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AURA Runs

GODDARD SPACE FLIGHT CENTER

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SIVO - Advanced Software Technology Group

Northrop Grumman

Information Technology-TASC

GMI Science Meeting

March 17-19, 2008

UC-Irvine

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Recent AURA Combo Production Runs

Run	Date completed	Location on anonymous ftp site: gmidata2/output/
Aura3 (Jan 2004 - Dec 2006)	10/16/2007	gmic/aura3
FVGCM **(**Jan 1994 - Dec 1998)	9/30/2007	gmic/fvgcm/ap1.0HO2Aura2Fvgcm
Aura4 (Jan 2004 - Dec 2006)	3/9/2008	gmic/aura4

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AURA Family Tree

Original AURA simulation

↓

Convection fix for the creation of all of the advected species in the upper troposphere

Soil Nox fix

AURA2 - 2/26/2007

↓

FVGCM - 9/30/2007

AURA3 - 10/16/2007

Trunk merge with Aura branch
+
Many science/software changes

↓

AURA4 - 3/9/2008

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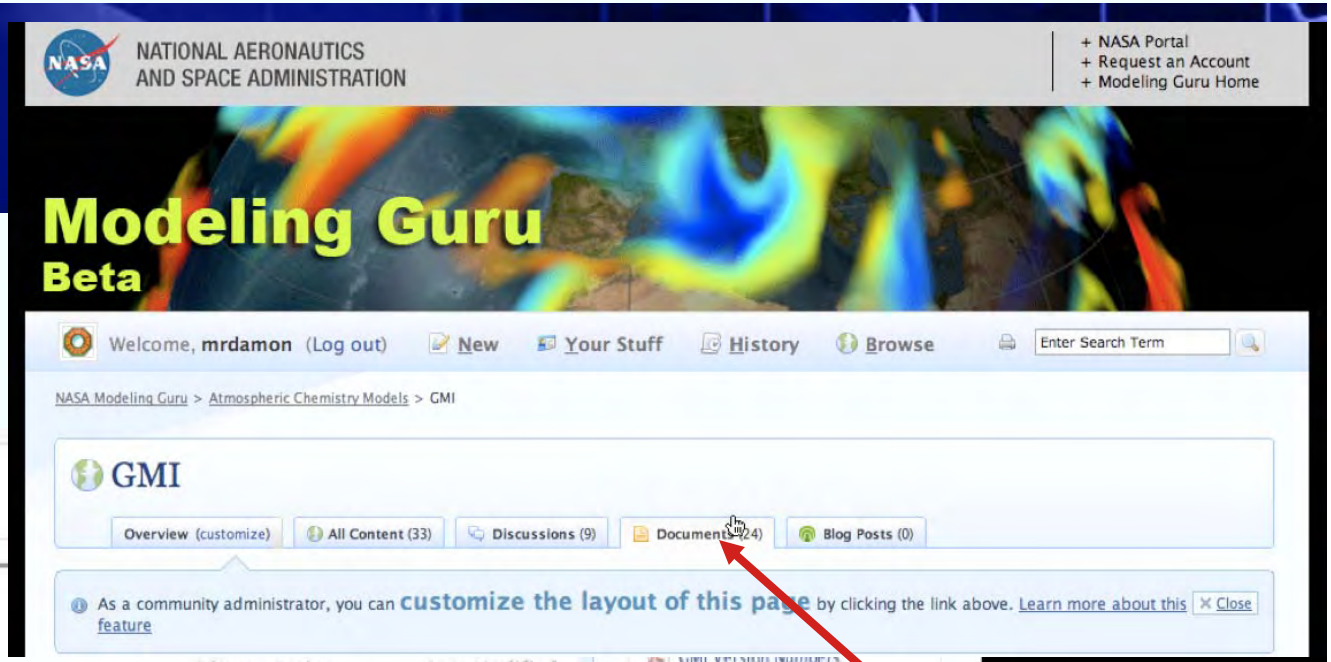
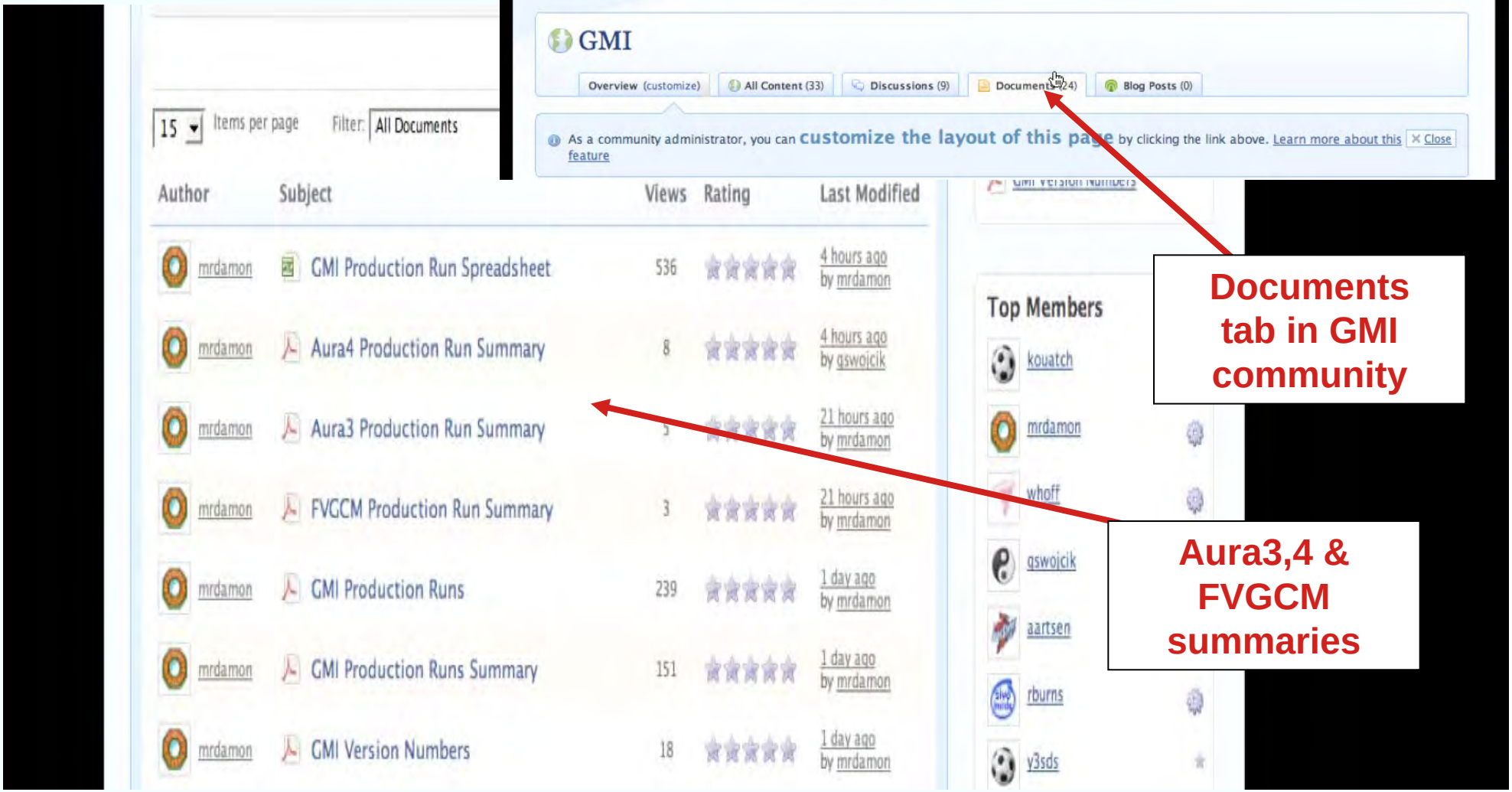
AURA Runs Modeling Guru





