Radionuclide simulations with GMI model V2

David B. Considine, NASA LARC

NASA GMI Science Team Meeting
June 6, 2005

Rn-222/Pb-210 comparisons

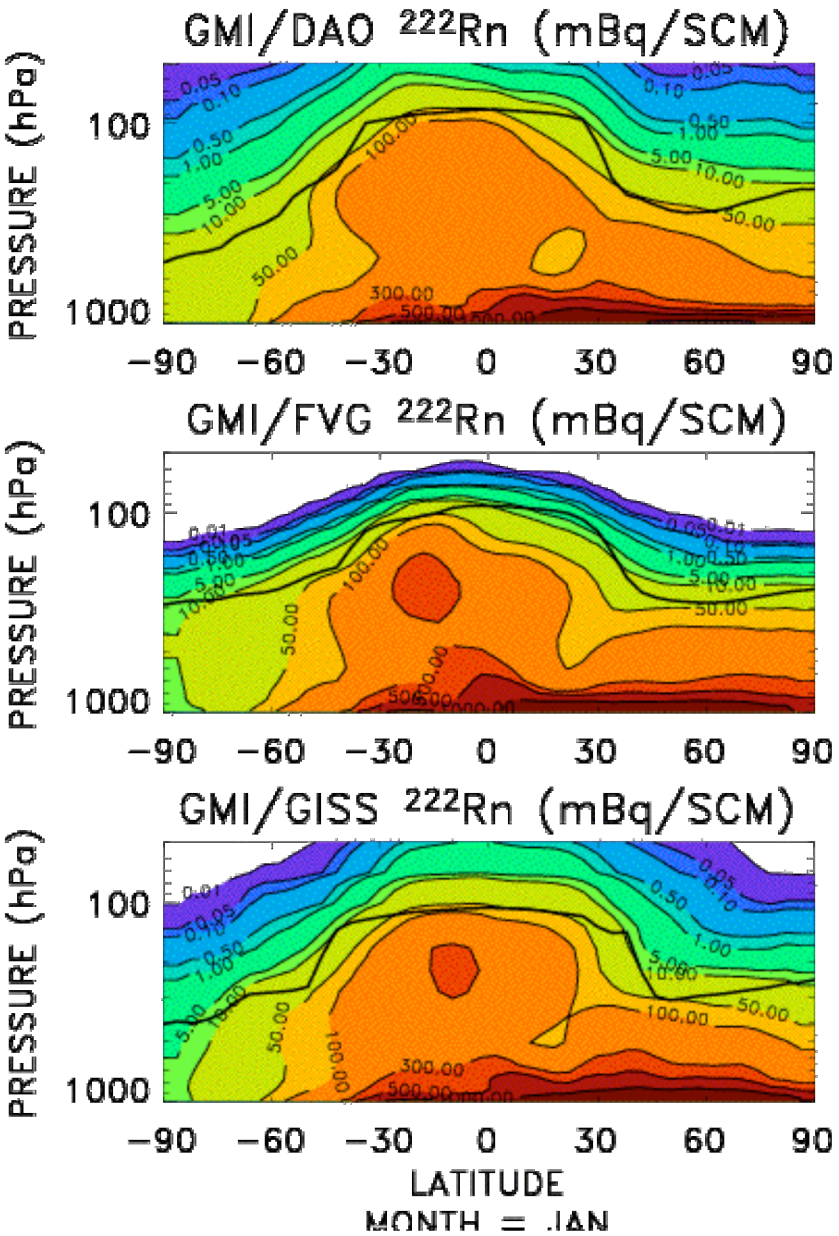
Simulation Descriptions

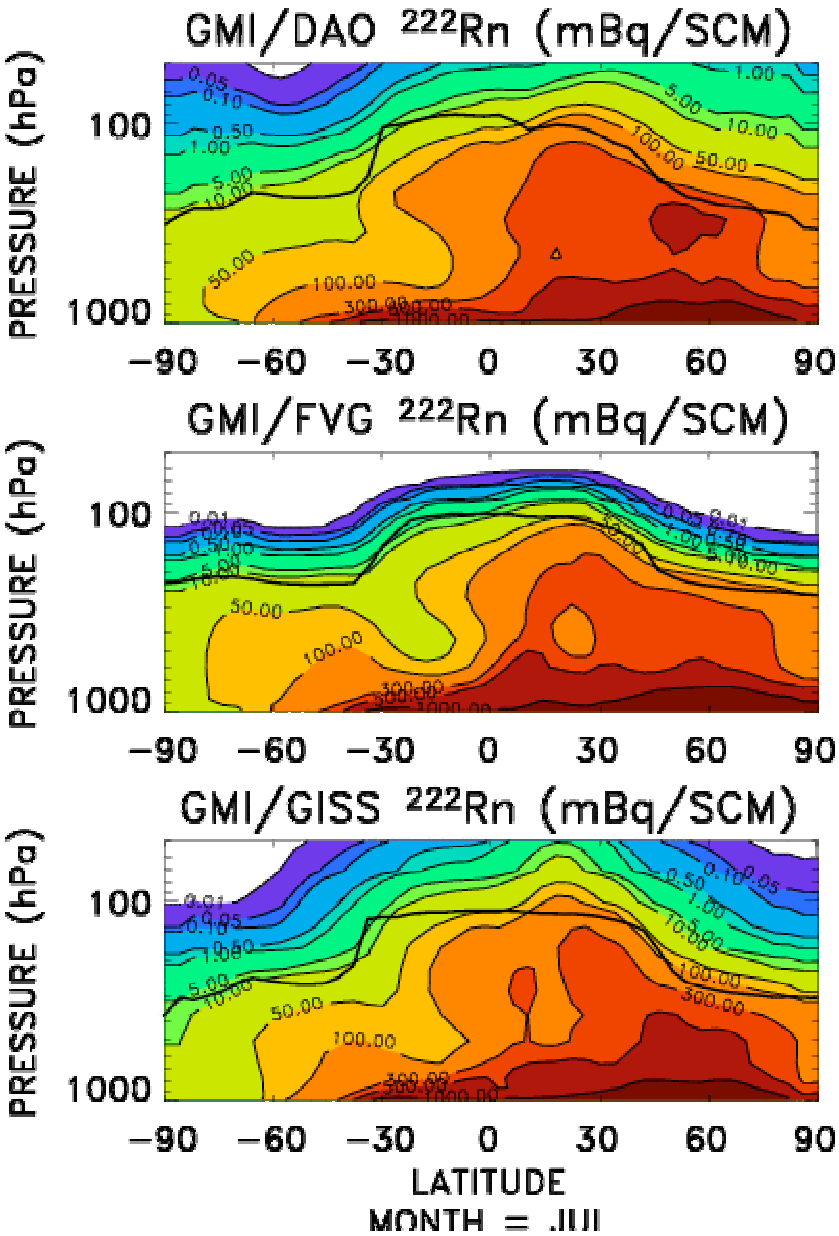
1. GMI/DAO - uses GEOS-STRAT Met fields.
   - no significant changes since v1 - here for completeness.

