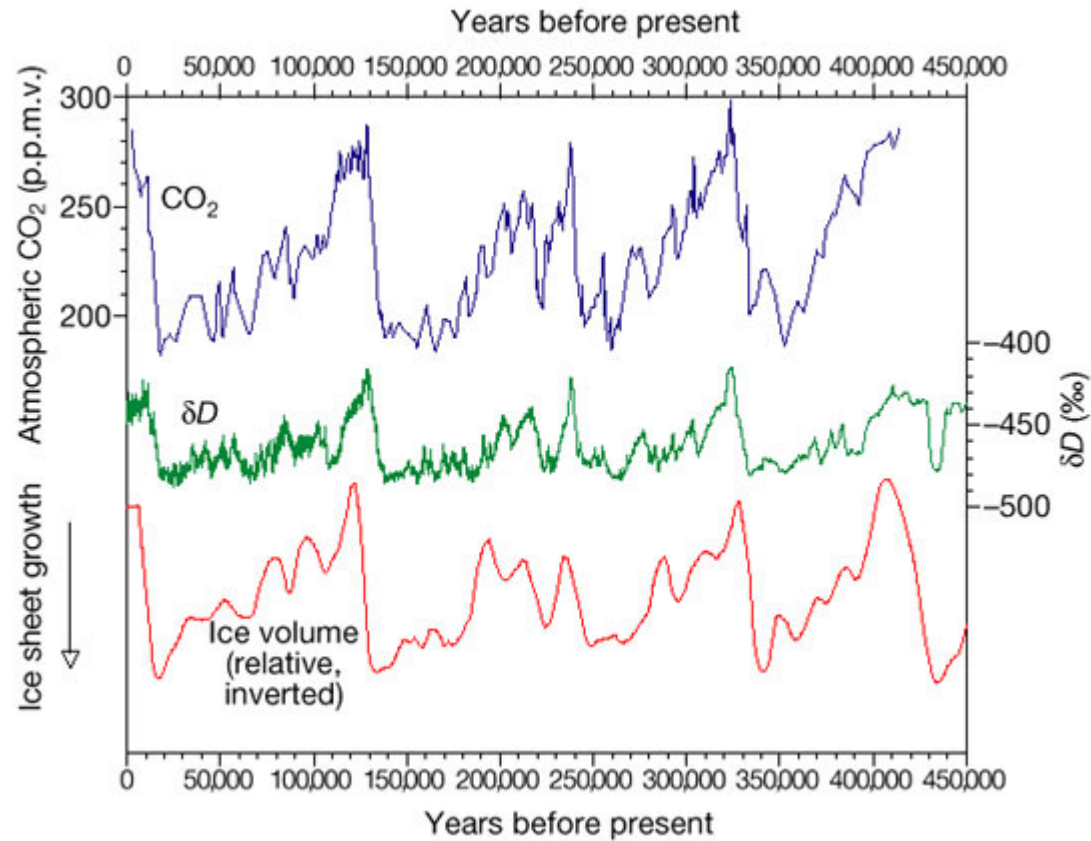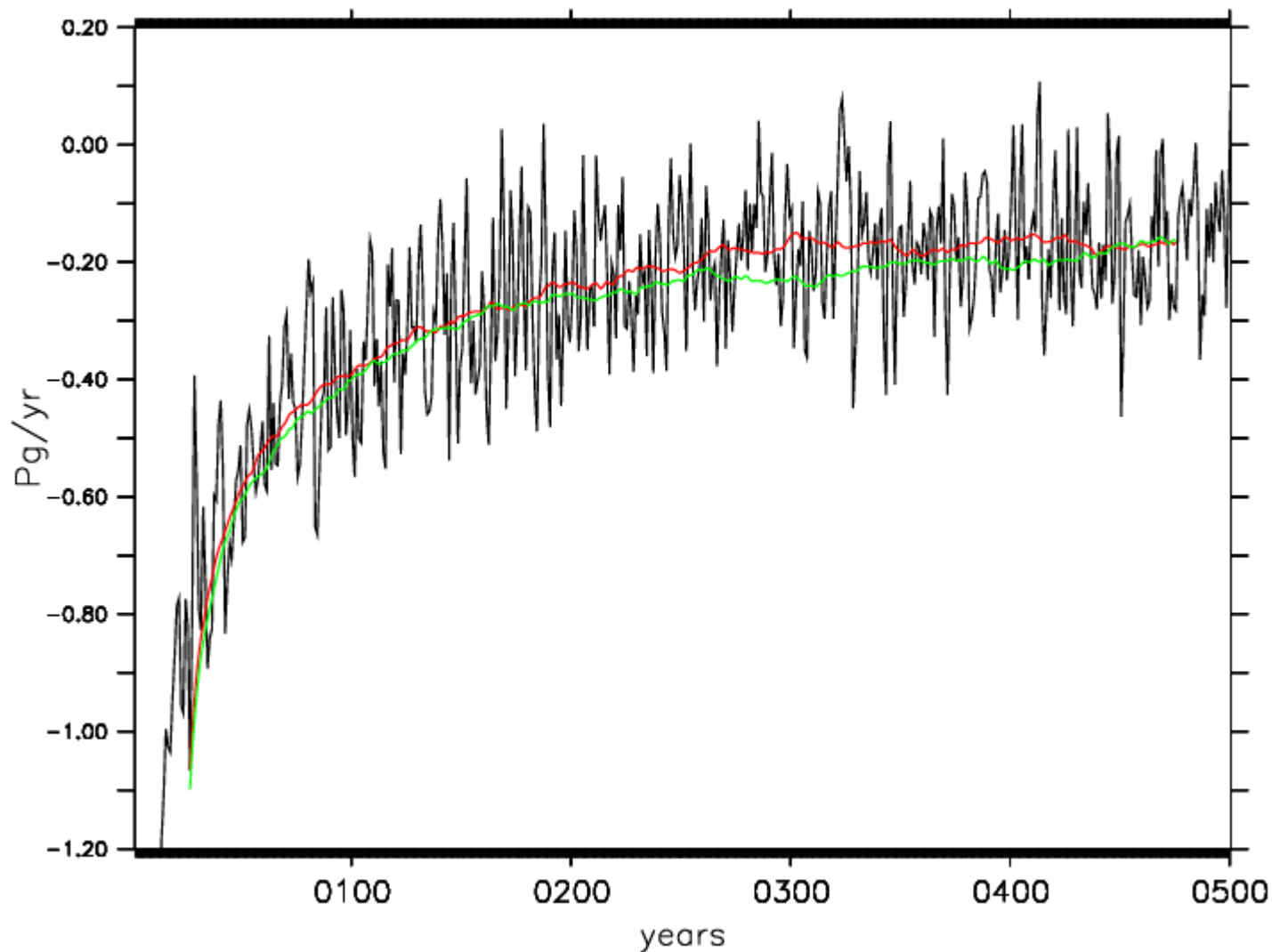# Carbon and Glacial Inception

