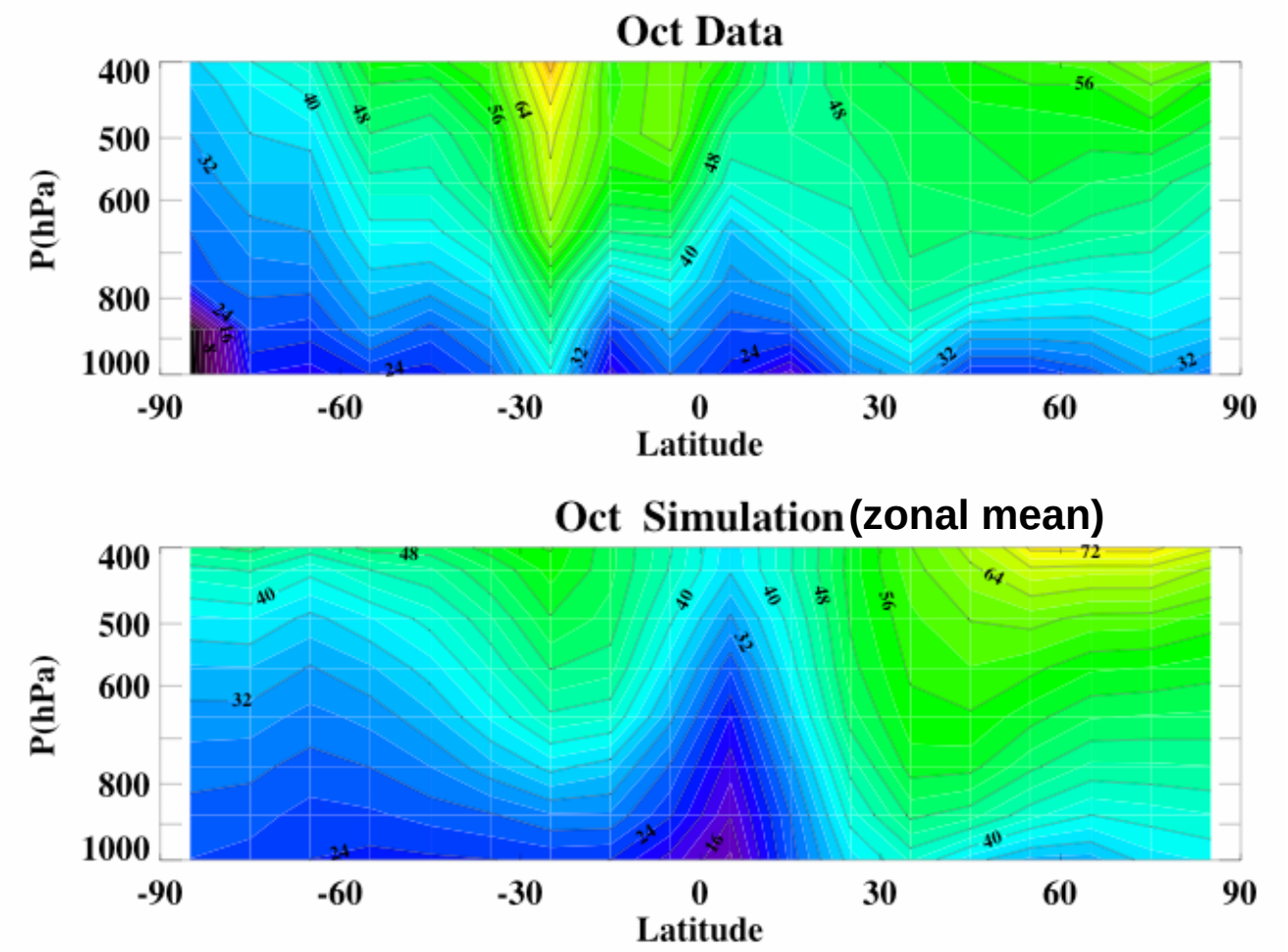
Ozone vs Latitude and Pressure Altitude for October



