

# Status of BGC in CESM1

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# What is in the CESM1 release

- POP Ecosystem model (first release)
  - Online User's Guide
  - Scientific Reference in prep
- CLM features (in CCSM4 release)
  - Carbon-Nitrogen Model
  - Land Cover & Land Use Change (LCLUC)
  - Dynamic Global Vegetation Model (DGVM)
- CAM CO<sub>2</sub> features (first release)
  - CO<sub>2</sub> constituents that use LND & OCN CO<sub>2</sub> fluxes as surface boundary condition
  - Pass CO<sub>2</sub> to driver for LND & OCN flux computations
  - Couple CO<sub>2</sub> constituents to radiation computations

# What is in the CESM1 release

- New BGC compsets (i.e. works out of the box)
  - Spun-up Initial Conditions
- Diagnostics from 30 year segment of 1850 controls
  - no ATM CO<sub>2</sub> or Ocean BGC yet
- Model Output from 30 year segment of 1850 controls
  - in progress

# New BGC Compsets

- Terminology
  - BGC CO<sub>2</sub>: used by surface components
  - RAD CO<sub>2</sub>: used by ATM radiative code
  - Prognostic CO<sub>2</sub>: predicted ATM concentrations
    - computed from LND and OCN CO<sub>2</sub> fluxes
  - Diagnostic CO<sub>2</sub>: prescribed ATM concentrations
- B\_1850\_BGC-BPRP
- B\_1850-2000\_BGC-BPRP
- B\_1850\_BGC-BDRD
- B\_1850-2000\_BGC-BDRD
- C\_NORMAL\_YEAR\_ECOSYS

# Spun-up Initial Conditions

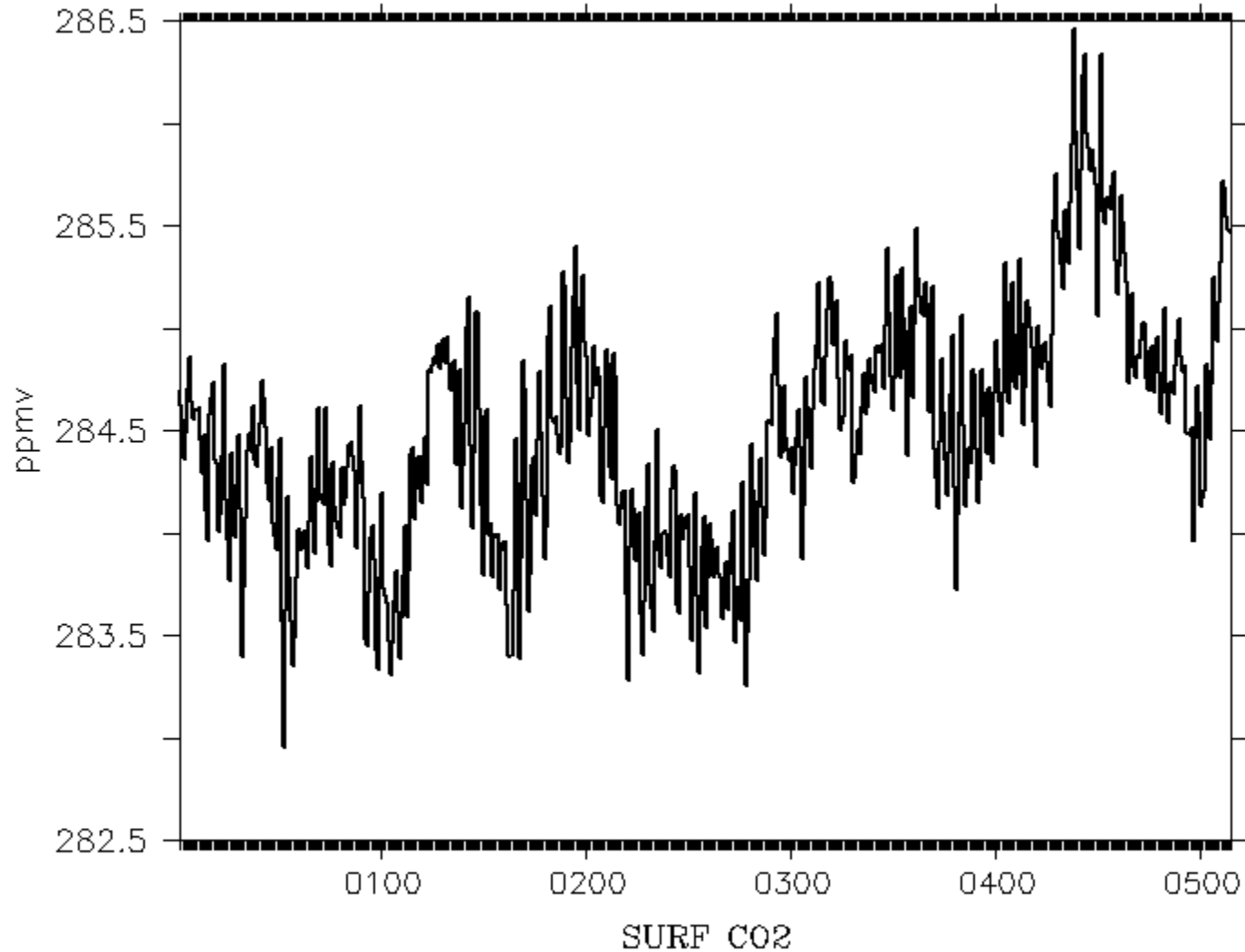
- IC's are provided for coupled compsets
  - Uses physics of CAM4
- Resolution
  - ATM/LND: 0.9x1.25
  - OCN/ICE: gx1v6
- Ocean Alone IC are provided for gx1v6, gx3v7, but are not spun-up