Markus Jochum

with

Synte Peacock, Keith Lindsay, Keith Moore and Sam Levis
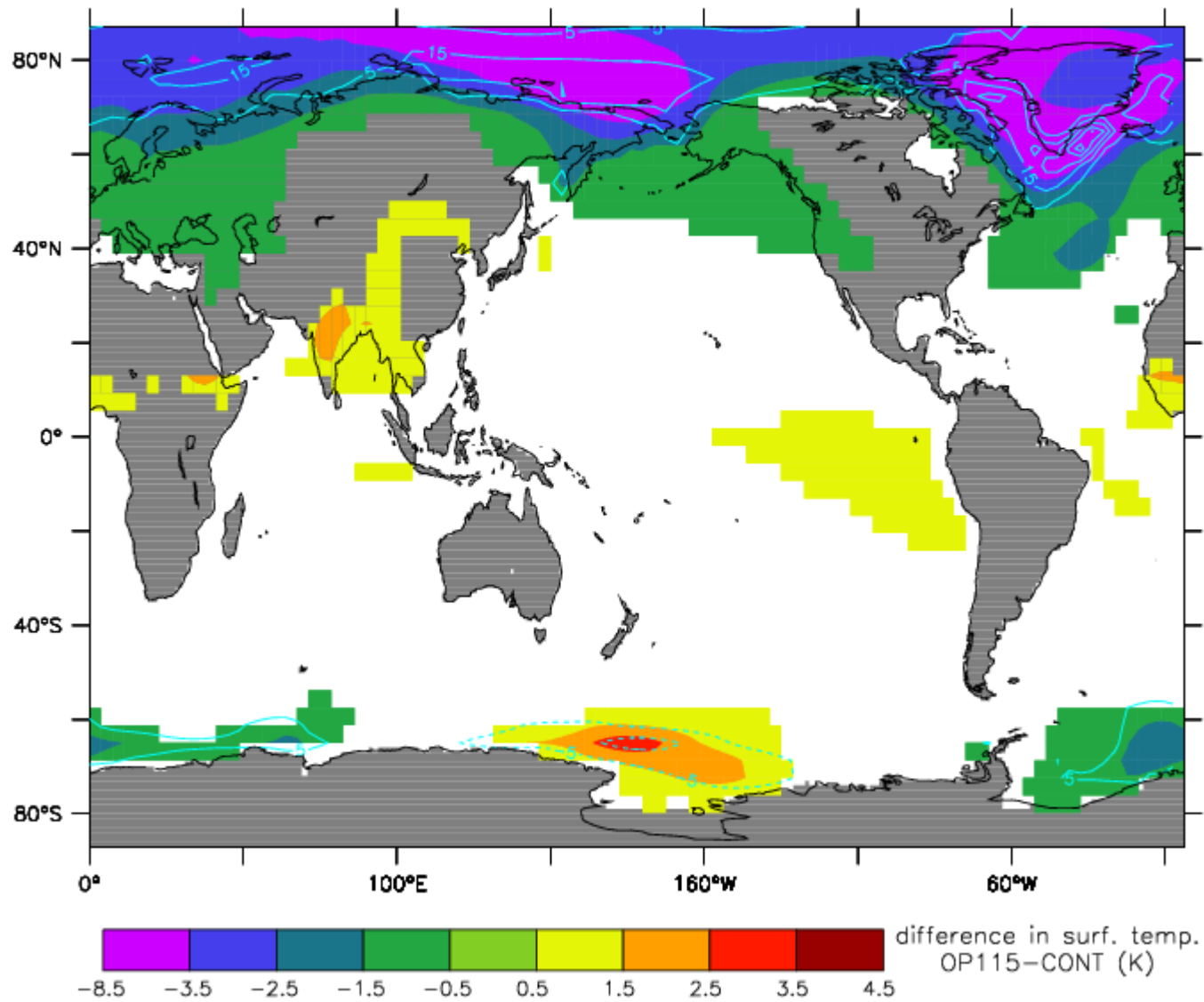
(NCAR)

Carbon dixoide and