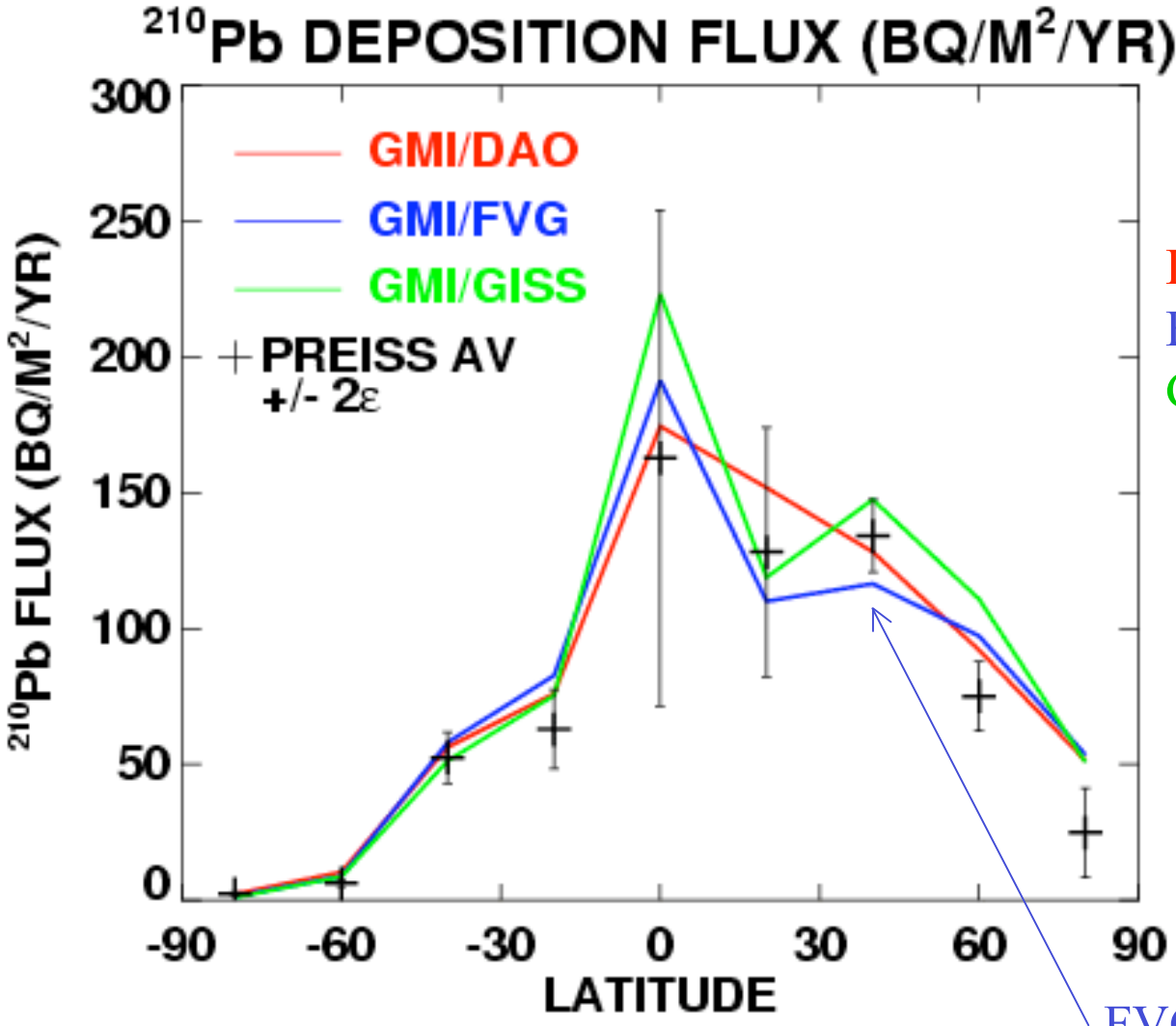
2. GMI/FVGCM (GEOS-4 AGCM)
   - our “new hope!”
   - includes convective scavenging and transport in shallow and deep convection.
   - includes downdraft transport, entrainment and detrainment

3. GMI/GISS
   - Convective transport divided into deep and shallow components per M.P. suggestion. Scavenging occurs in both.