# Status of Runs

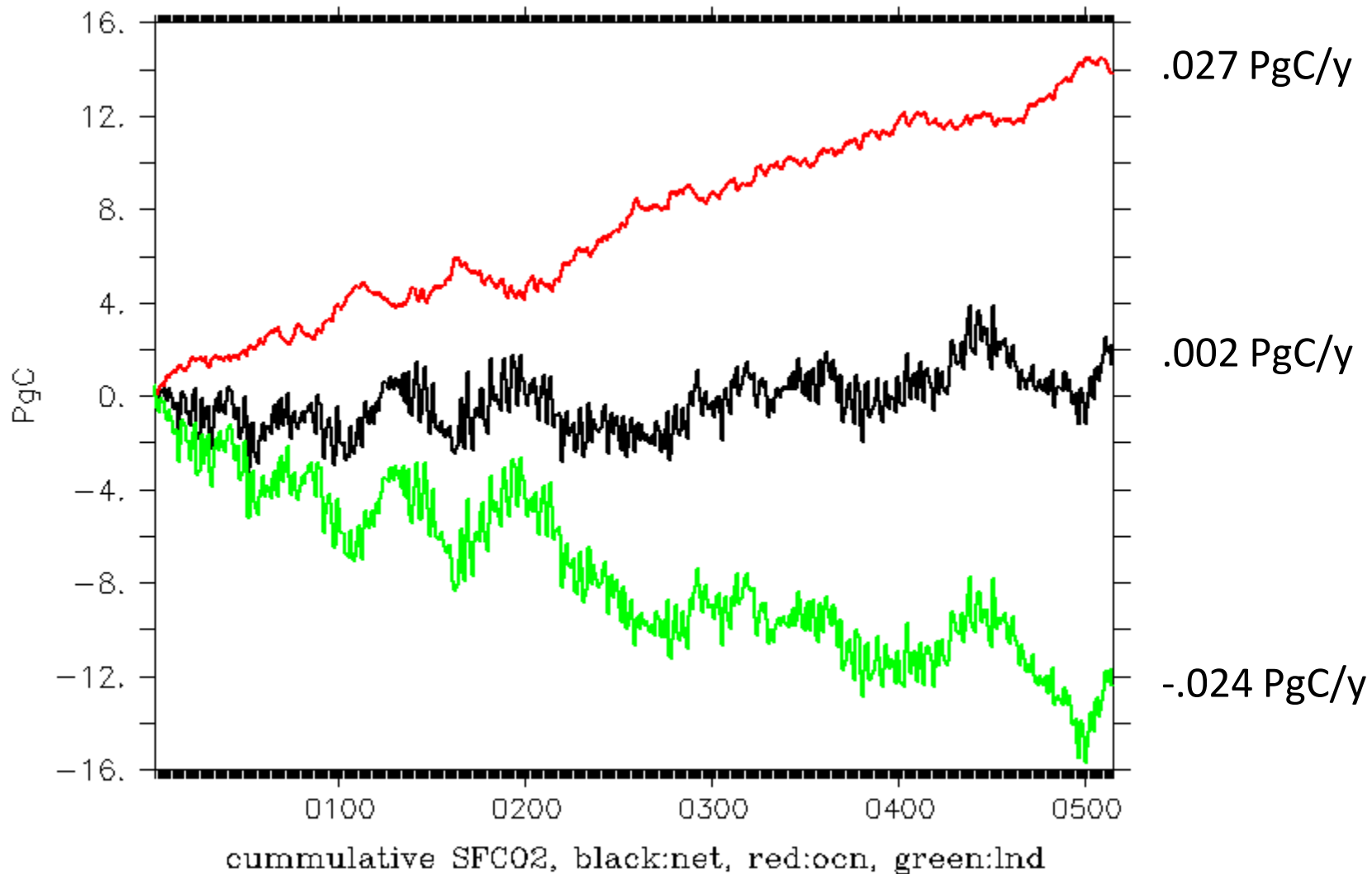
## 2010-06-29

- Prognostic CO<sub>2</sub>
  - 1850 Control 526 years
  - 20<sup>th</sup> Century 1 run done
  - 20<sup>th</sup> Century, 1850 RAD 1850-1871
- Prescribed CO<sub>2</sub>
  - 1850 Control 308 years
  - 20<sup>th</sup> Century 1 run done
  - 20<sup>th</sup> Century, 1850 RAD 1850-1869

# Prognostic CO<sub>2</sub> 1850 Control

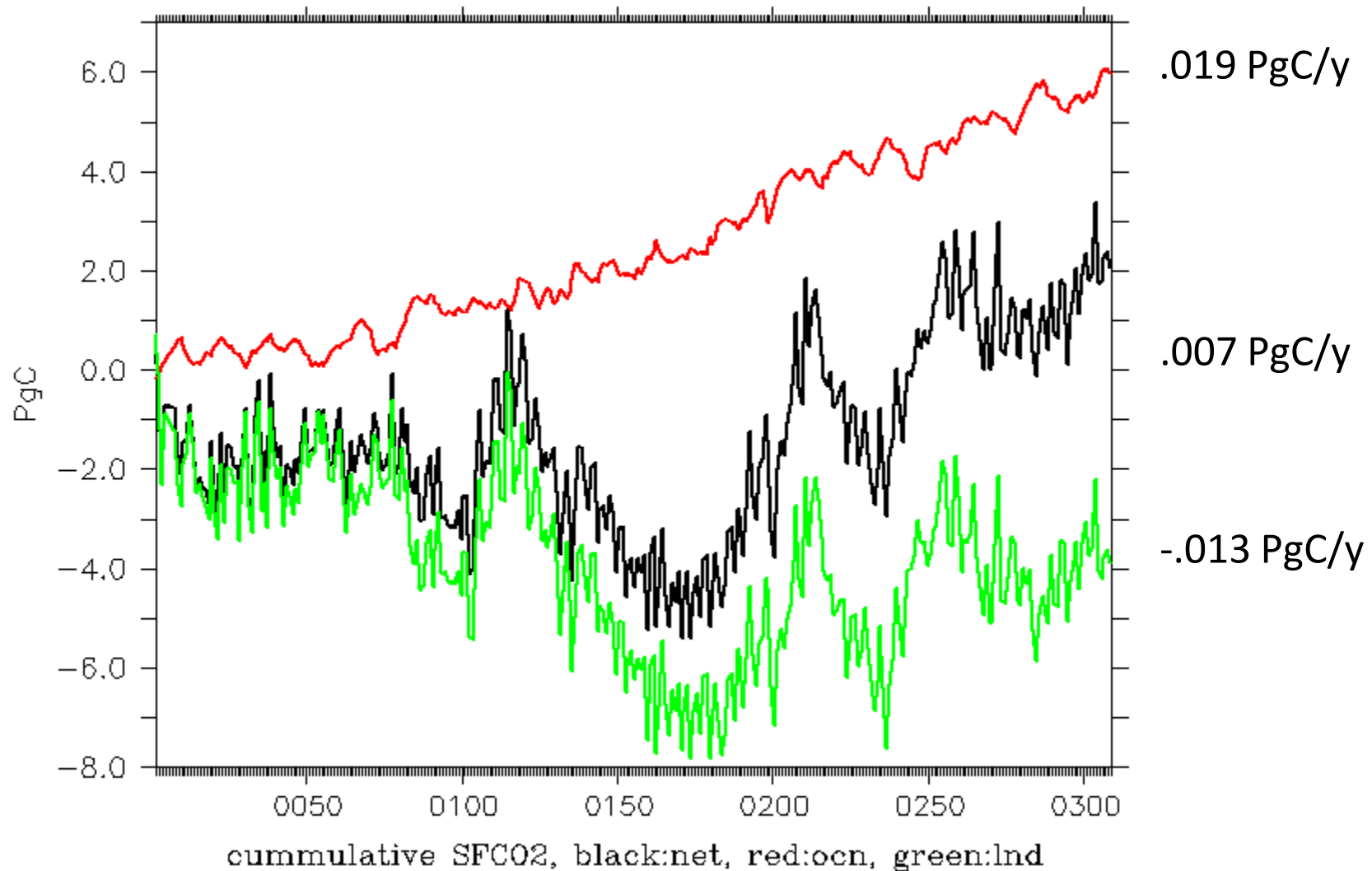


# Prognostic CO<sub>2</sub> 1850 Control



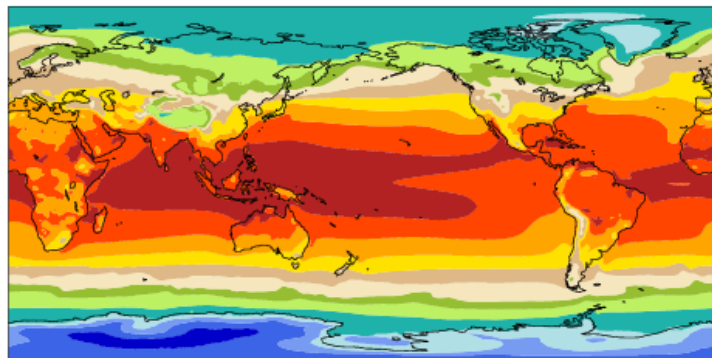


# Prescribed CO<sub>2</sub> 1850 Control



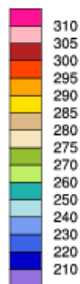
b40.coup\_carb.004 (yrs 351-370)