deuterium/hydrogen ratio from the Vostok
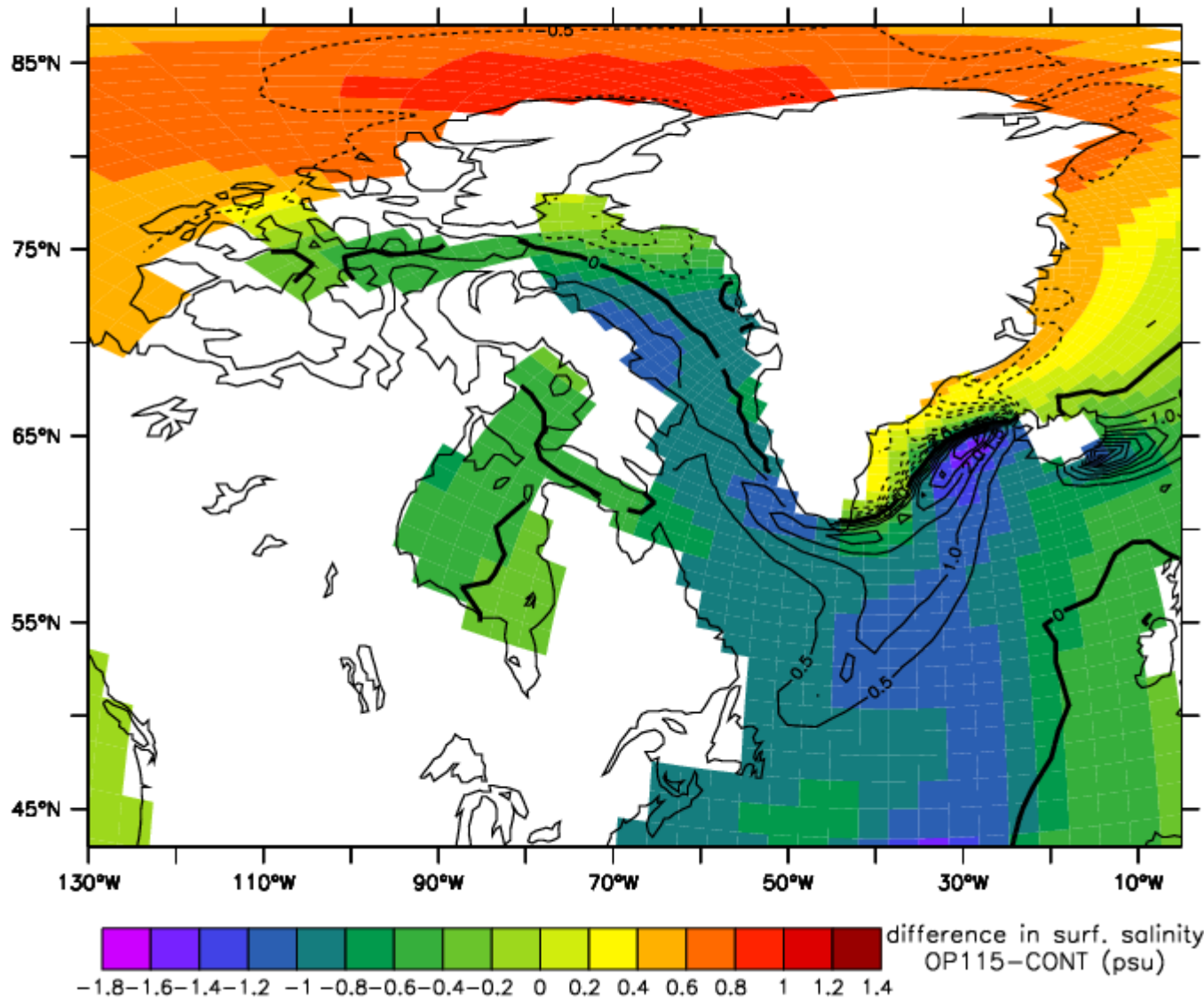ice core, and global ice volume from sediment cores
(Sigman and Boyle 2000)