Summer and winter zonal mean Rn-222 distributions





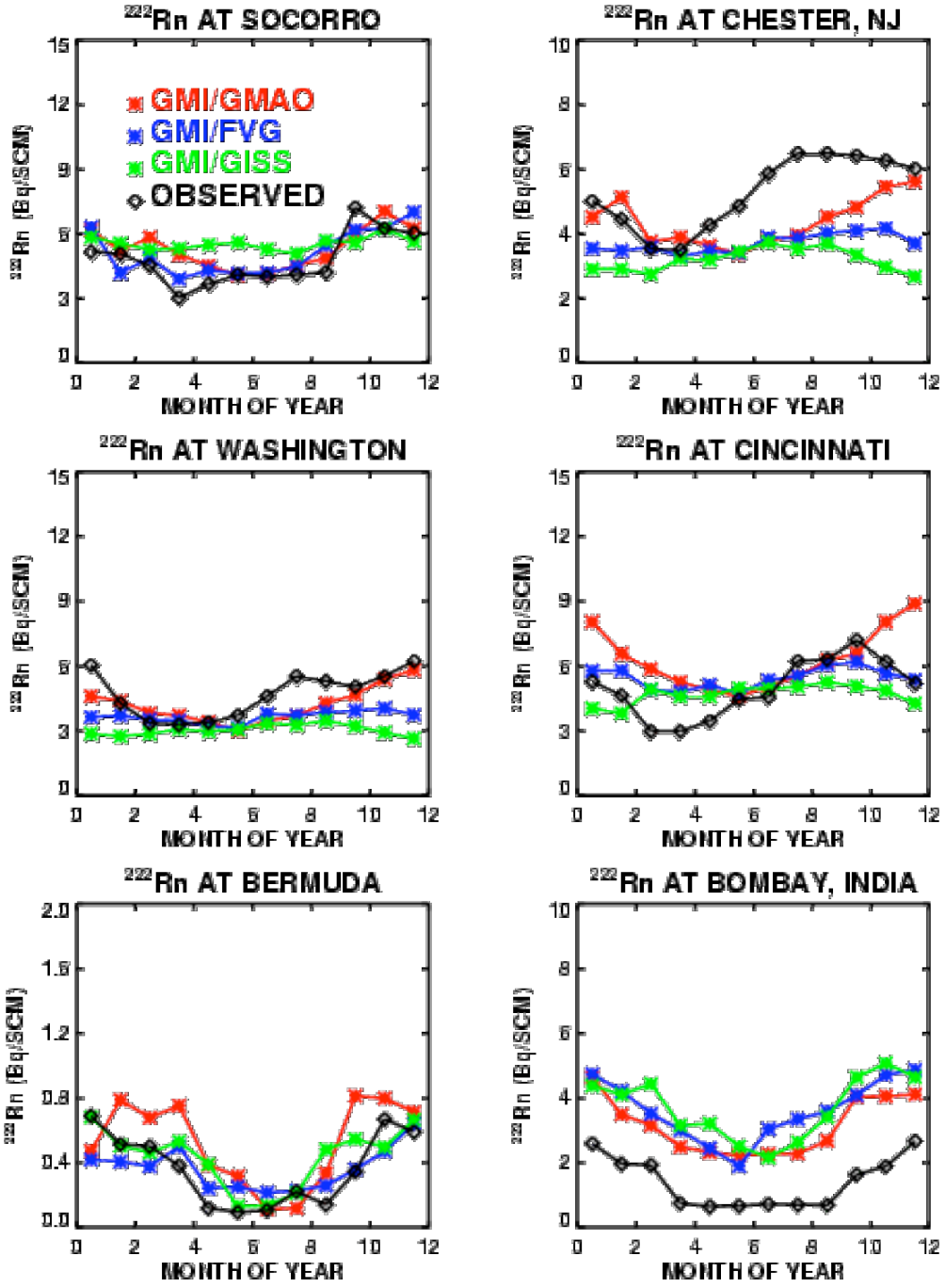


Global Averages

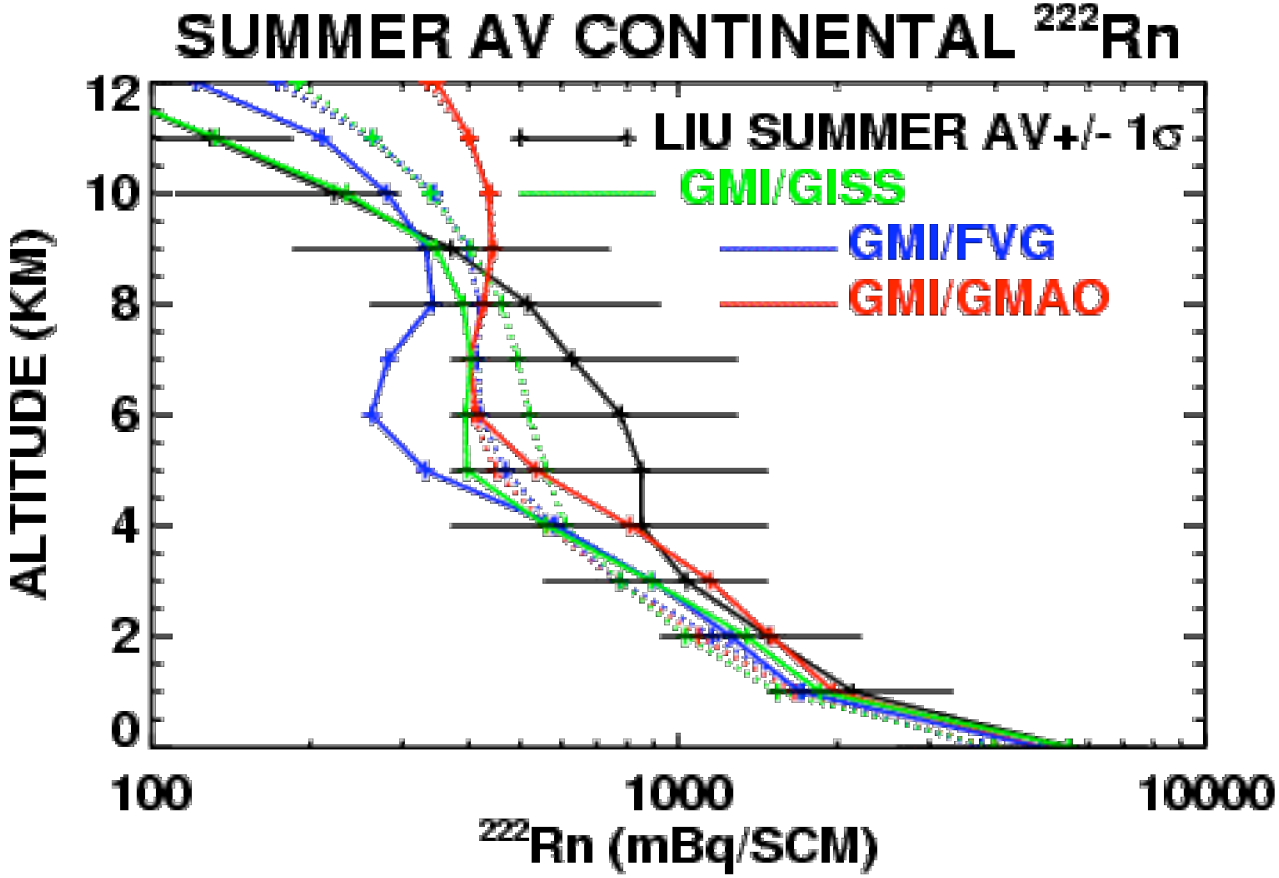
	Wet	Dry	Total
DAO	68.48	3.81	72.29
FVG	69.52	4.19	73.71
GISS	67.83	4.48	72.31

FVGCM has slightly larger globally averaged Pb-210 deposition than DAO or GISS, hence slightly more radon emission.