Surf Temp (radiative) mean= 287.24 K



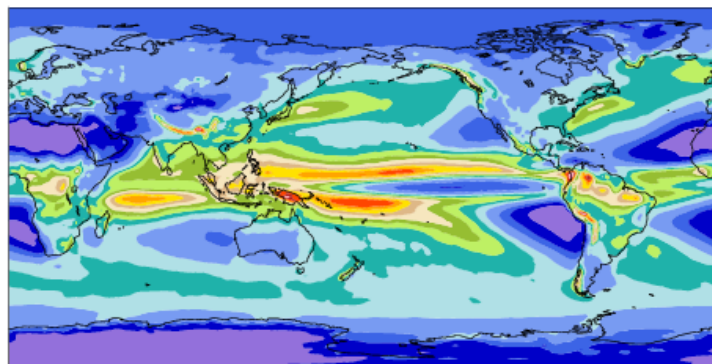
**ANN**

Min = 214.75 Max = 304.18



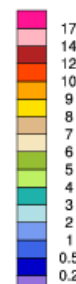
b40.coup\_carb.004 (yrs 351-370)

Precipitation rate mean= 2.93 mm/day



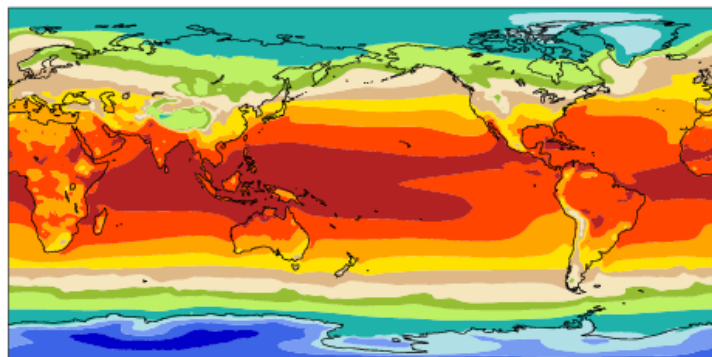
**ANN**

Min = 0.04 Max = 20.31

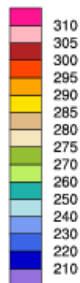


b40.1850.track1.1deg.006 (yrs 863-882)

Surf Temp (radiative) mean= 287.26 K

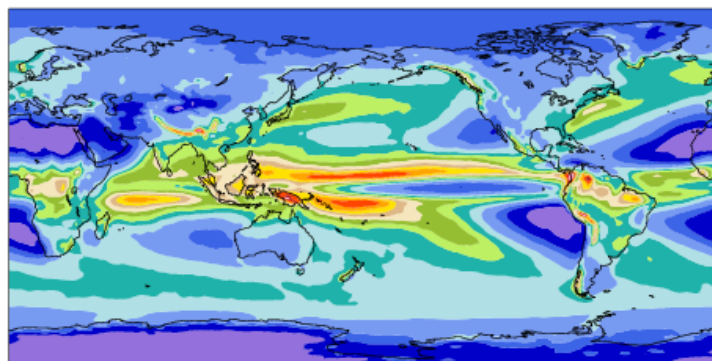


Min = 214.34 Max = 304.15

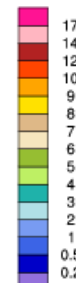


b40.1850.track1.1deg.006 (yrs 863-882)