Global air-sea carbon fluxes (negative = outgassing)
Black: CONT, Red: CONT (smoothed), Green OP115

Difference in surface air temperature (OP115-CONT)

Difference in SSS (shades) and meltwater flux (in m/yr)
OP115-CONT

Quantifying Carbon Fluxes

| Latitudes	Observations	CONT	OP115	IRONCONT
49N-90N	0.1	0.387 ± 0.001	0.390 ± 0.001	0.377 ± 0.001
18N-49N	0.5	0.404 ± 0.002	0.375 ± 0.002	0.367 ± 0.002
18S-18N	- 0.7	$- 0.847 \pm 0.007$	$- 0.860 \pm 0.007$	$- 0.95 \pm 0.009$
44S-18S	0.6	0.320 ± 0.002	0.324 ± 0.002	0.257 ± 0.002
90S-44S	- 0.4	$- 0.432 \pm 0.004$	$- 0.424 \pm 0.004$	$- 0.422 \pm 0.004$
90S-90N	0.0	$- 0.168 \pm 0.008$	$- 0.194 \pm 0.008$	$- 0.366 \pm 0.009$
Export Production	5 - 15	8.9	8.5	10.0
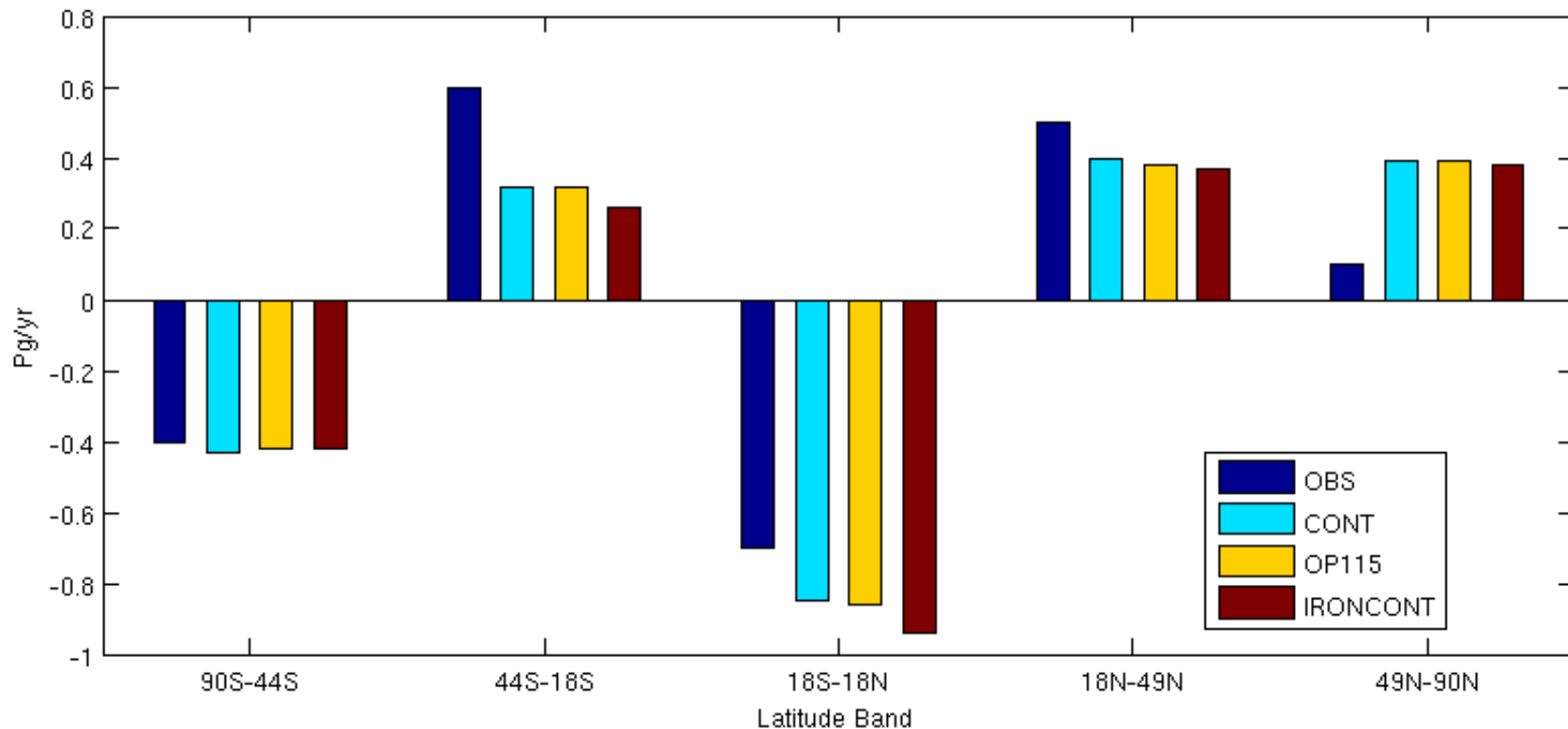
Air sea carbon fluxes integrated over latitude bands (after Gruber et al. 2009)
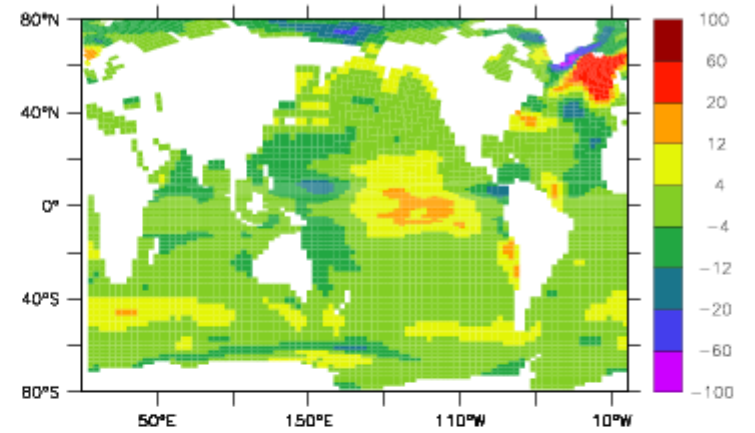
CONT