Documents tab in GMI community

Aura3,4 & FVGCM summaries

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General Details

- Combo mechanism
- NCCS discover
- 2º lat x 2.5º lon x 42 levels (lid at 0.01 hPa)
- 124 species
- Fast JX v5.2
  - The x-section data has been revised using JPL-02, IUPAC (up to 2004) and Gierczak's acetone tables

- **Aura3, FVGCM**
  - 64 processors
  - 8.5 hours per month (average)
  - Runs performed on Aura branch
- **Aura4**
  - 132 processors
  - **4.5 hours per month (average)**
  - Run performed on Trunk after merge with Aura branch

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Model outputs & diagnostics

- **4 overpass times**
  - 10 – 11 am; 1 – 2 pm; midnight – 3 am; 9 pm – midnight
  - CH2O, CO, NO, NO2, O3, and OH
  - Photolysis overhead ozone column
  - Temperature, surface pressure, mass, grid box, relative humidity, and cloud optical depth (1000 nm)
- **Instantaneous daily output**
  - CH4, CO, HNO3, N2O, O3, OH, ClO, Cl2O2, ClONO2, HCl, CH3Cl, CFCl3 and CF2Cl2
  - Potential vorticity, tropopause pressure, temperature, surface pressure, mass, relative humidity and metwater
- **All species in “const” array are in monthly averaged files**

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Corrections from Aura2 for Aura3 & FVGCM

- **HO2 uptake reaction**
- **New lightning algorithm**
- **Updated boundary conditions**

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2004-06 Aura3

Tag: Aura2ReRun_6_2005_12_2006
Version: 2.0.0.b6

- **3 hr GEOS4 DAS met fields**
- **6 year spin up, with source gas boundary conditions for 1998-2003 to adjust strat mixing ratios of long-lived species**
- **GFEDv2 year-specific biomass burning**
- **Guenther et al. 1995 isoprene emissions, no scaling**
- **2000-1 fossil fuel emissions (EDGAR+others)**
- **Yevich biofuel**
- **Monthly emission file with pre-processed ship emissions**
- **2004-06 aerosol dust data**
- **JPL-02 updates**
- **New tropopause definition**
- **Dale Allen 2006 lightning scheme (ap1.0)**
- **Ship emissions**
- **195 profile stations**

Output & Diagnostics

Surface hourly ozone for 1/2004 – 5/2005

Lower 8 levels of hourly ozone for 6/2005 – 12/2008

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1994-98 FVGCM

Tag: AuraRunsCodeBranch_ap1_0HO2AuraFvgcm
Version: 2.0.0.b2

- **3 hr GEOS4 AGCM met fields**
- **Combo FVGCM spinup restart file December 1994 from Bryan**
- **Harvard 1980-1990 biomass burning source**
- **GEIA (Guenther et al., 1995) isoprene emission**
- **Harvard fossil fuel 1995**
- **Boundary conditions from 1994-1998**
- **2002 aerosol dust data**

Output & Diagnostics

Surface hourly ozone for 1/1994 – 12/1994

Lower 8 levels of hourly ozone for 1/1995 – 12/1998

- JPL-02 updates
- New tropopause definition
- Dale Allen 2006 lightning scheme (ap1.0)
- Ship emissions
- 195 profile stations

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Aura4 *Corrections from Aura3*

- H2 atmospheric volume mixing ratio fix from David Considine
  - MXRH2=0.5d-06
  - Reset every model time step
- “condense” routine fixed to use local value of ilat, not global.
- Corrected the production of ozone from shipping NOx emissions
- Only one February record in restart file (Aura3 had two)
- 2004-5 GFEDv2 boreal emissions bug fix

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2004-06 Aura4

Tag: NewProcess_for_Restart_and_SpcCon_OutFiles_v2
Version: 2.16.0

- **3 year spin up with notable differences in CO**
- **GFEDv2 year-specific biomass burning *with diurnal variation***
- **Hourly NOx fossil fuel variation, provided by Aaron van Donkelaar (Dalhousie Univ.)**
- **Chinese seasonality of emissions from Streets**
- **MEGAN emissions**
- **JPL-06 updates**
- **Monthly emission file with with pre-processed ship emissions**
- **2004-06 aerosol dust data**
- **Dale Allen 2007 lightning scheme (ap1.2)**

Output & Diagnostics

2-D troposphere and combo constituent column in the daily file

2-D total column and troposphere O3, NO2, CH2O in the column file

Tropopause pressure in daily & all overpass files

Hourly ozone at first eight levels

6 new profile stations: Bog, Rio, Dak, Dou, Lua, Win

- 3 hr GEOS4 AGCM met fields
- Guenther et al. 1995 isoprene emissions, no scaling
- Yevich biofuel
- Boundary conditions same as Aura3
- JPL-02 updates
- New tropopause definition
- Ship emissions