Precipitation rate mean= 2.93 mm/day

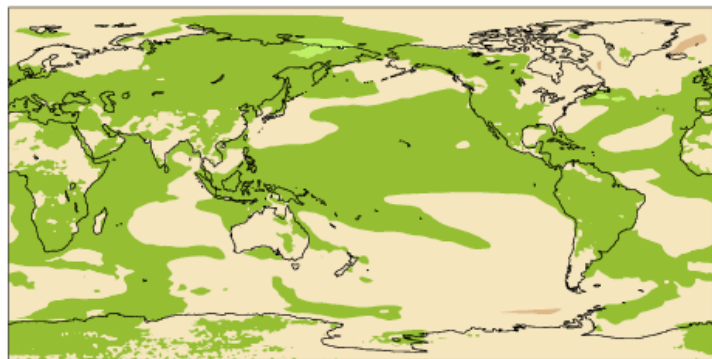


Min = 0.05 Max = 20.29

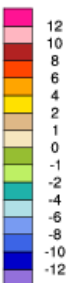


b40.coup\_carb.004 - b40.1850.track1.1deg.006

mean = -0.01 rmse = 0.22 K

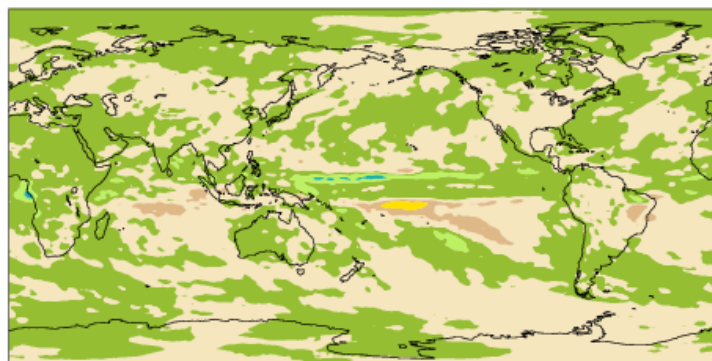


Min = -1.73 Max = 1.67

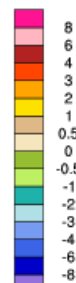


b40.coup\_carb.004 - b40.1850.track1.1deg.006

mean = -0.00 rmse = 0.21 mm/day



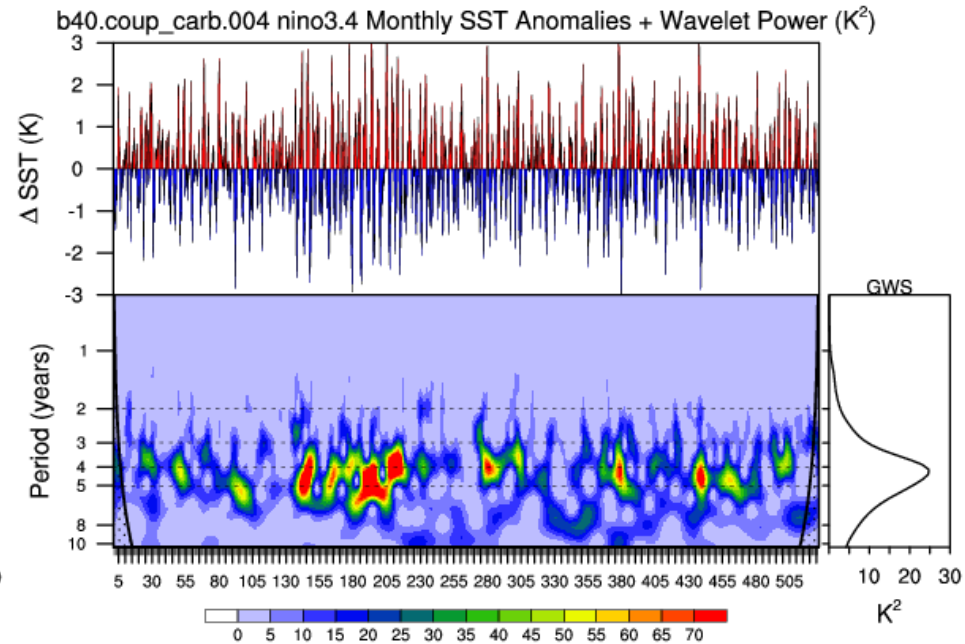
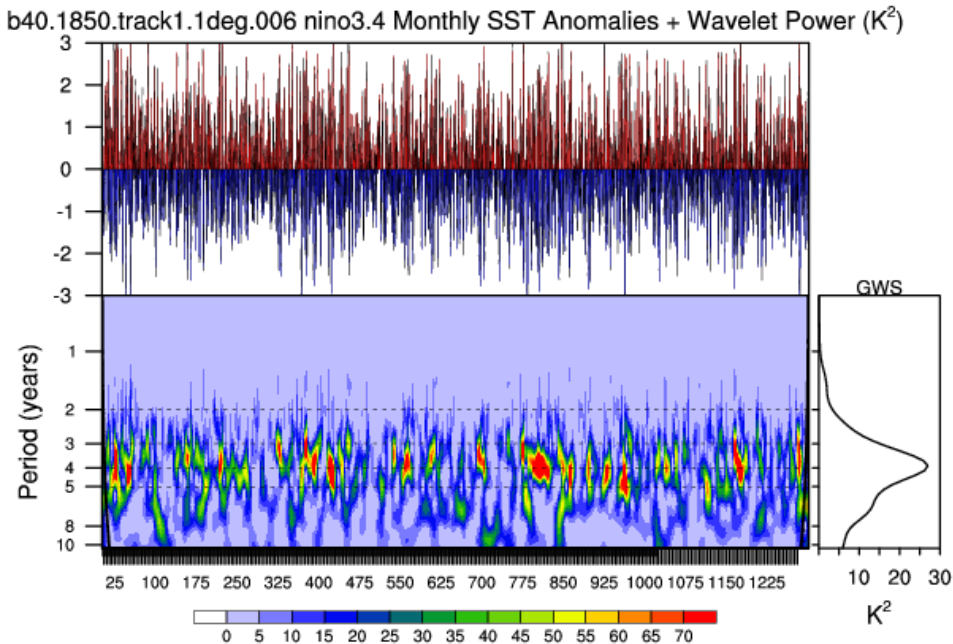
Min = -1.34 Max = 1.80



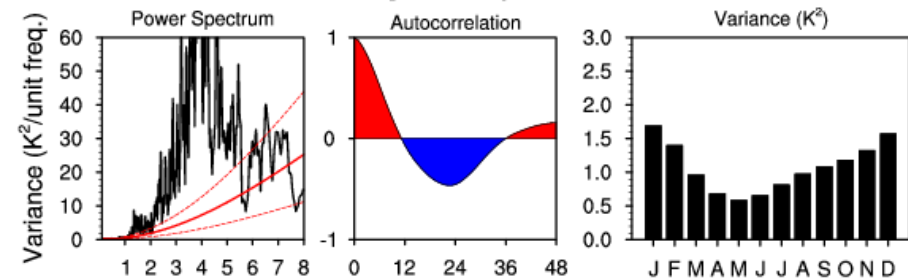
# Nino 3.4 Variability

CCSM4,  $\sigma=1.039$  (Obs=0.824)

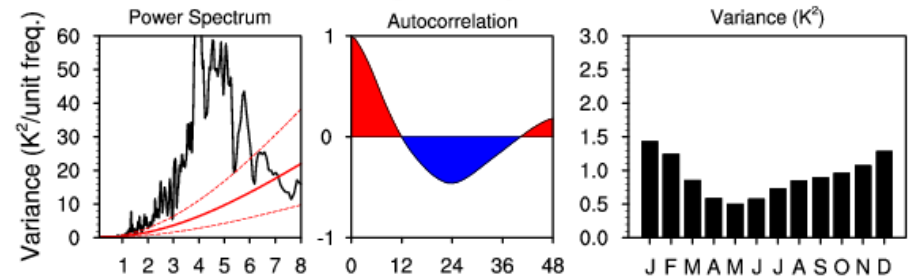
CESM1,  $\sigma=0.955$  (Obs=0.824)