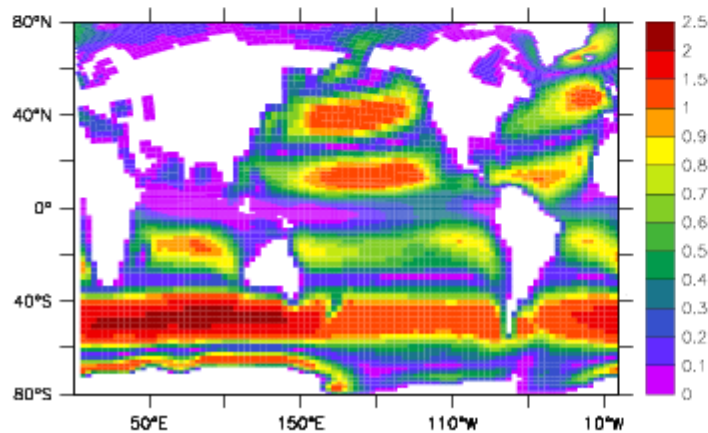# OP115-CONT

carbon fluxes
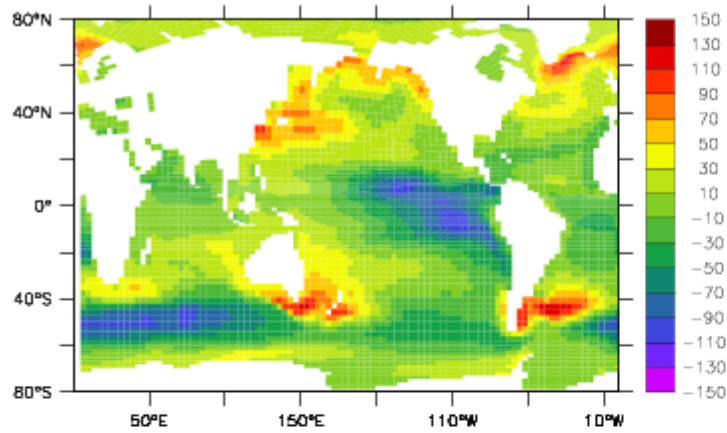
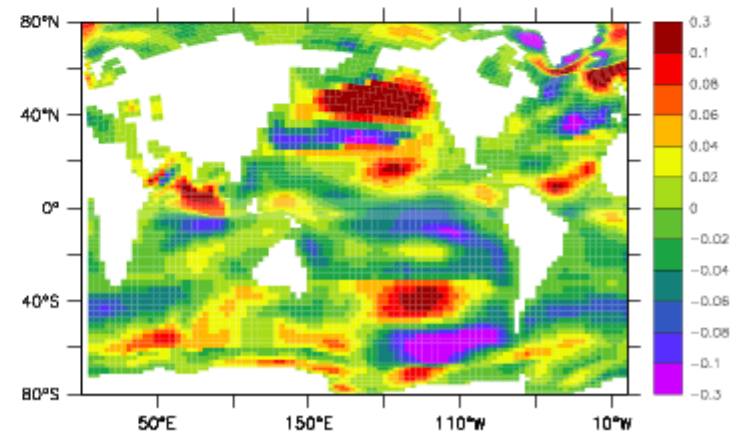
a) air-sea carbon fluxes CONT (nmol/m²/s)