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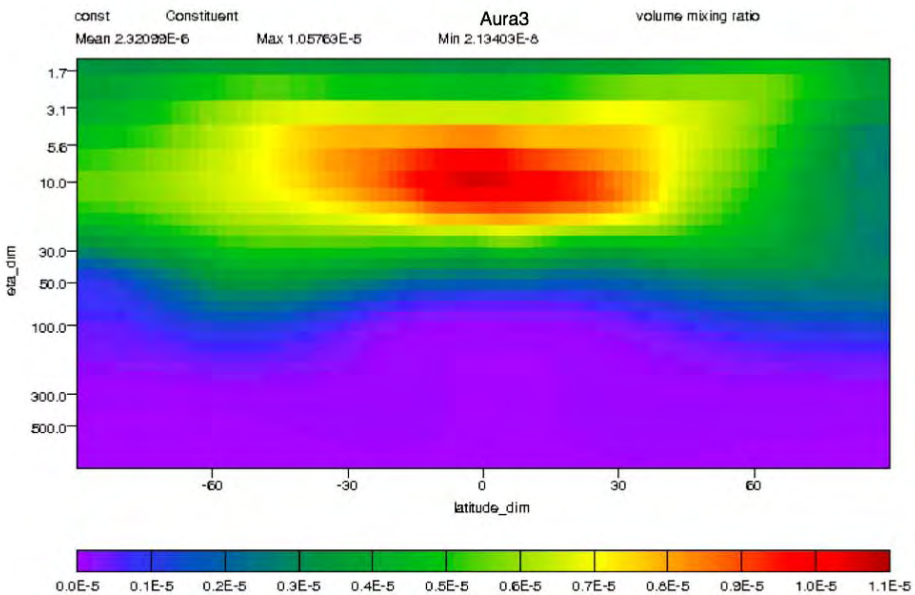
Additional AURA Simulations

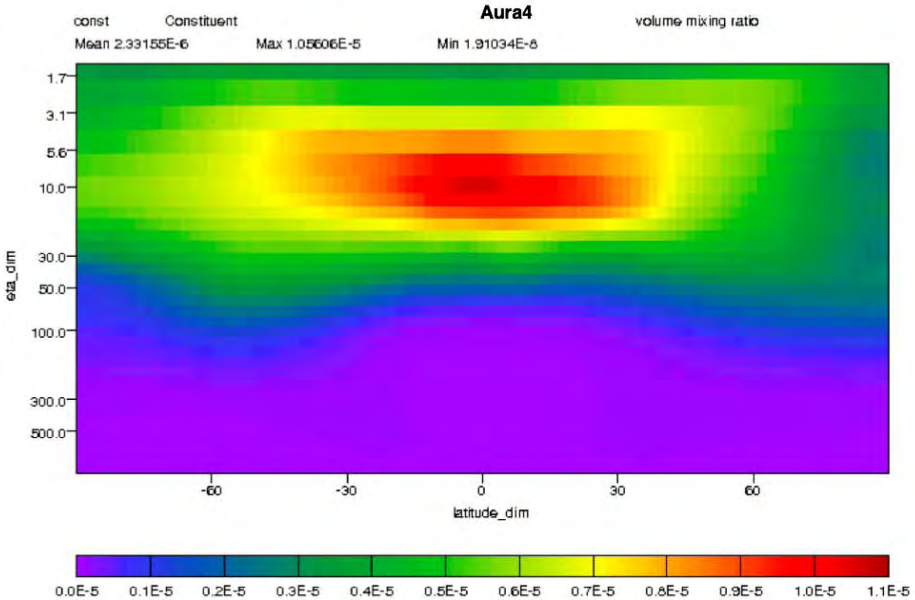
- AURA4
  - No ilat fix in condense routine
  - no NO from lightning
  - old vertical NOx profile
  - NO from lightning from file only
- AURA3
  - new NOx profile
  - lightning ap1.1
- AURA2

OCT

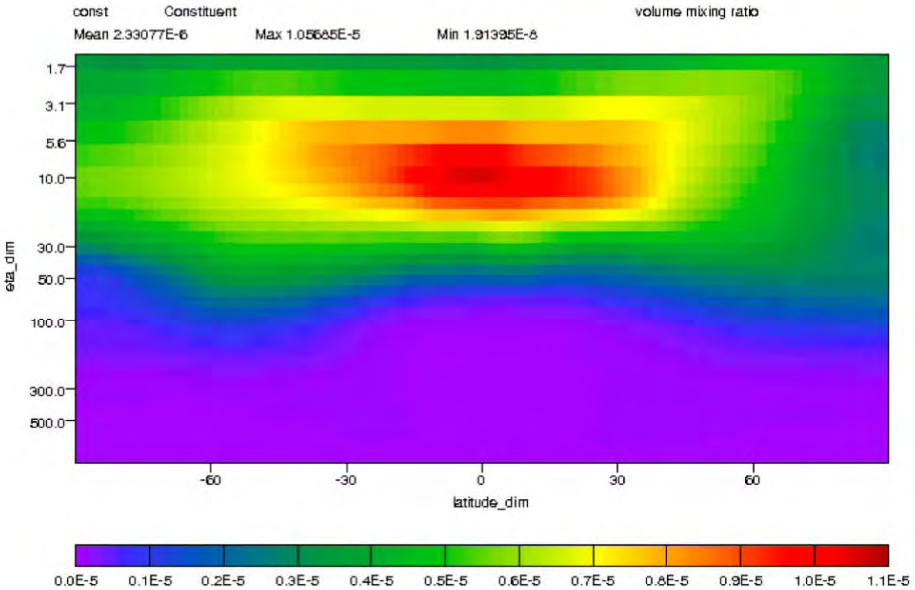
AURA3



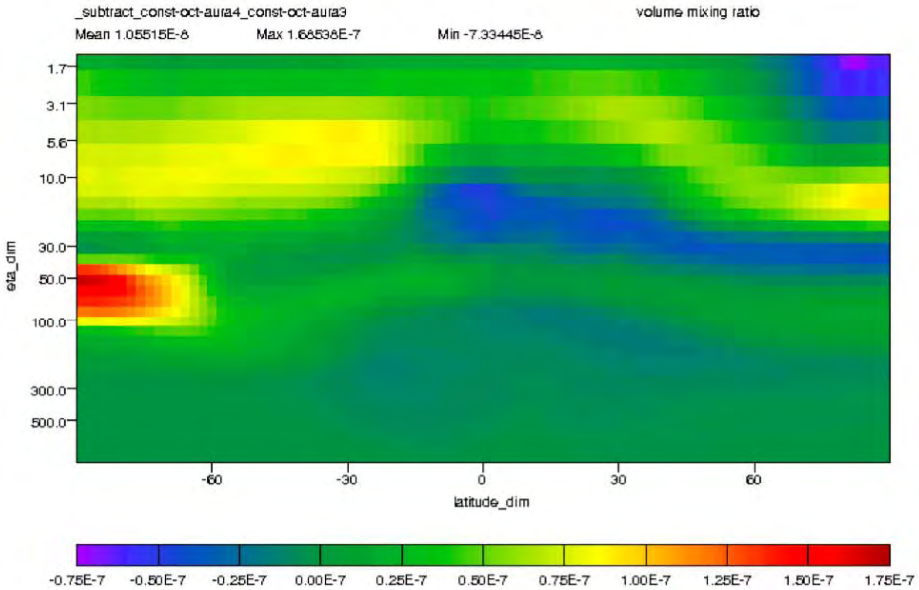
AURA4



AURA4 “No ilat fix”