FVG has smaller midlatitude deposition than other two.

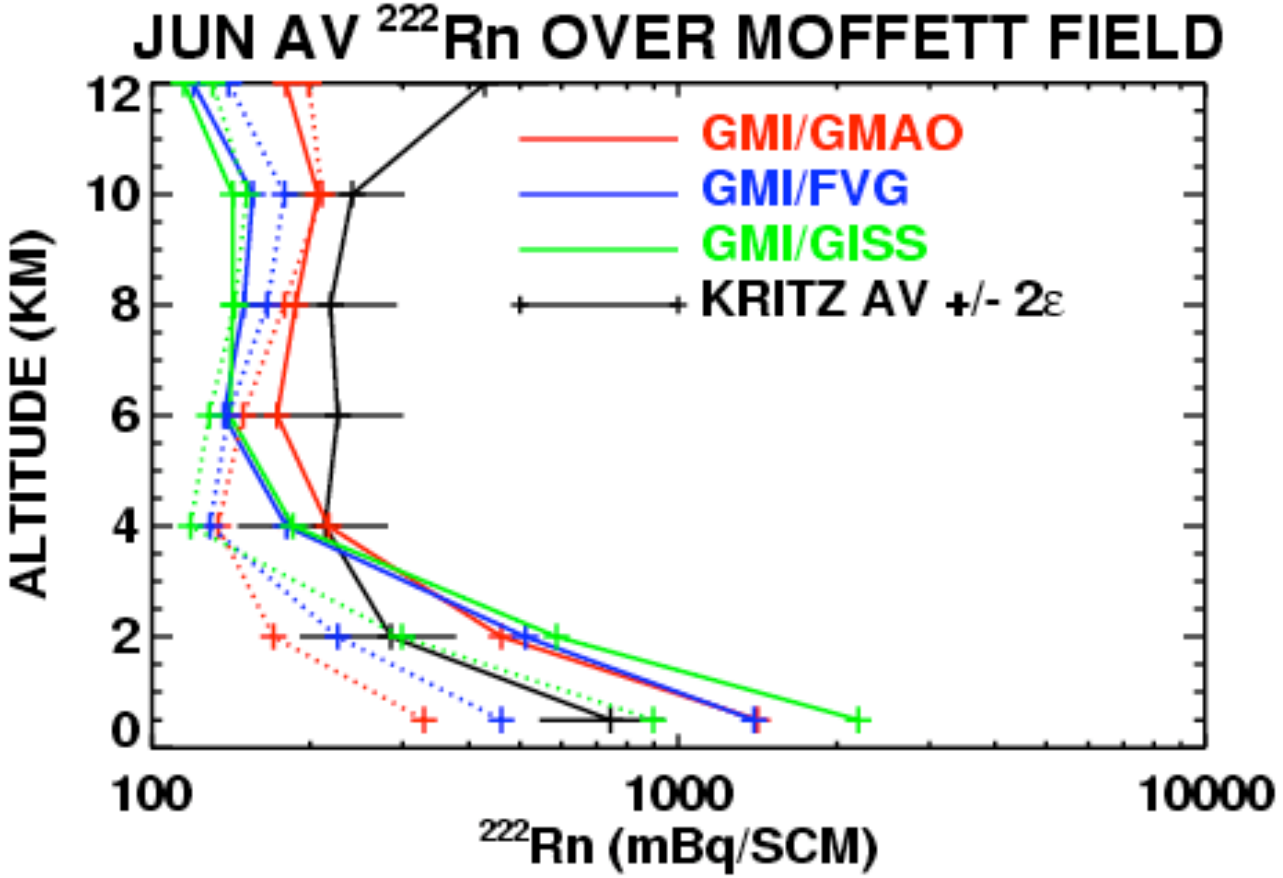

222Rn AT SOCORRO
GMI/GMAO
GMI/FVG
GMI/GISS
OBSERVED
222Rn (Bq/SCM)
MONTH OF YEAR
222Rn AT CHESTER, NJ
222Rn AT WASHINGTON
222Rn AT CINCINNATI
222Rn AT BERMUDA
222Rn AT BOMBAY, INDIA