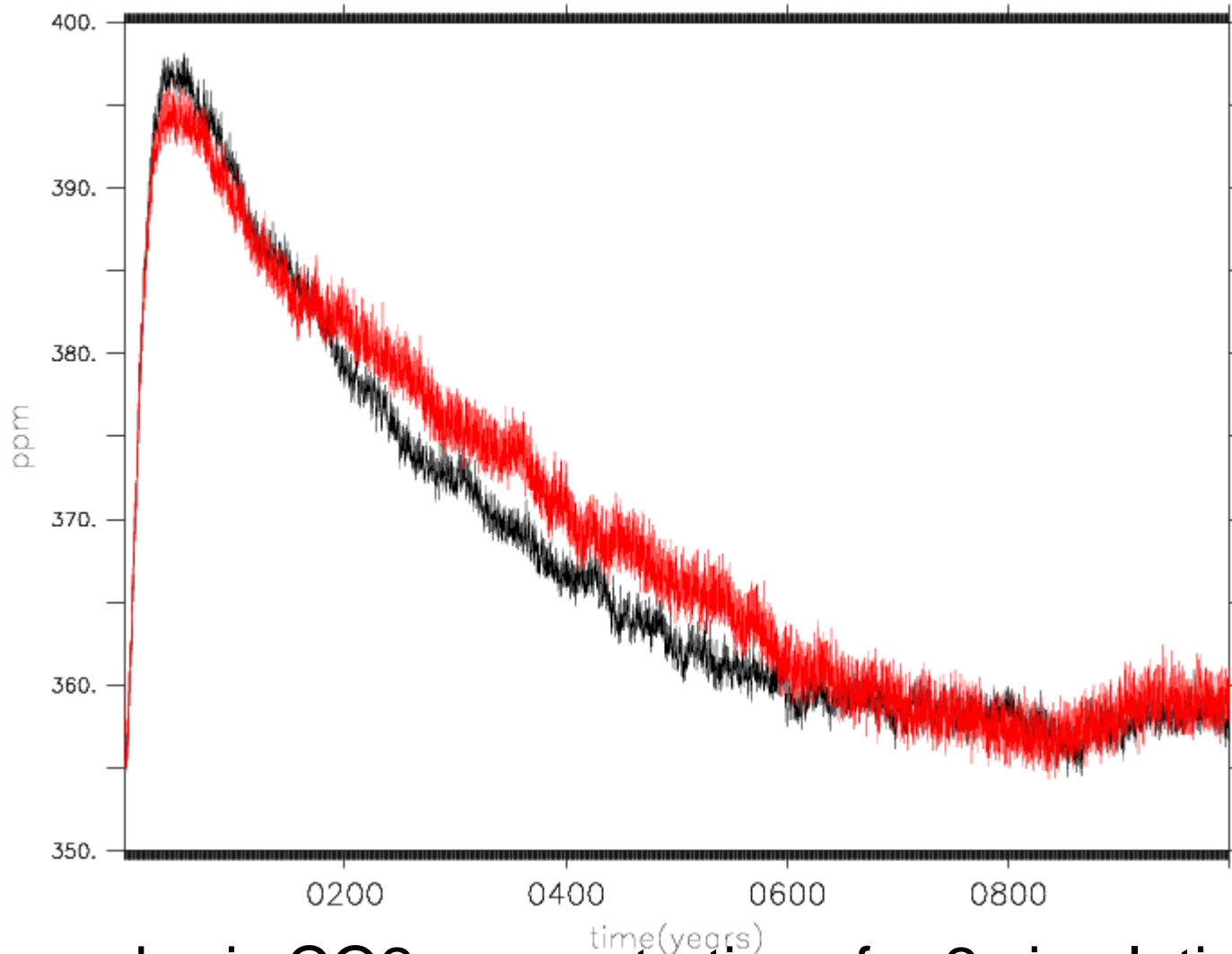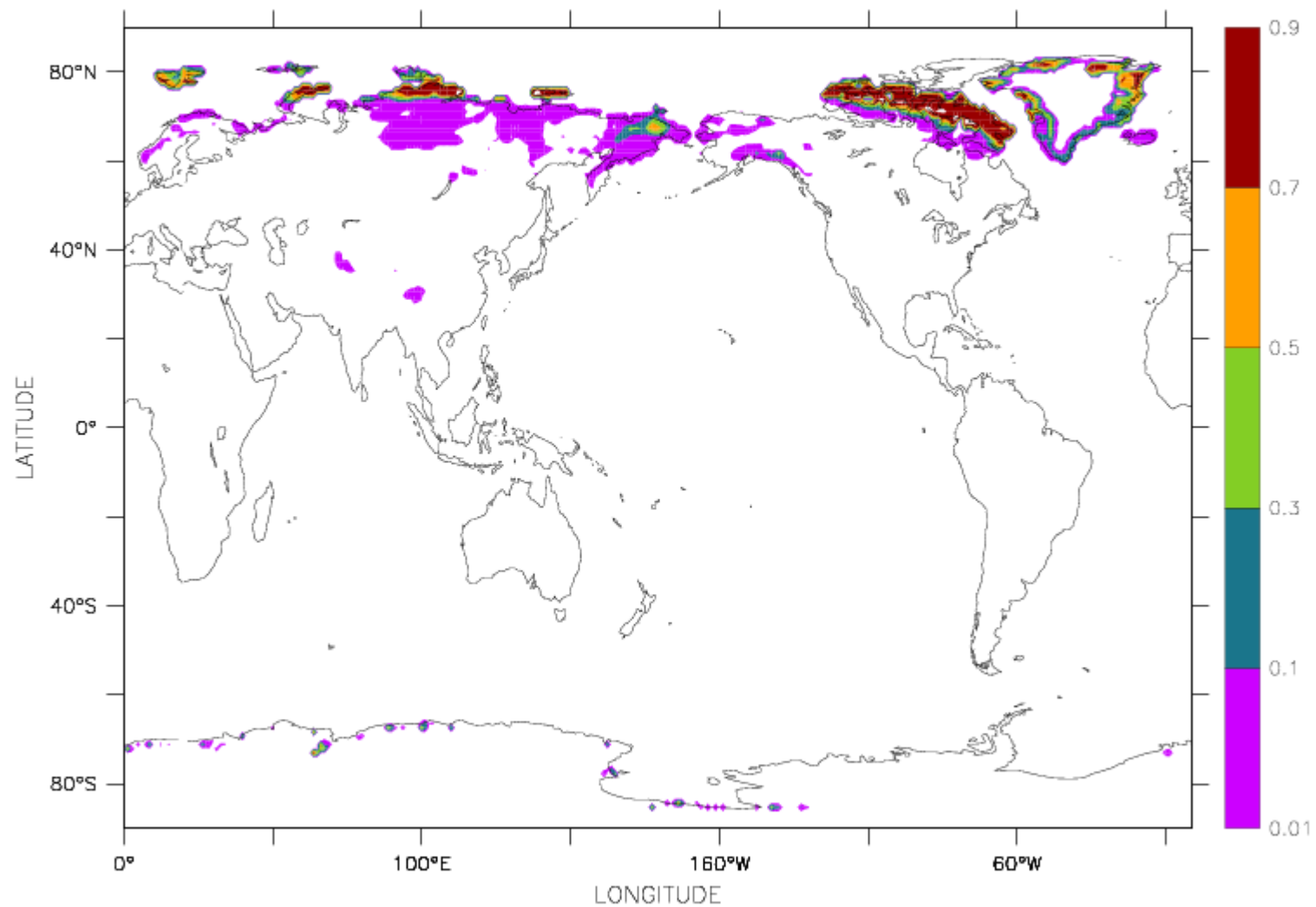b) air-sea carbon fluxes OP115-CONT (nmol/m²/s)