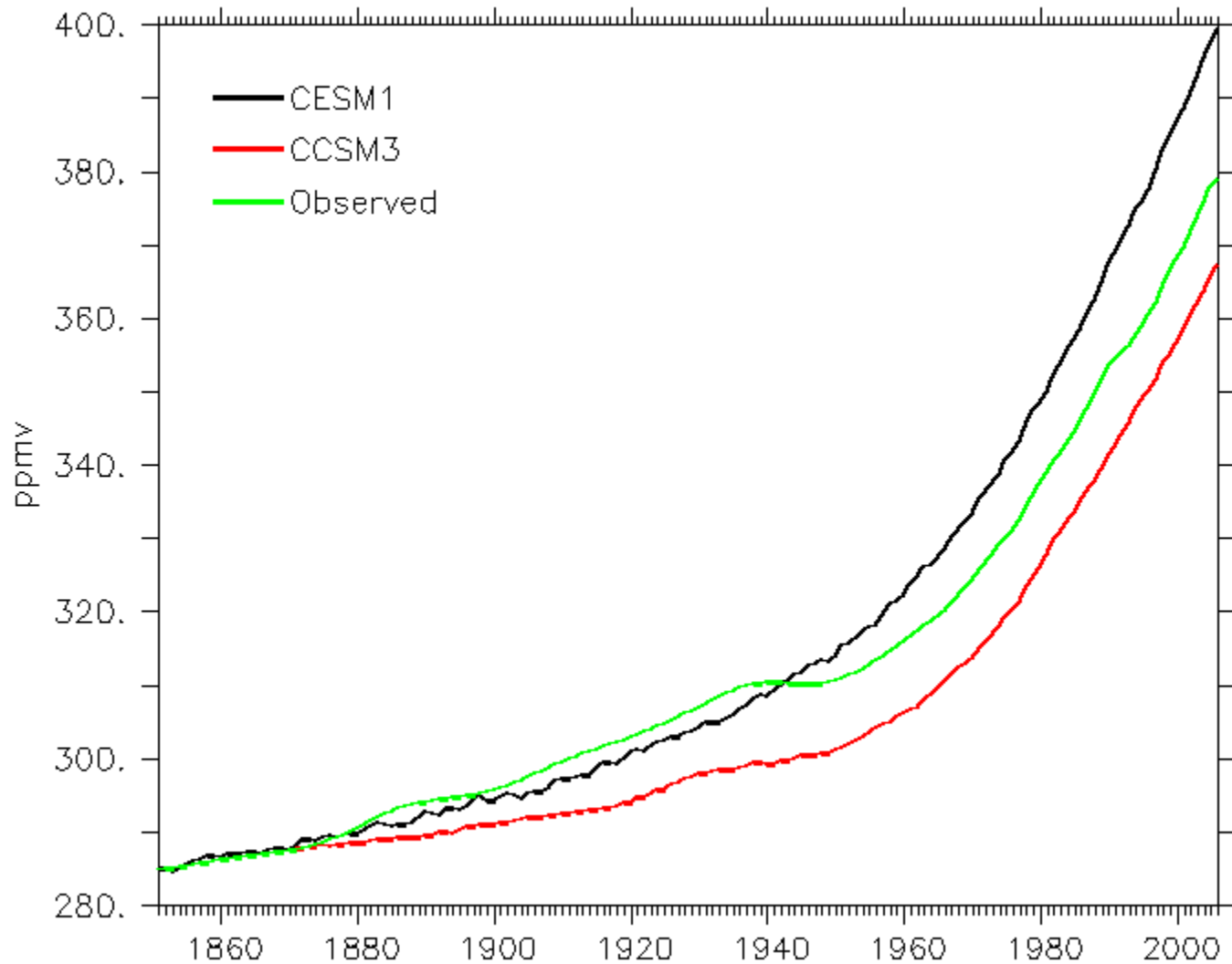
Averaged over years 1 to 1300:



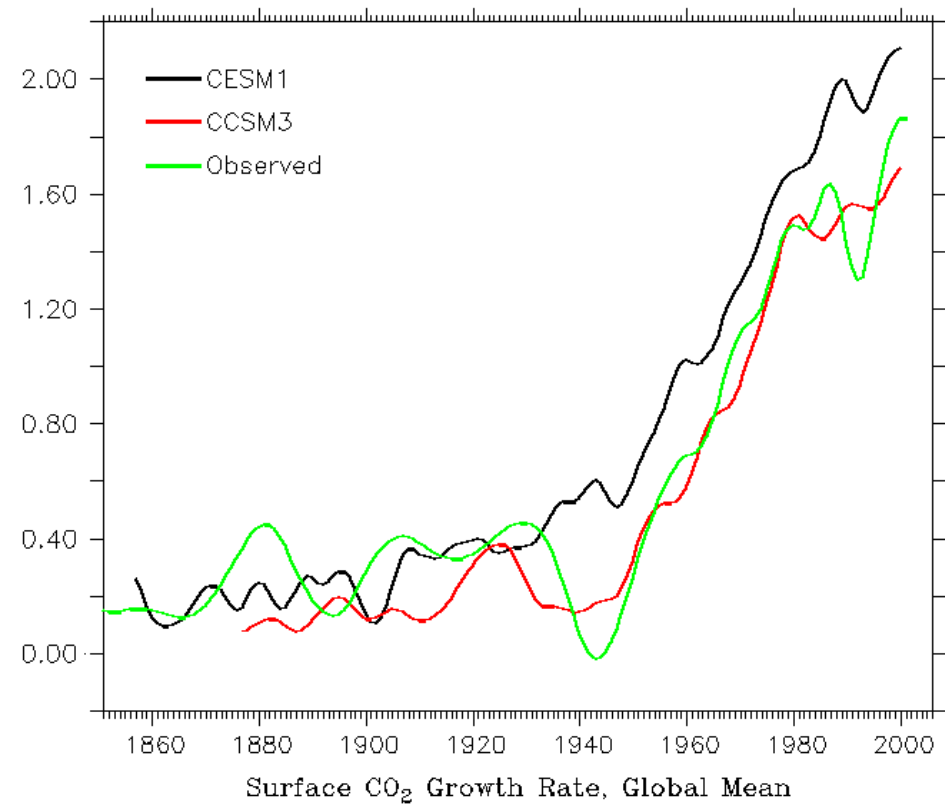
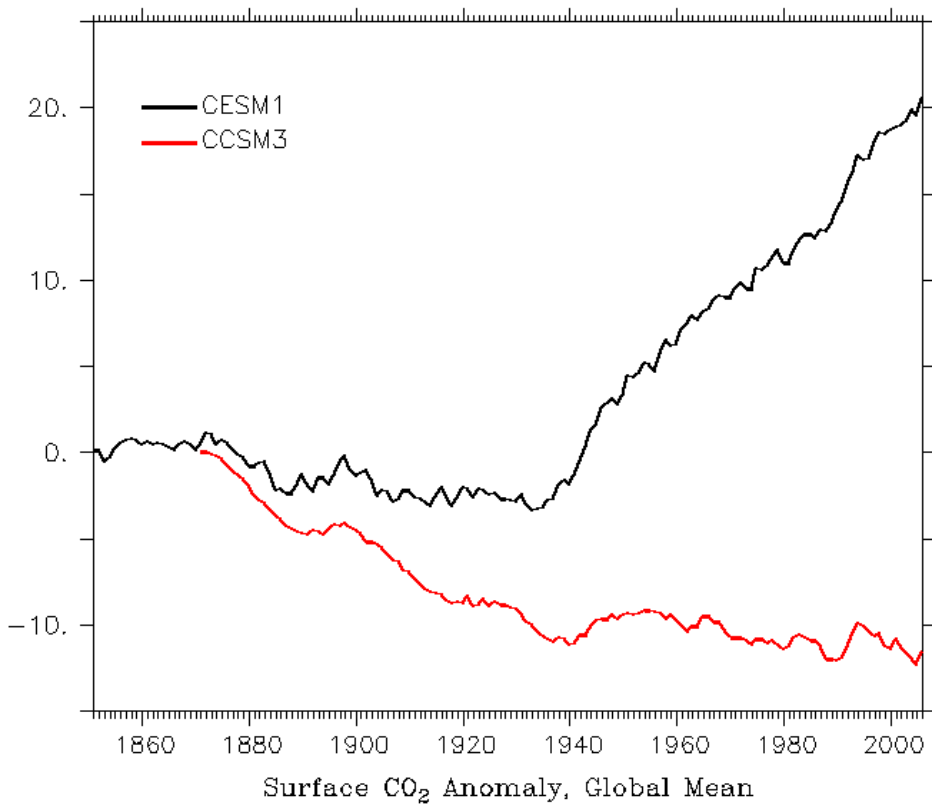
Averaged over years 1 to 526:



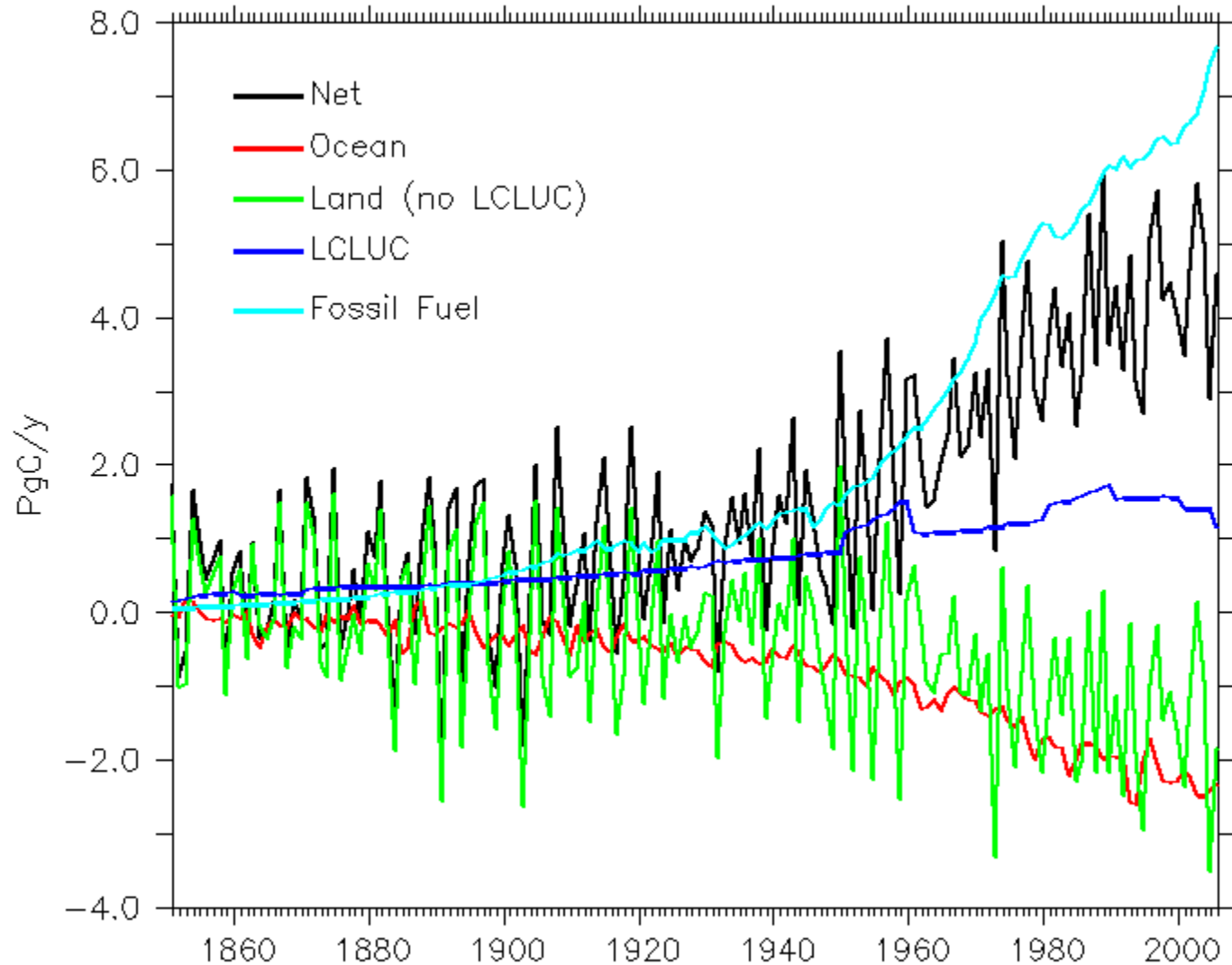
# Surface CO<sub>2</sub> in 20<sup>th</sup> Century Runs



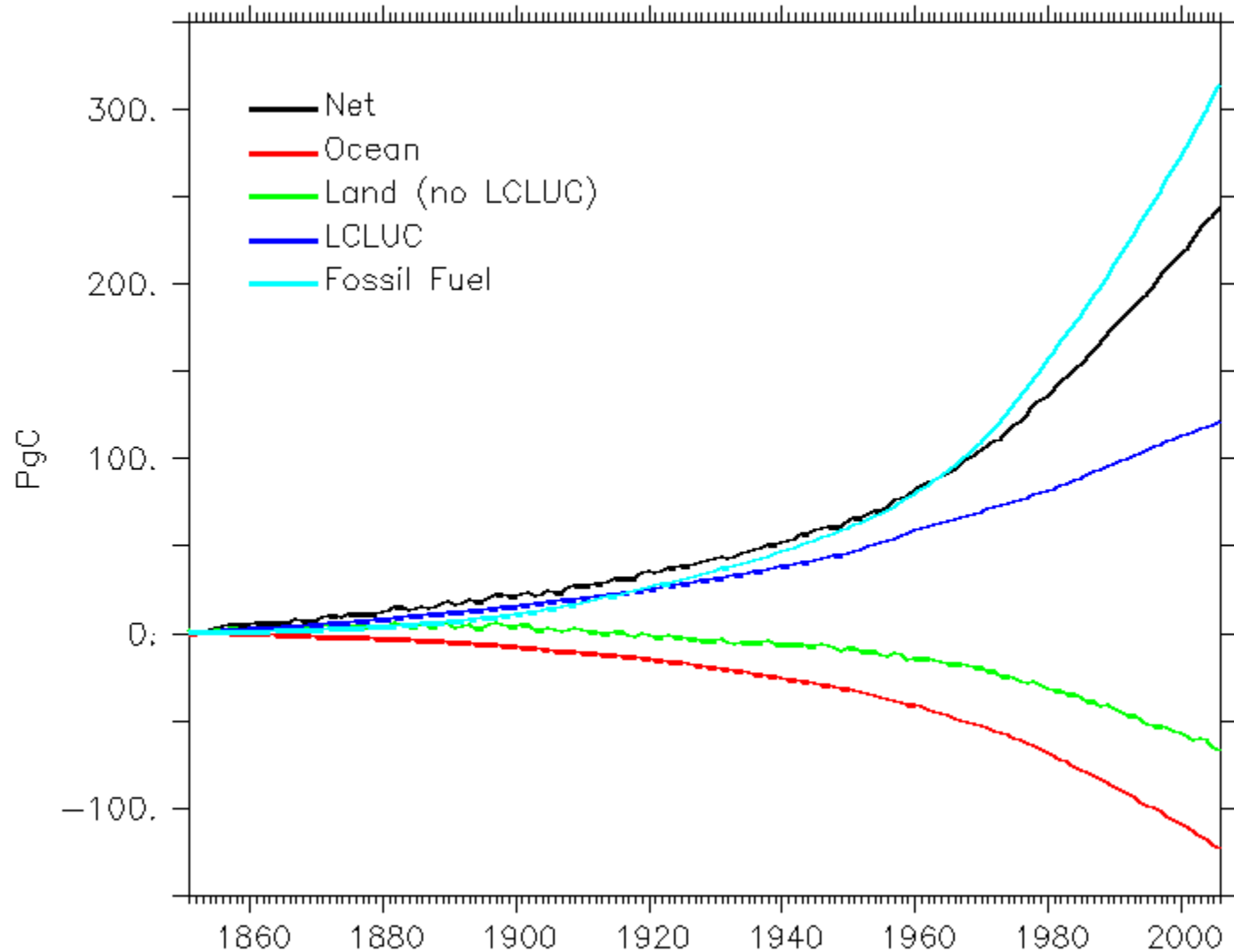
# Surface CO<sub>2</sub> in 20<sup>th</sup> Century Runs