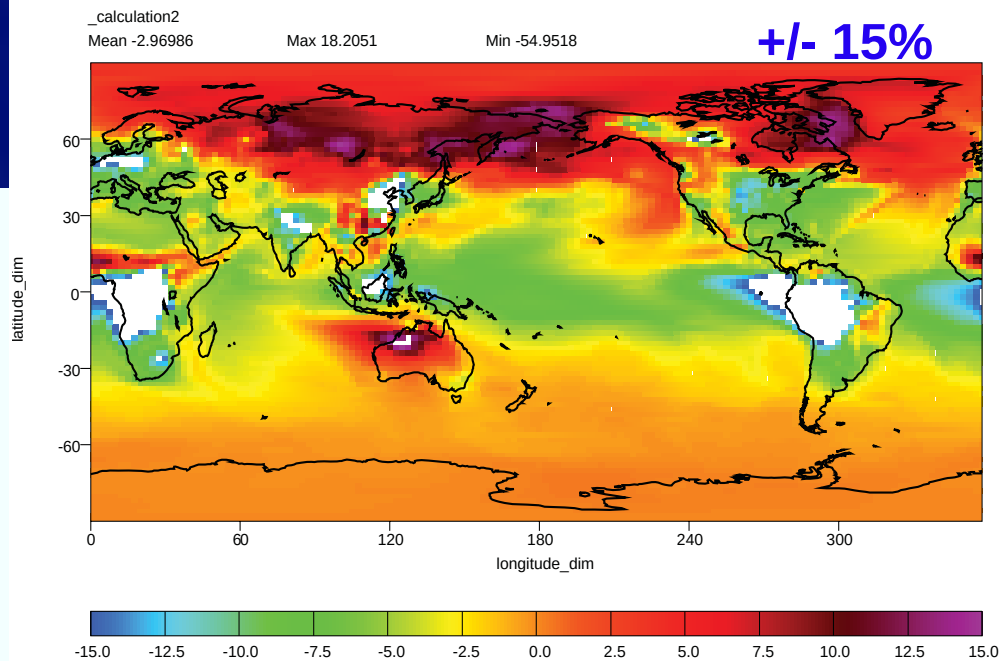
AURA4 - AURA3



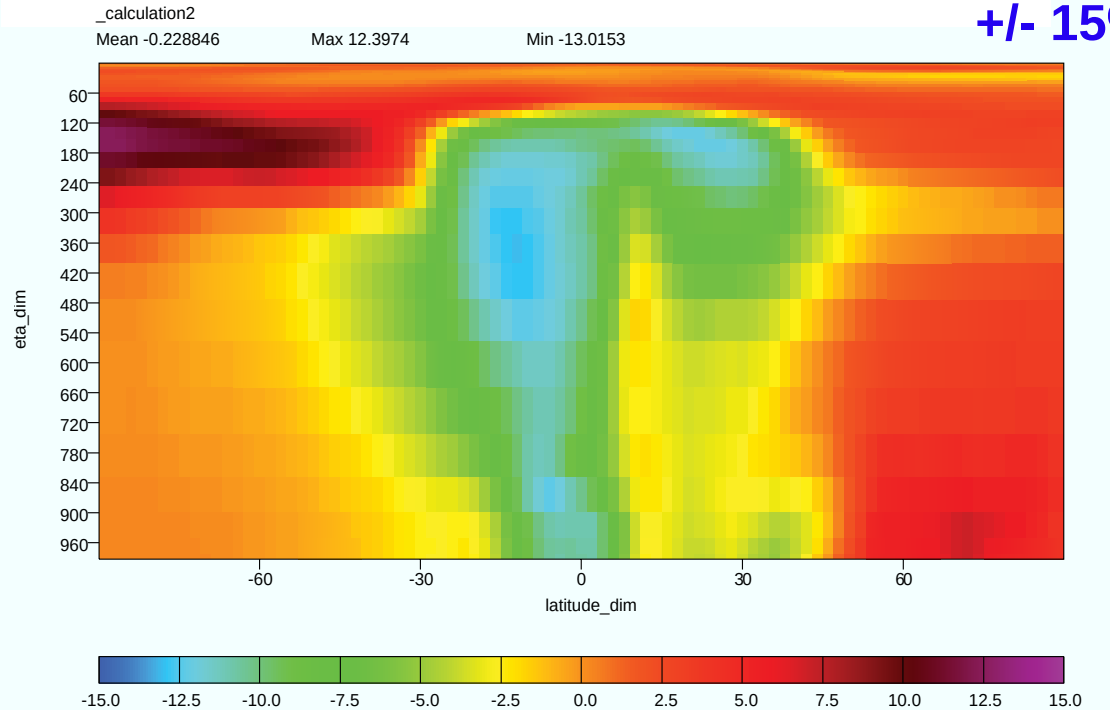
Ozone

July %Difference
(Aura4-Aura3)/Aura3*100.

Surface +/- 15%



Zonal Mean +/- 15%



OH

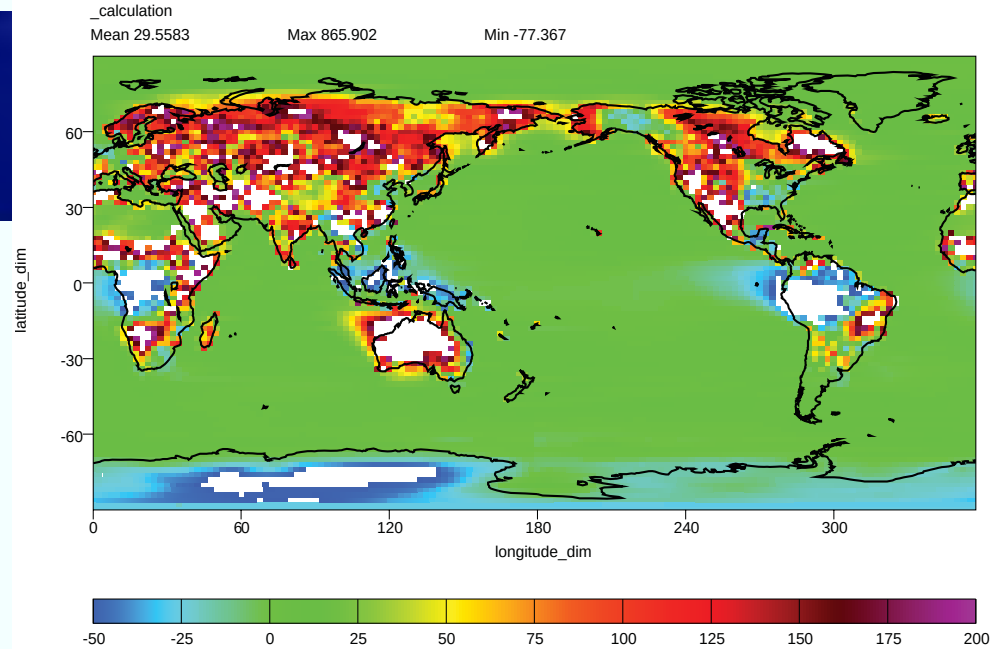
MC lifetime
(wrt tropospheric OH)