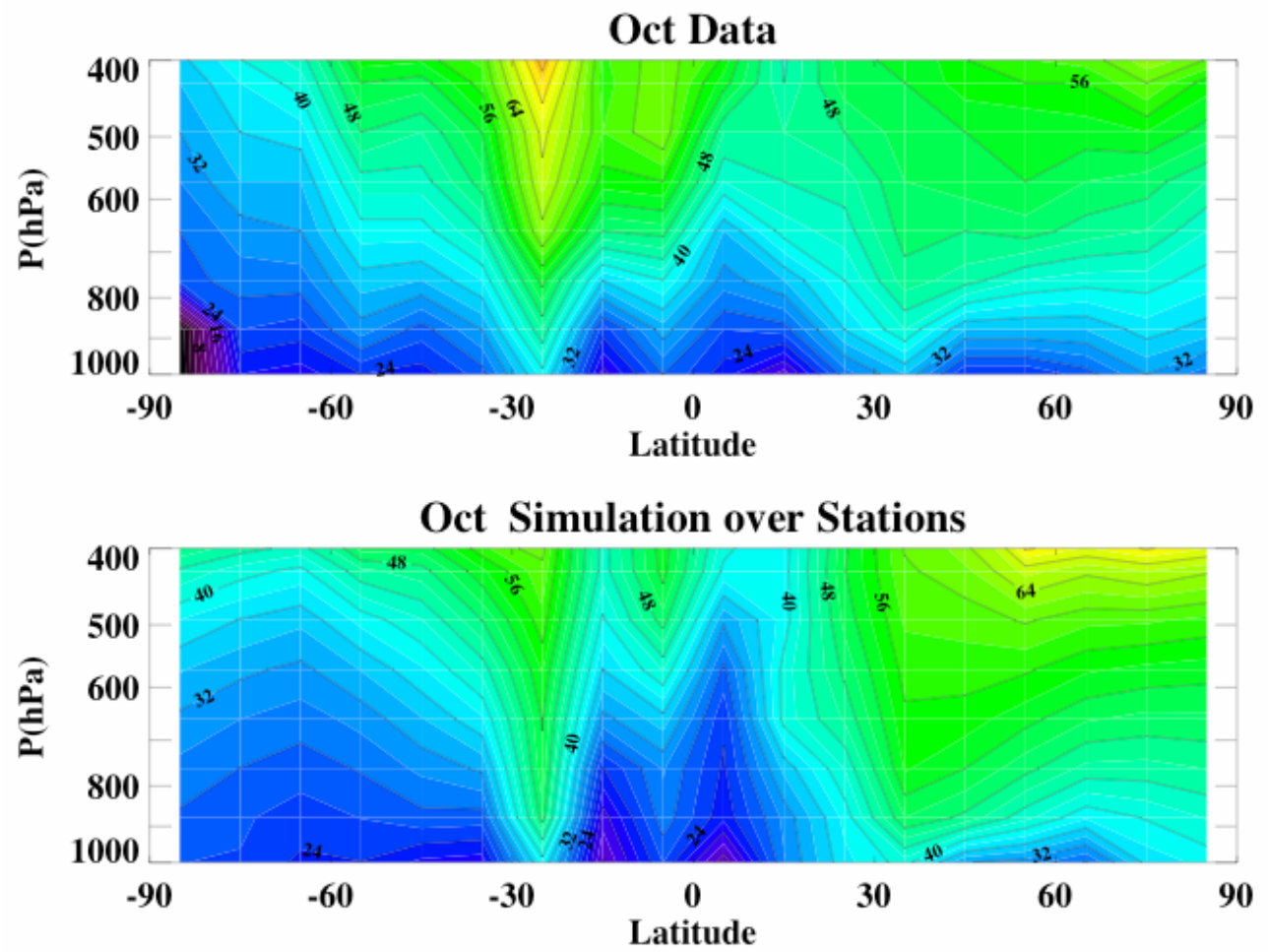
Combo Comparison to Ozone Climatology in Lower Stratosphere