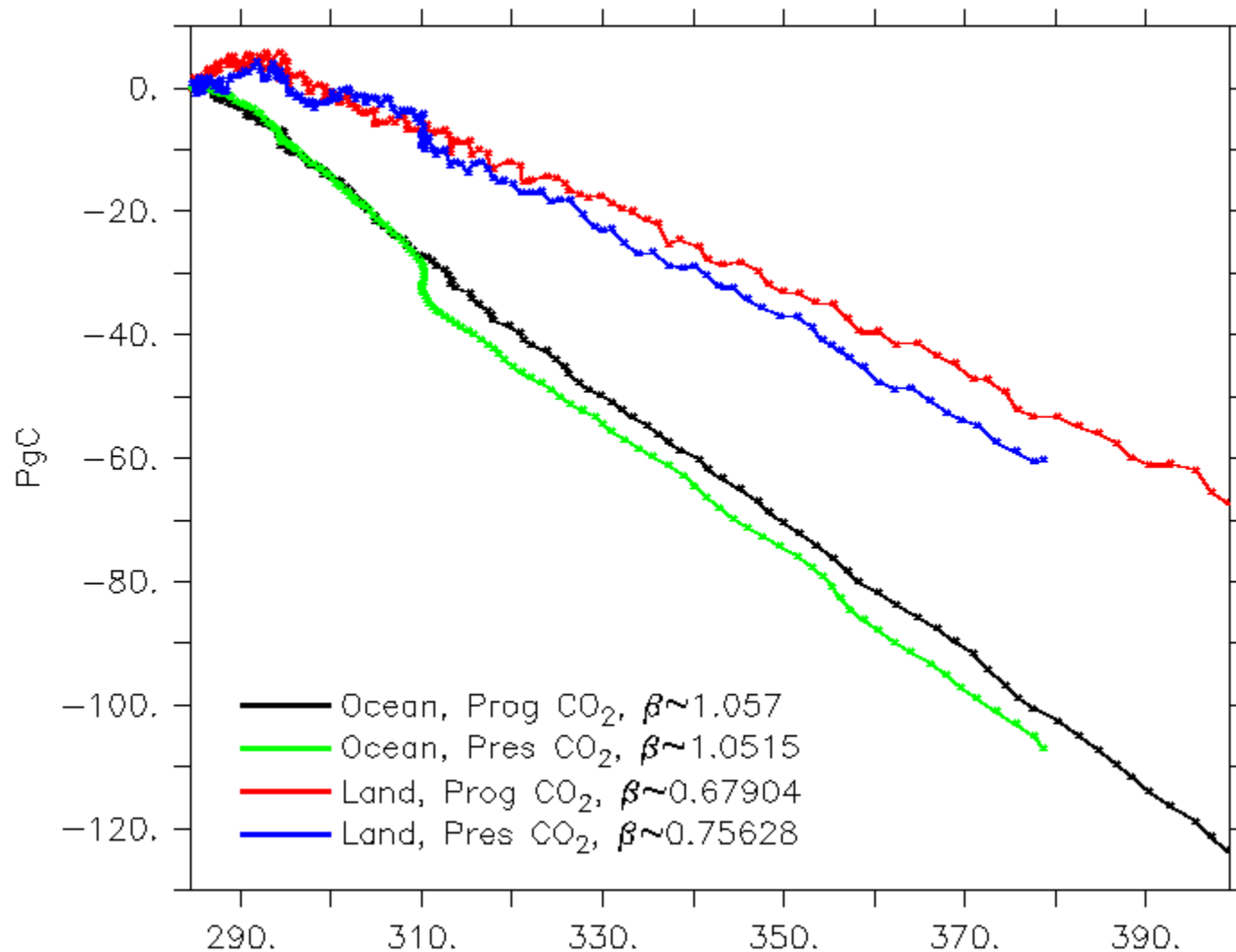
# CO<sub>2</sub> Surface Fluxes



# Cumulative CO<sub>2</sub> Surface Fluxes

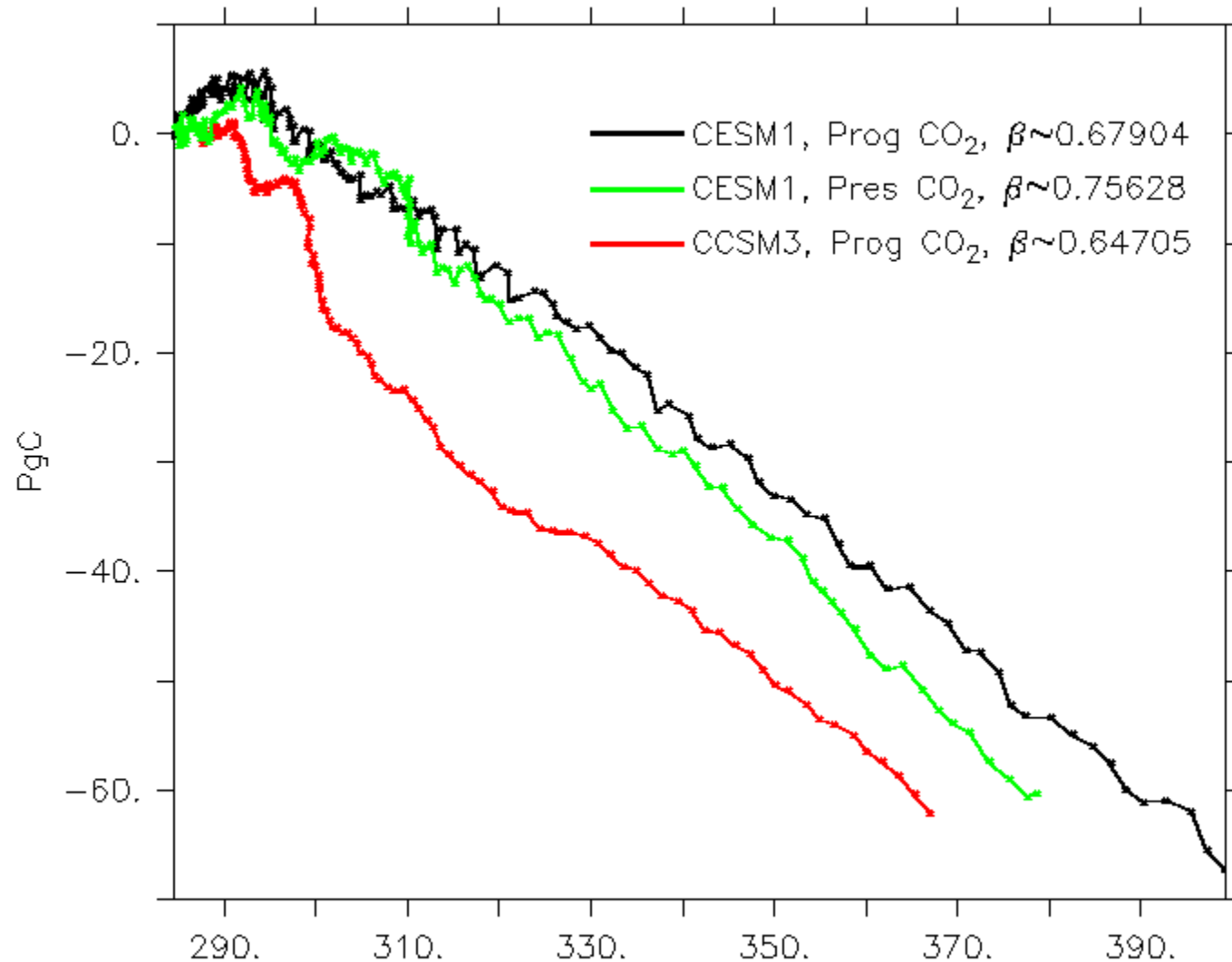


# Cumulative Uptake vs. Surface CO<sub>2</sub>

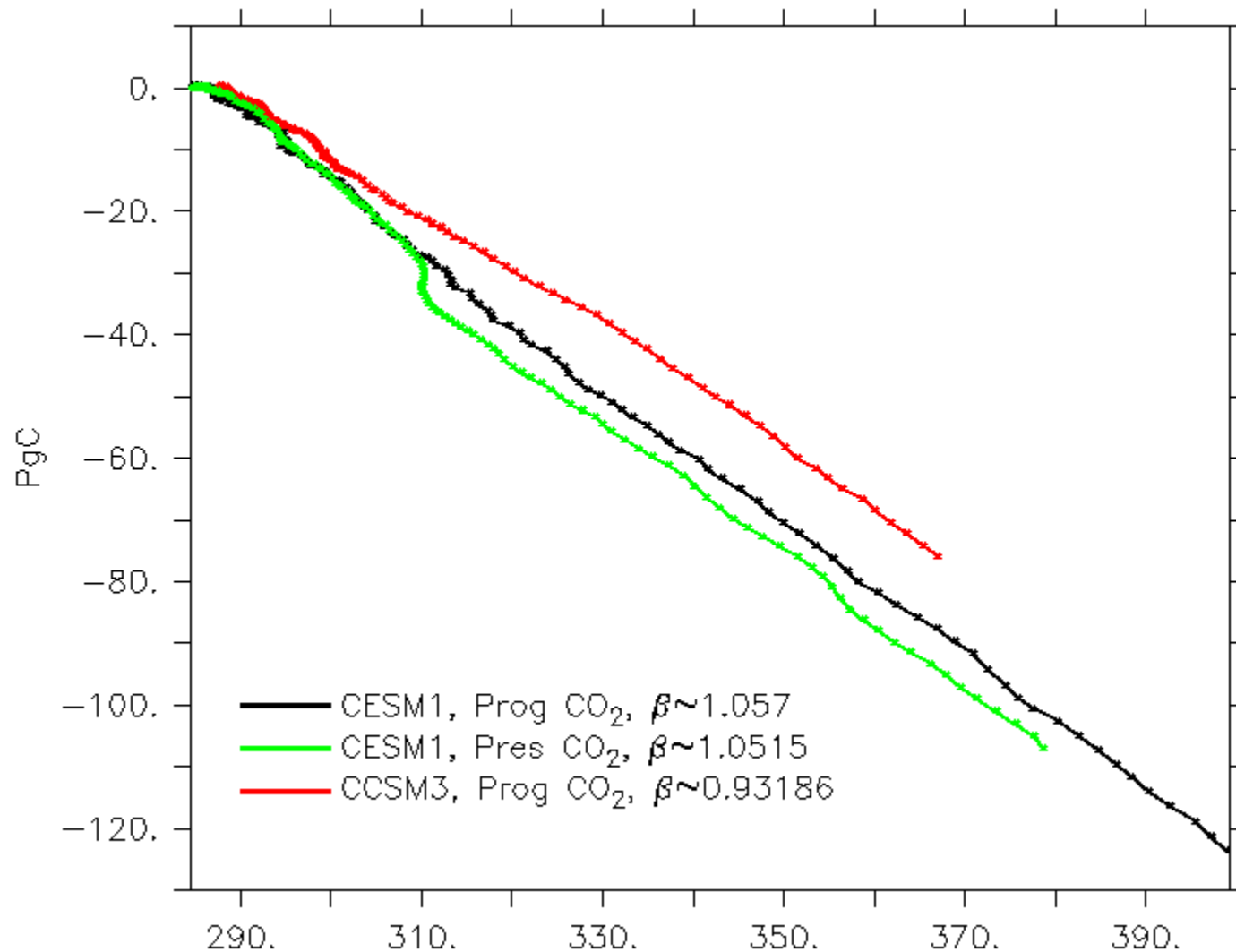