Aura3 = 6.8-6.9 y
Aura4 = 6.3-6.7 y

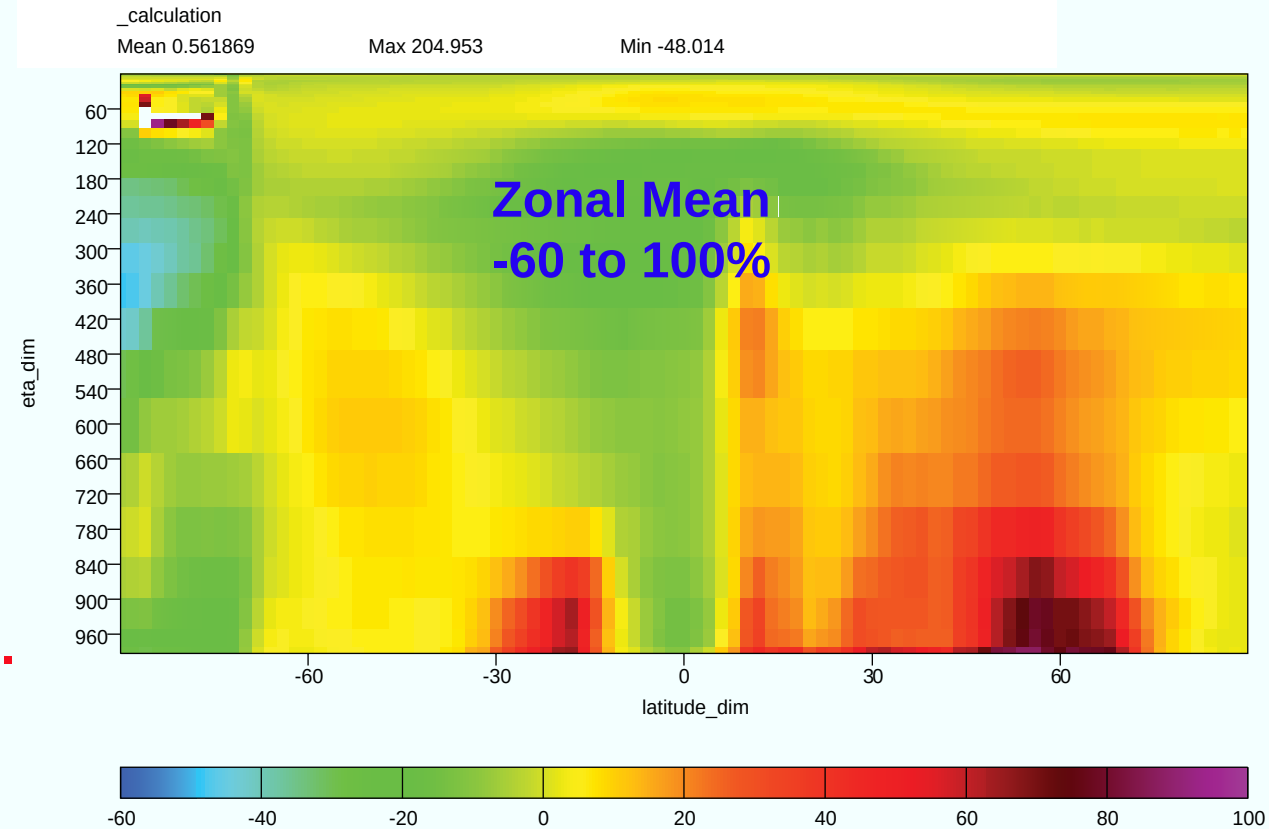
Mean tropospheric OH
($x10^6$ molec/cm^3)

Aura3 = 0.83-0.86
Aura4 = 0.83-0.87

OH: July %Difference
(Aura4-Aura3)/Aura3*100.



Surface
-60 to 200%



Zonal Mean
-60 to 100%

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CO

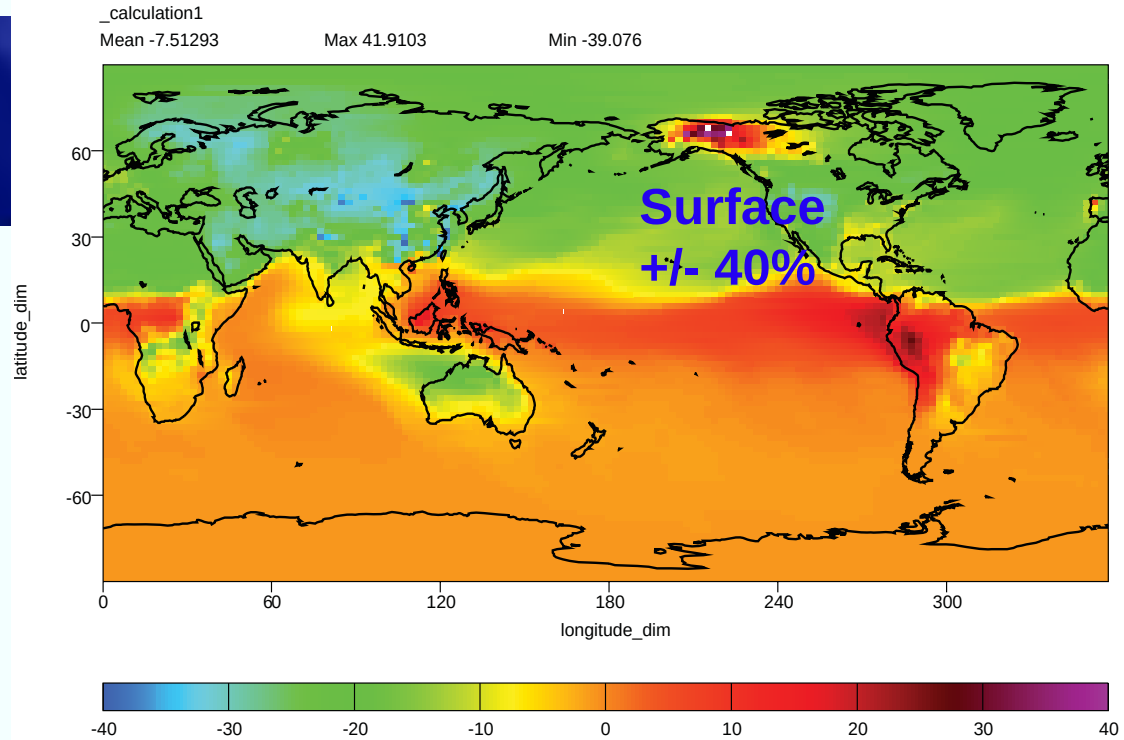
MC lifetime
(wrt tropospheric OH)