Combo CTM compared to Ozone Climatology for lower troposphere

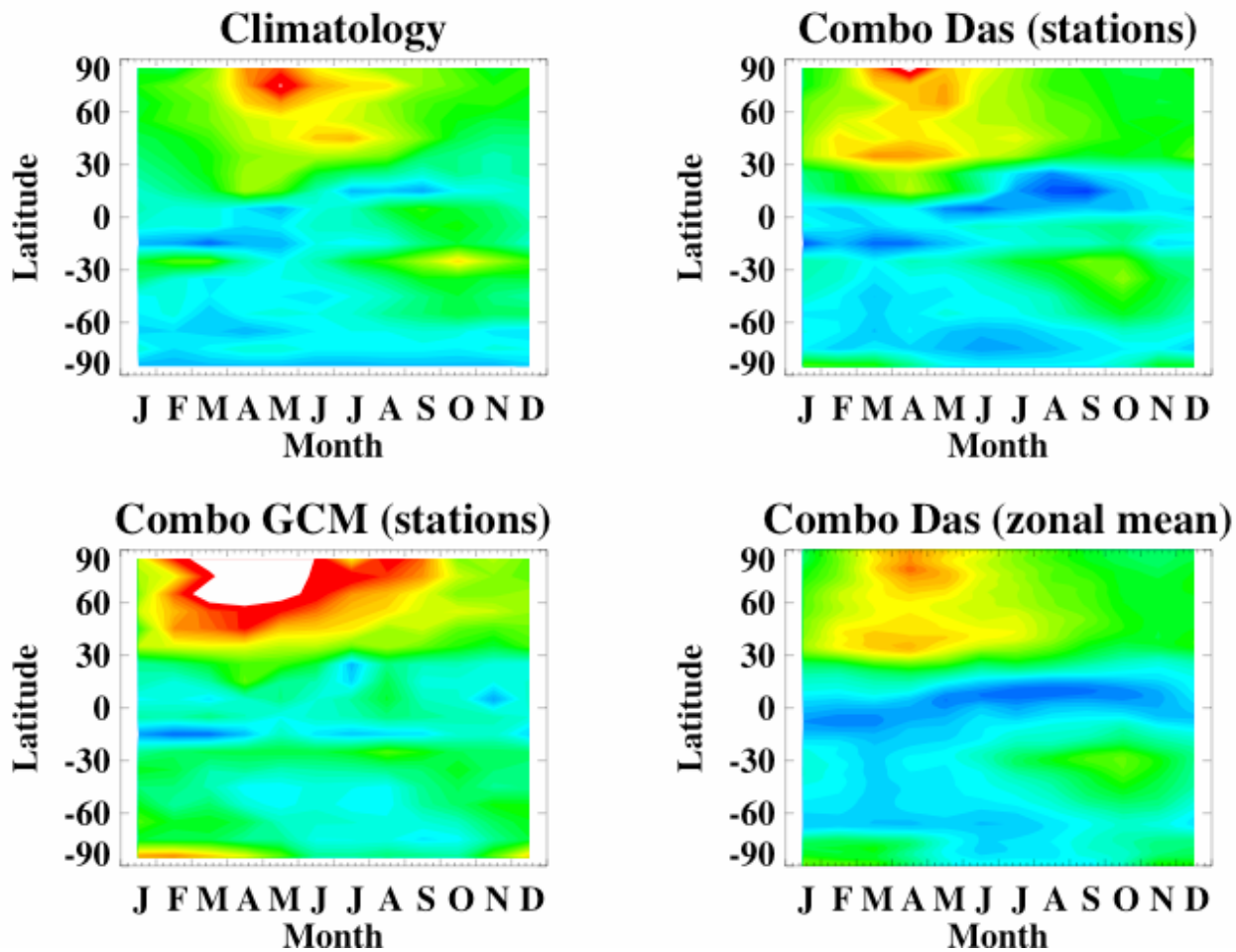


Combo CTM compared to Ozone Climatology for lower troposphere

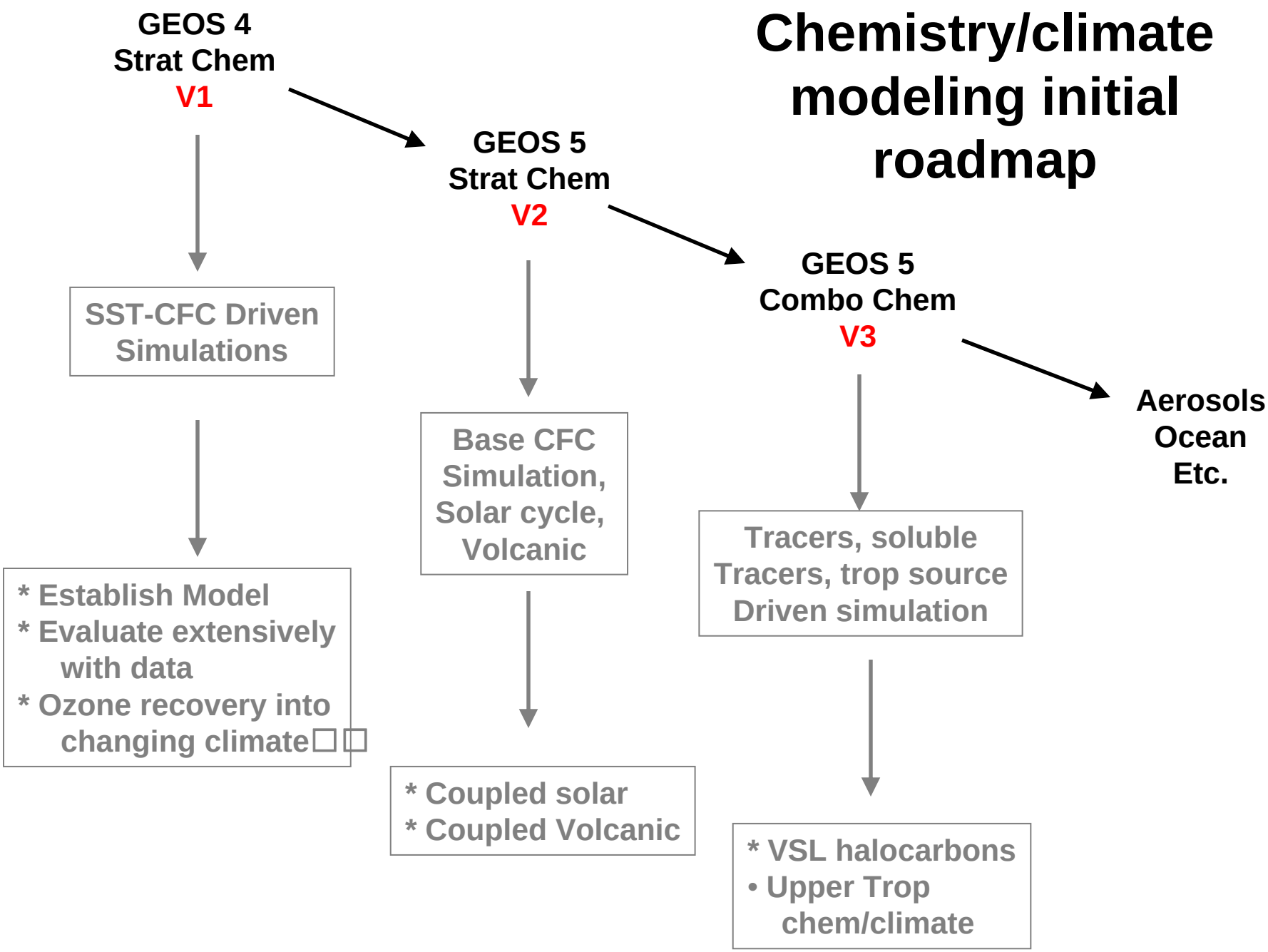


Month/Latitude Dependence of Ozone at Constant Pressure level of 370 hPa

GCM had excellent agreement with data from 200 hPa down to nearly 300 hPa.



Conclusions

- **Combo has *excellent* stratospheric representation**
- **Should yield good representation of stratospheric impact on troposphere (for mass, ozone and other constituents) - no need for Synoz type of approximation**
- **We will incorporate Combo into our chemistry climate model to study combined effects of stratospheric and tropospheric composition on climate**

Chemistry/climate modeling initial roadmap