# Cumulative Land Uptake vs. Surface CO<sub>2</sub>

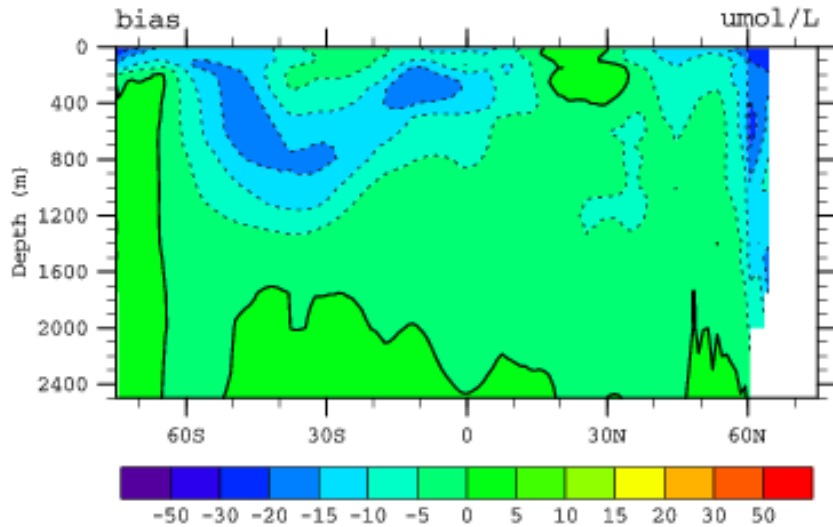


# Cumulative Ocean Uptake vs. Surface CO<sub>2</sub>



# Ocean Anthropogenic CO<sub>2</sub> & CFC11

## CCSM3 - GLODAP



## CESM1 - GLODAP