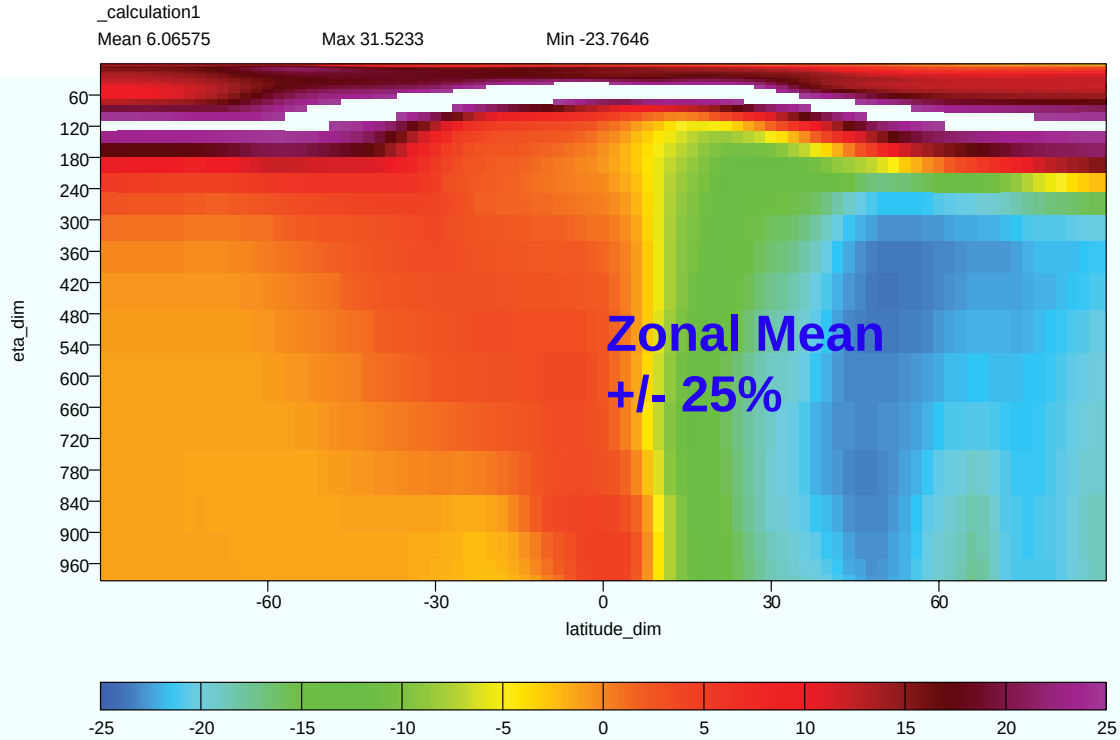
Aura3 = 6.8-6.9 y
Aura4 = 6.3-6.7 y

Mean tropospheric OH
(0.83-0.86x10^6 molec/cm^3)

Aura3 = 0.83-0.86
Aura4 = 0.83-0.87

July %Difference
(Aura4-Aura3)/Aura3*100.





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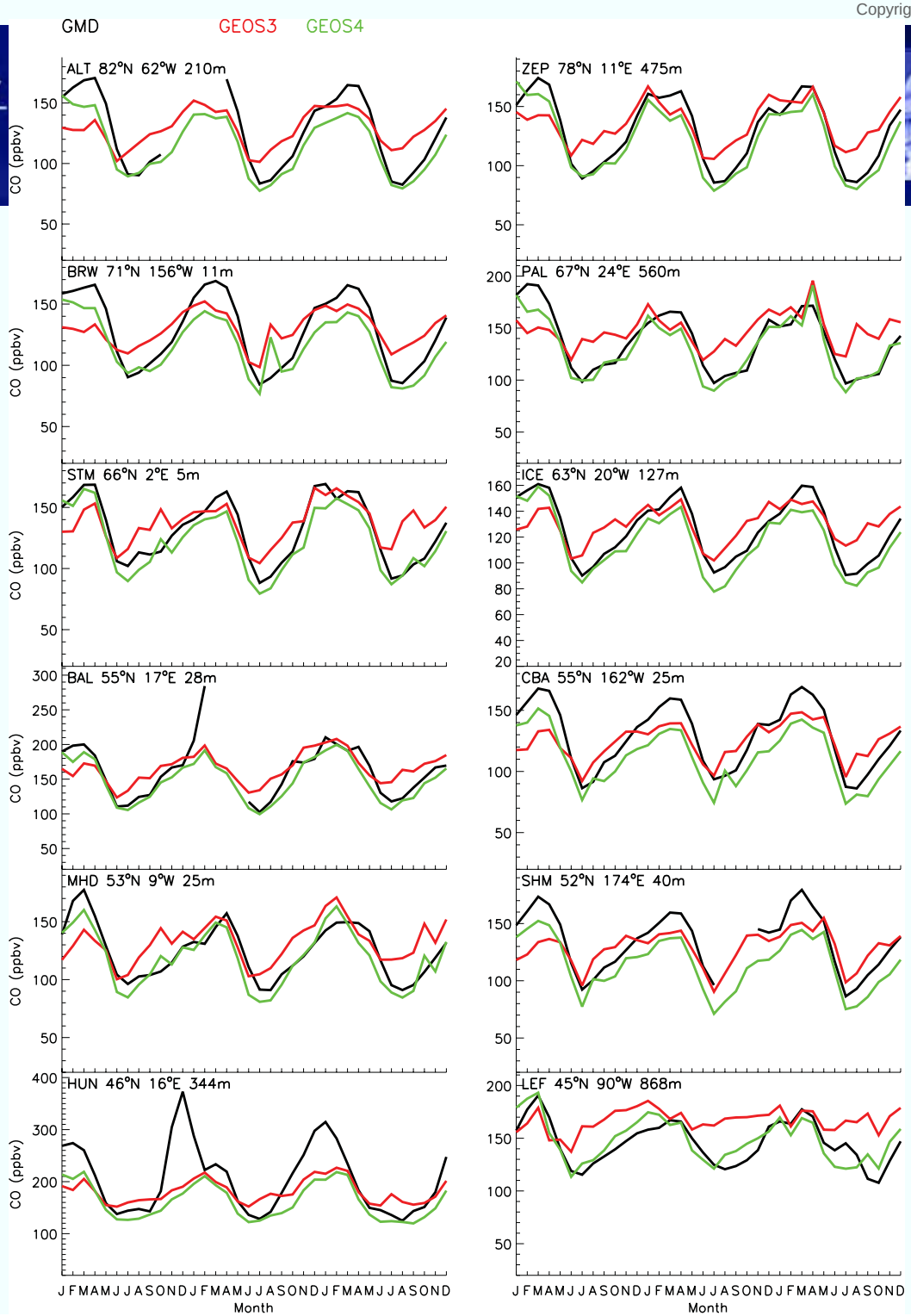
Aura3