Model simulations compared to Liu et al. 1984 Rn-222 climatology



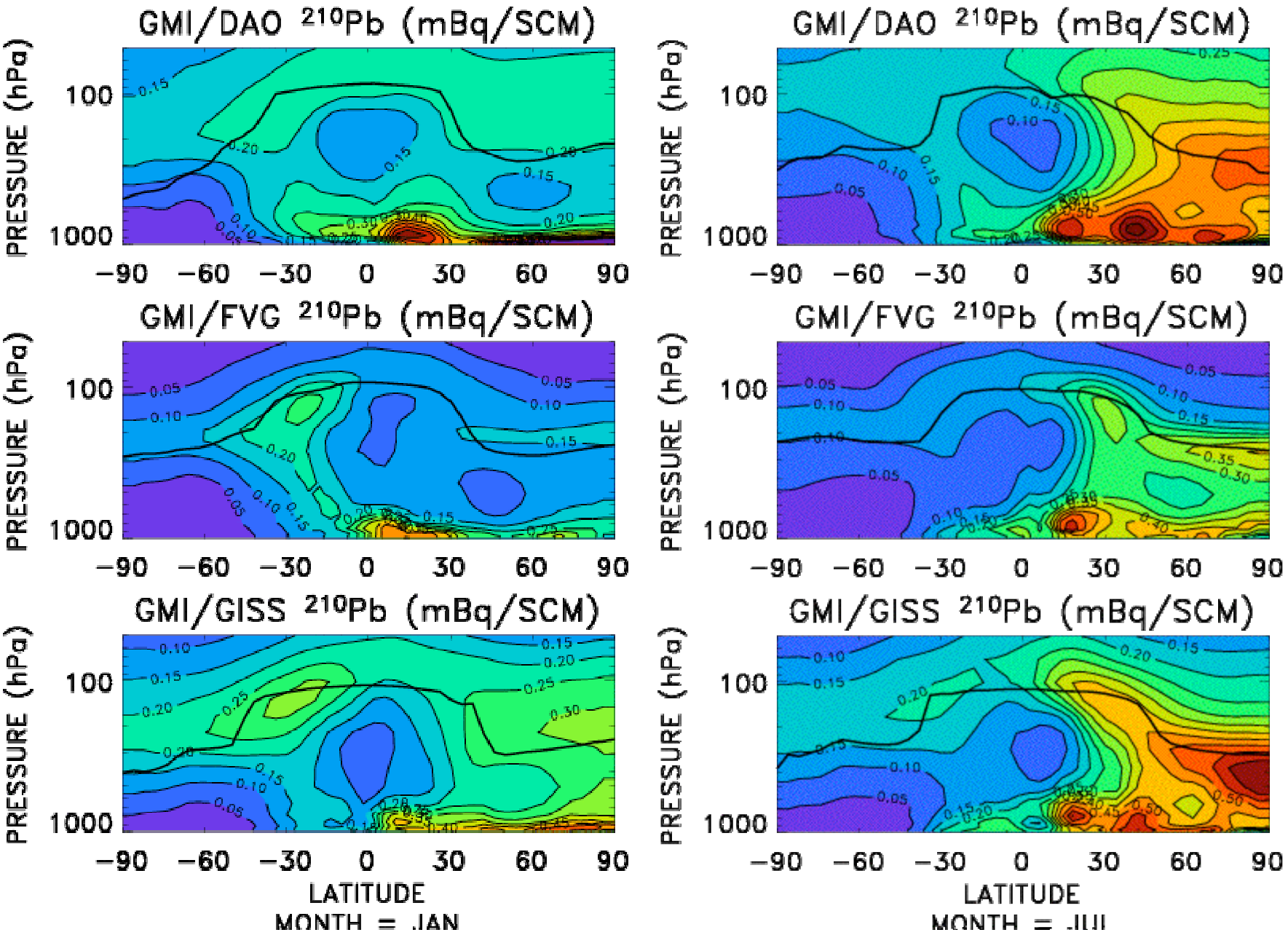
Solid lines - model sampled at Liu profile locations
Dotted lines - NH continental average, JJA

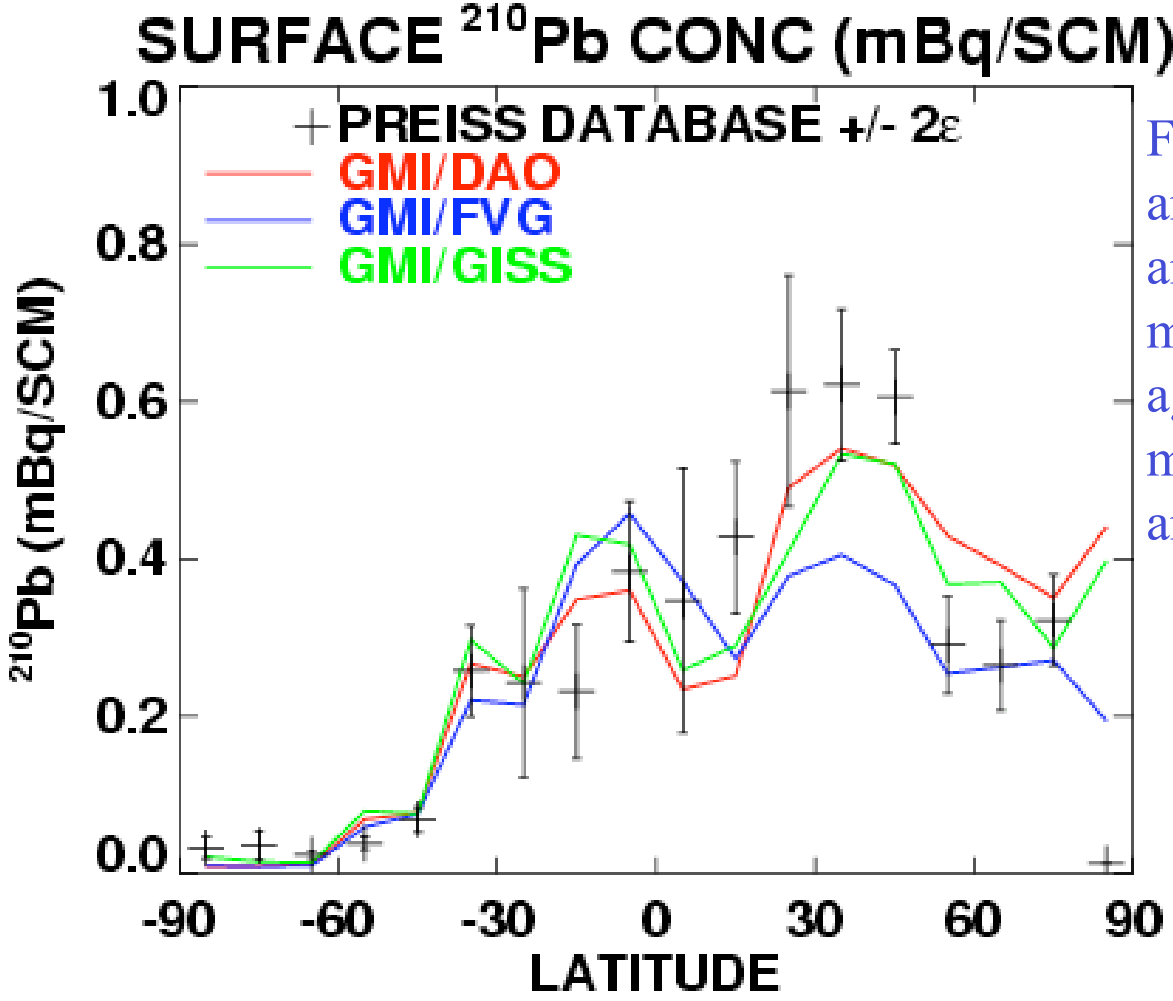
Model simulations compared to Kritz et al. [1998] balloon profiles made during 1994 balloon flights over Moffett field



Solid - Model interpolated to Moffett field lat, lon.
Dotted - Model interpolated to 5° west of Moffett field, illustrating strong longitudinal gradients at surface