Aura4



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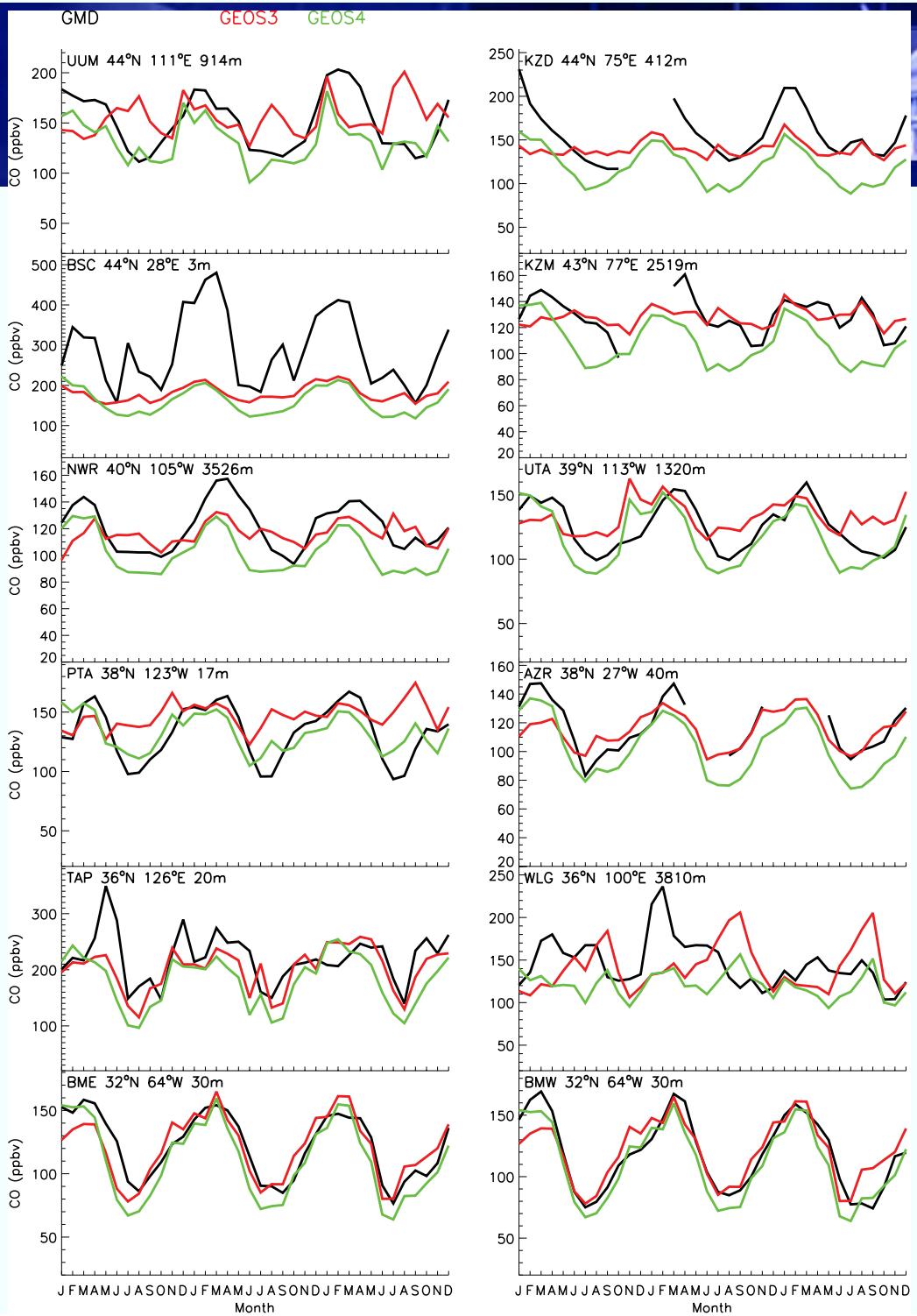
Aura3