Summer and winter zonal mean Pb-210 distributions



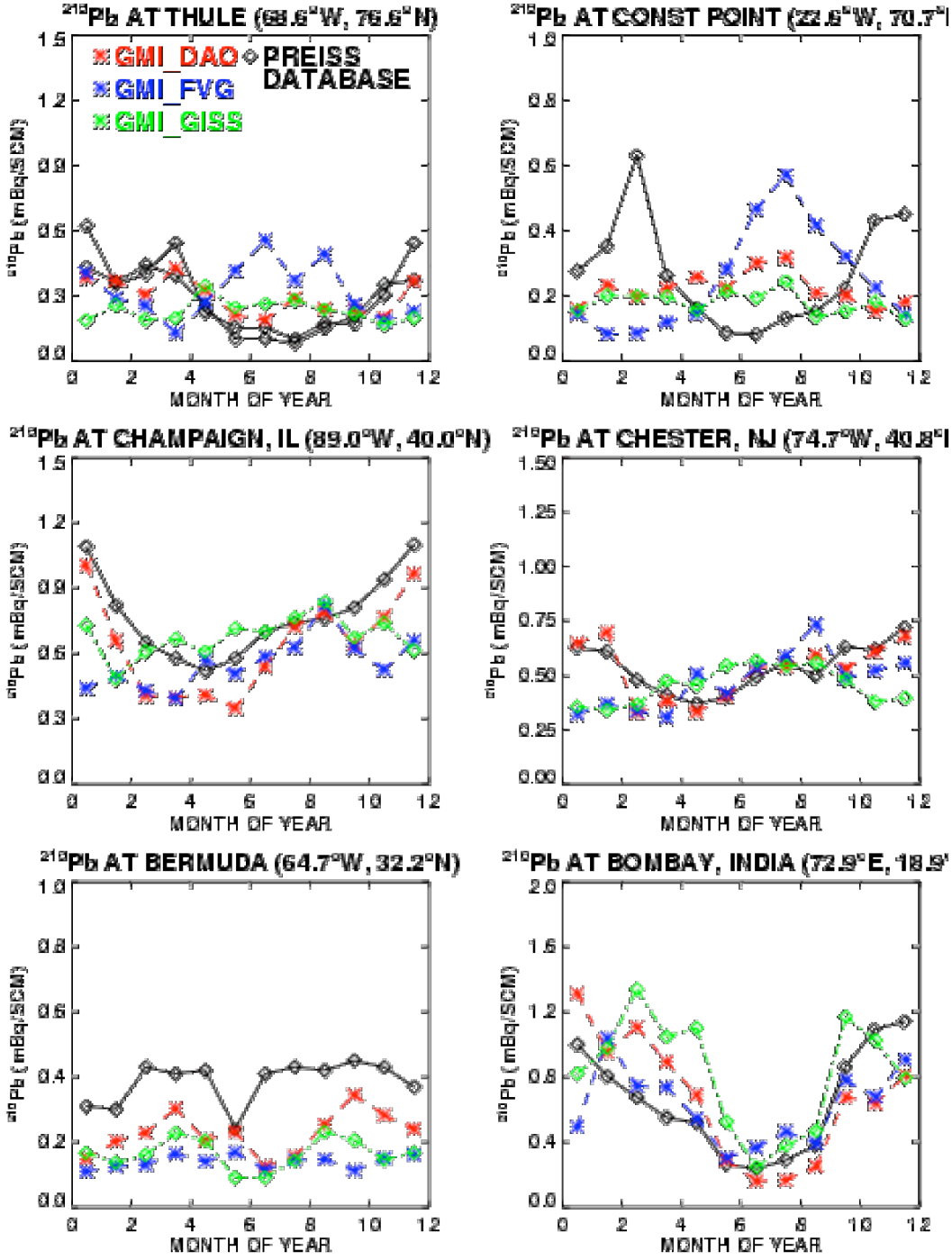


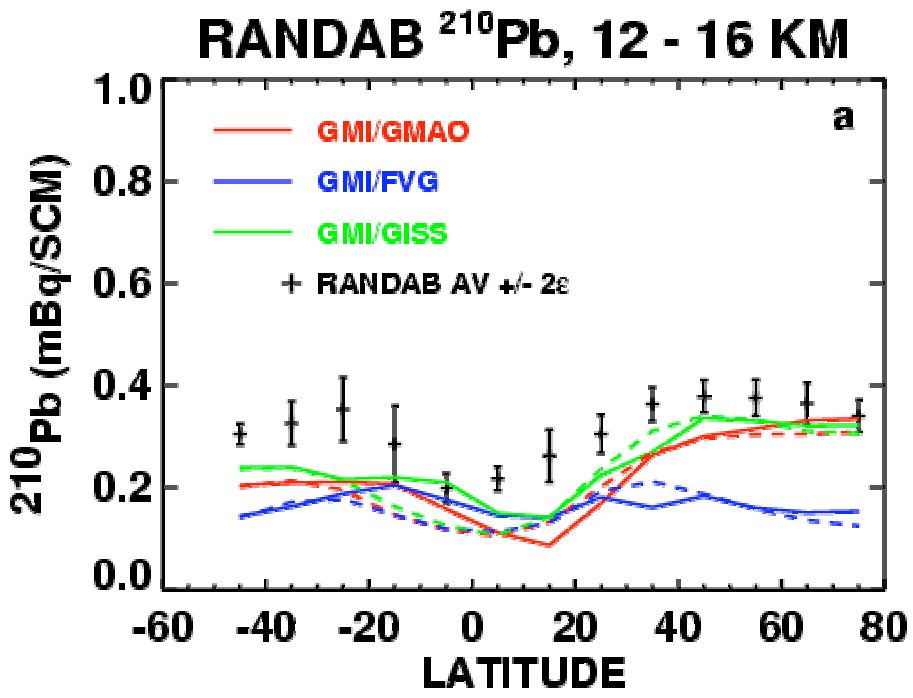
FVG surface concentrations are lower than observations and other simulations in NH mid to high lats - good agreement in tropics and SH midlats with other simulations and observations.

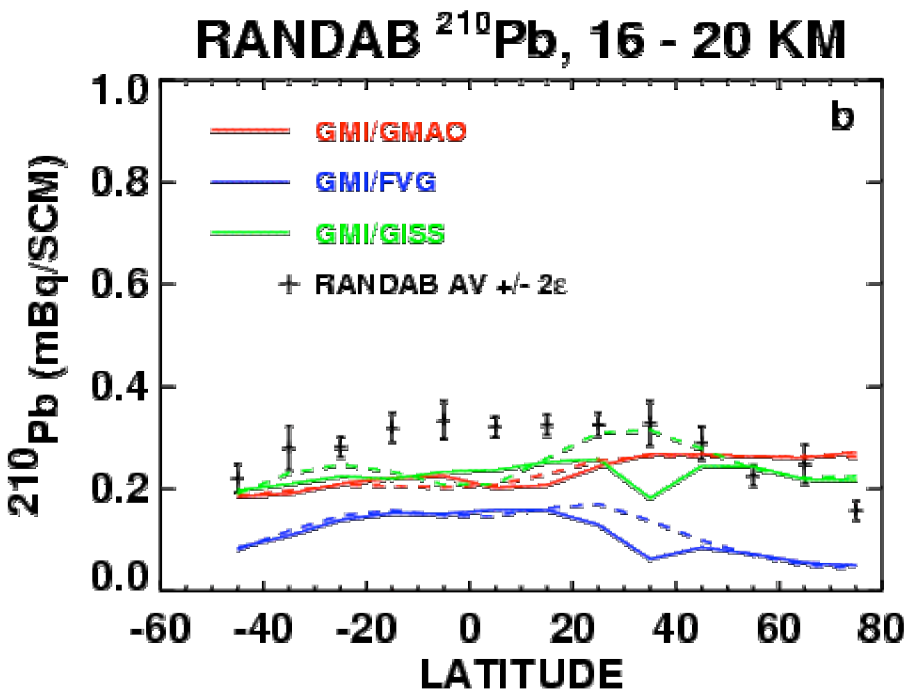
Pb-210 Regional Averages

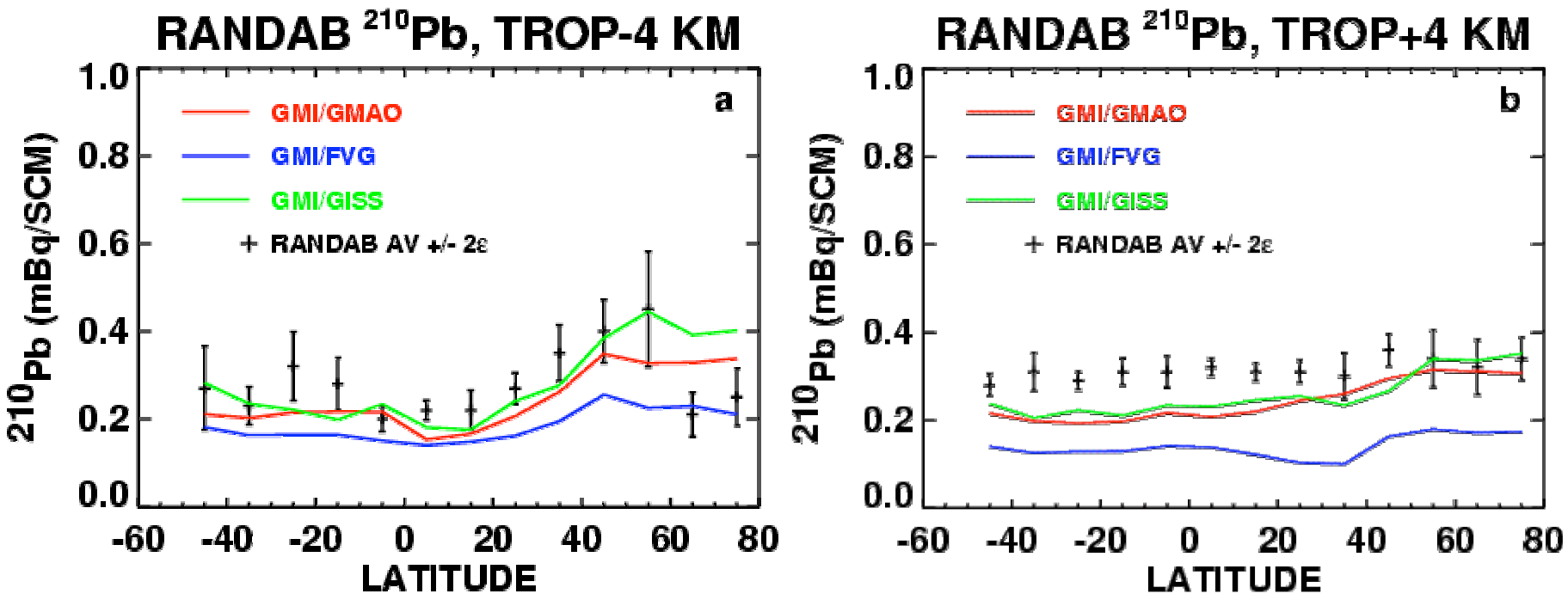
	Arctic	N. America	S. America	Europe	India	Japan
Preiss	0.29 (.08)	0.57 (.08)	0.25 (.05)	0.42 (.08)	0.76 (.16)	0.51 (.22)
DAO	0.35 (.10)	0.54 (.08)	0.32 (.06)	0.41 (.07)	0.64 (.14)	0.41 (.17)
FVG	0.26 (.07)	0.42 (.06)	0.32 (.07)	0.23 (.04)	0.47 (.10)	0.30 (.13)
GISS	0.29 (.08)	0.52 (.08)	0.37 (.08)	0.41 (.07)	0.58 (.13)	0.32 (.13)