Aura4



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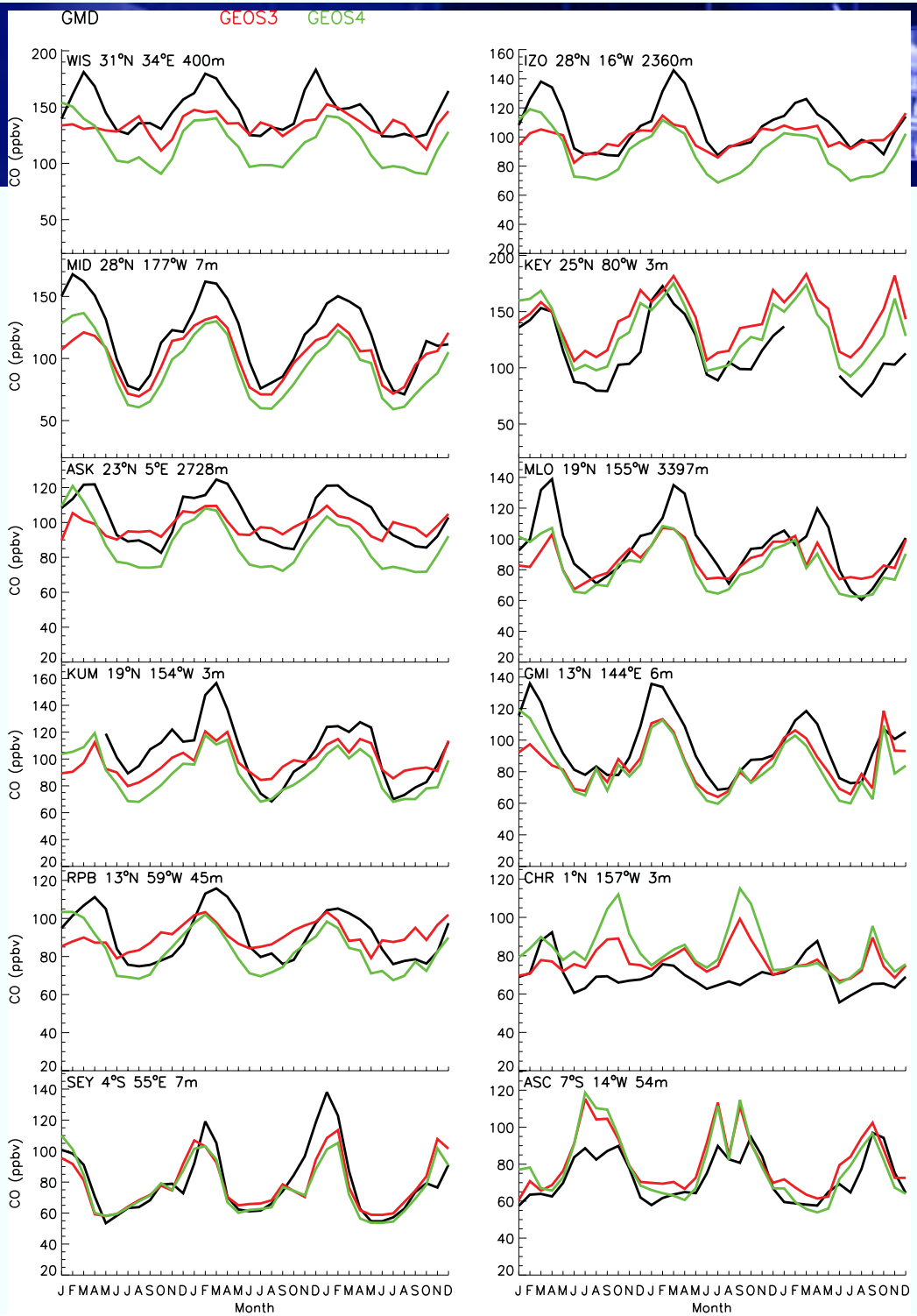
Aura3

Aura4



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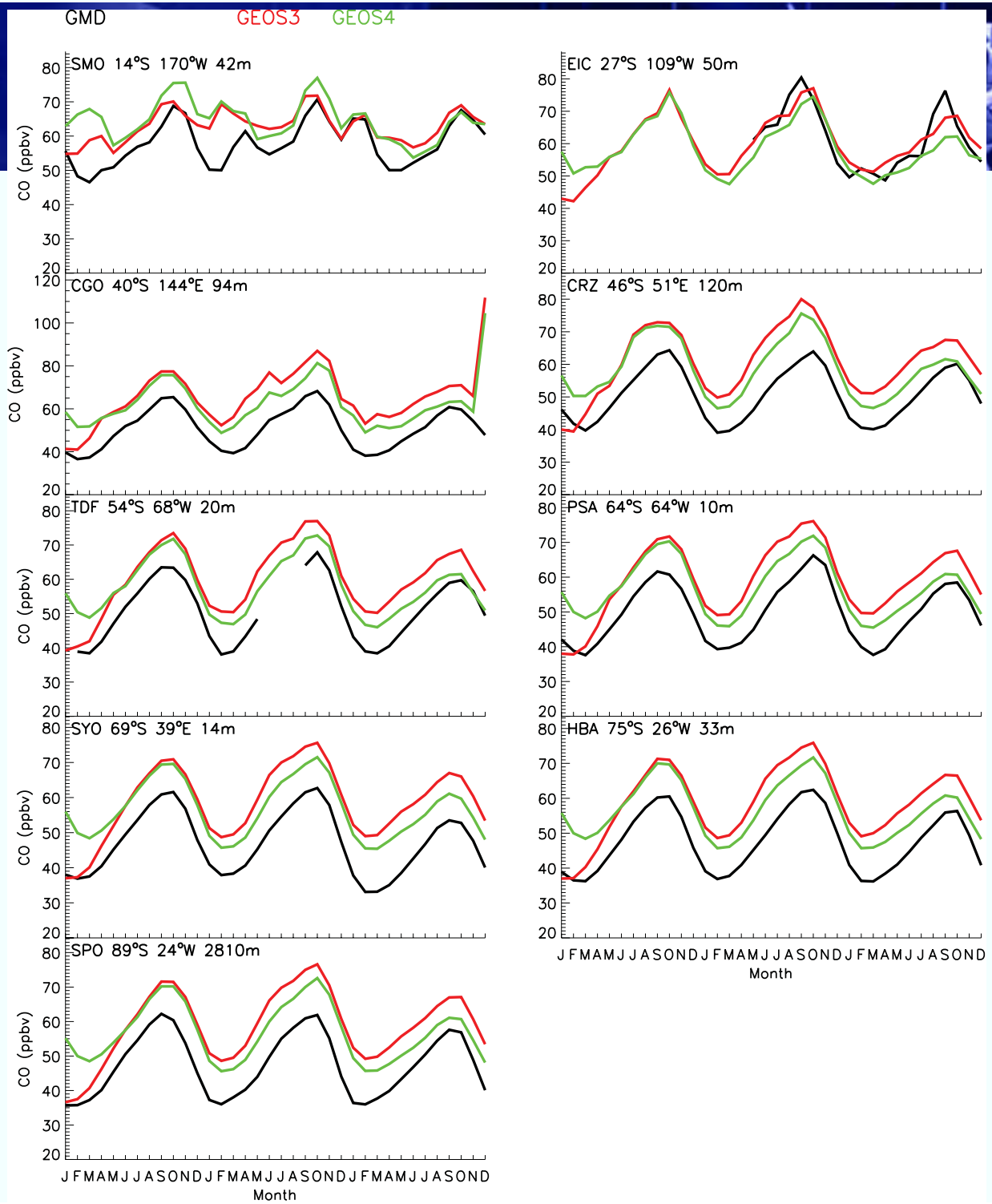
Aura3

Aura4