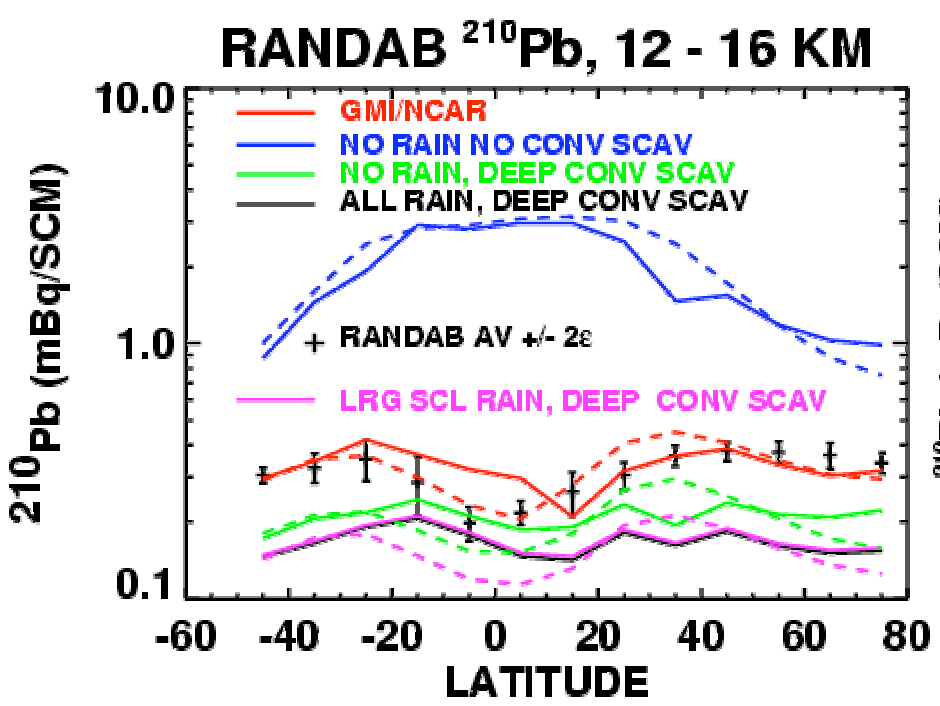
	Oceania	Antarctica	N. Pacific
Preiss	0.18 (.06)	0.030 (.008)	0.24 (.08)
DAO	0.17 (.06)	0.010 (.003)	0.10 (.03)
FVG	0.15 (.05)	0.010 (.002)	0.12 (.04)
GISS	0.15 (.06)	0.017 (.004)	0.11 (.04)

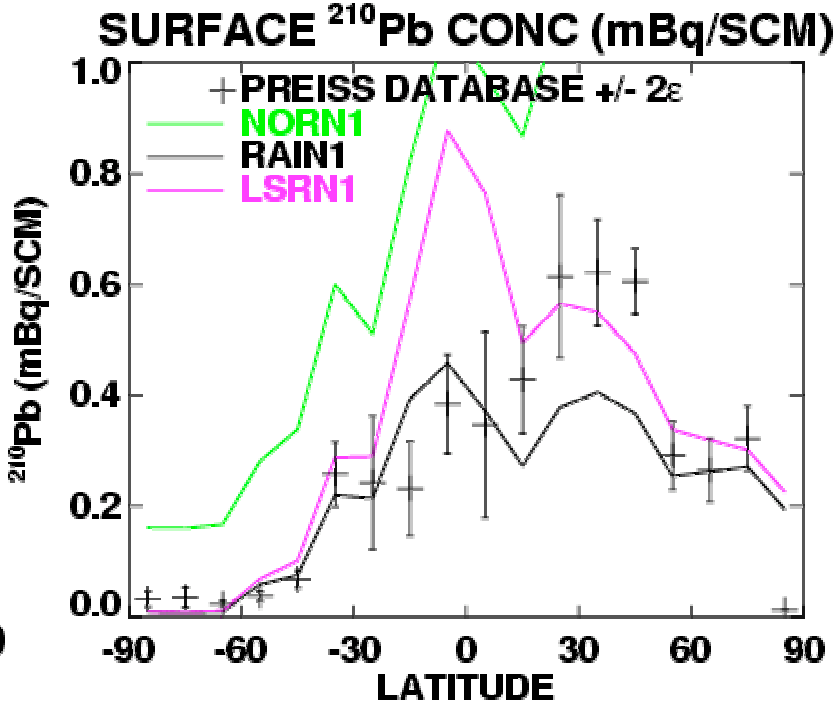

^{210}Pb AT THULE (68.6°W, 76.6°N)
GMI_DAO
GMI_FVG
GMI_GISS
PREISS DATABASE
^{210}Pb (mBq/SCM)
MONTH OF YEAR
^{210}Pb AT CONST POINT (22.6°W, 70.7°N
^{210}Pb AT CHAMPAIGN, IL (89.0°W, 40.0°N)
^{210}Pb AT CHESTER, NJ (74.7°W, 40.8°N
^{210}Pb AT BERMUDA (64.7°W, 32.2°N)
^{210}Pb AT BOMBAY, INDIA (72.9°E, 18.9°


RANDAB ^{210}Pb, 12 - 16 KM
a
GMI/GMAO
GMI/FVG
GMI/GISS
RANDAB AV +/- 2ε
^{210}Pb (mBq/SCM)
1.0
0.8
0.6
0.4
0.2
0.0
-60
-40
-20
0
20
40
60
80
LATITUDE


RANDAB ^{210}Pb, 16 - 20 KM
b
GMI/GMAO
GMI/FVG
GMI/GISS
RANDAB AV +/- 2ε
^{210}Pb (mBq/SCM)
1.0
0.8
0.6
0.4
0.2
0.0
-60
-40
-20
0
20
40
60
80
LATITUDE


RANDAB ^{210}Pb, TROP-4 KM
a
GMI/GMAO
GMI/FVG
GMI/GISS
+ RANDAB AV +/- 2ε
^{210}Pb (mBq/SCM)
1.0
0.8
0.6
0.4
0.2
0.0
-60
-40
-20
0
20
40
60
80
LATITUDE
RANDAB ^{210}Pb, TROP+4 KM
b
GMI/GMAO
GMI/FVG
GMI/GISS
+ RANDAB AV +/- 2ε
^{210}Pb (mBq/SCM)
1.0
0.8
0.6
0.4
0.2
0.0
-60
-40
-20
0
20
40
60
80
LATITUDE





Prescription:

1. Reduce amt of deep convective scavenging
2. Reduce rainout at midlatitudes (large scale rain)
3. Retain convective rainout to get agreement in tropics at surface.

Conclusions

1. GMI V2 radionuclide simulations for GEOS-STRAT and GISS II' met fields similar to previous results.

2. Rn-222 simulation for FVGCM met field shows good agreement with observations.

3. Pb-210 simulation with FVGCM low both in NH midlats at surface and in UT/LS region.

4. Appears that parameters in deposition algorithms will need to be changed to improve FVGCM simulation agreement with observations.

5. Changes in deposition algorithm parameters will affect simulations using GISS, DAO met fields.