wind stress

c) surface wind stress CONT (dyne/cm²)

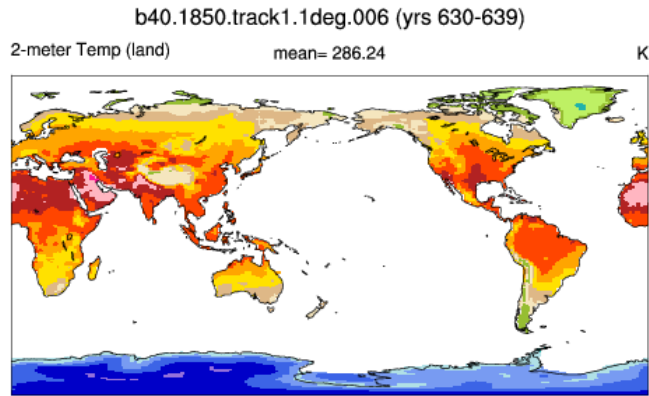d) surface wind stress OP115-CONT (dyne/cm²)

Atmospheric CO2 concentrations for 2 simulations with freely evolving atmospheric CO2 equivalent to CONT (black) and OP115 (red)
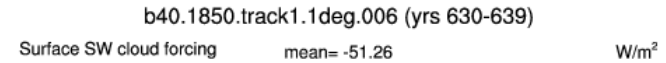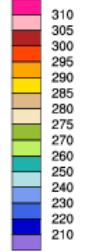
Difference in annual mean snow depth (in meters) between OP115 and CONT.
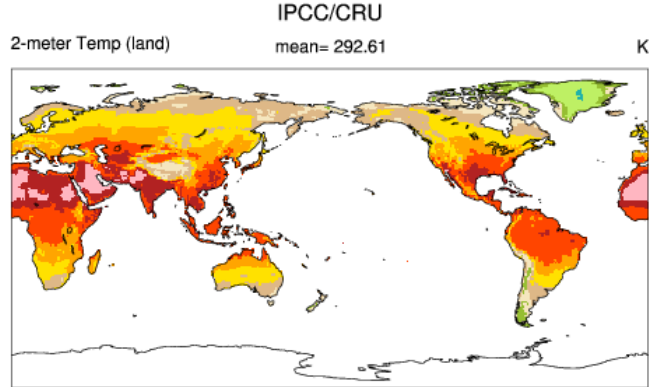
CCSM4 Summer Biases
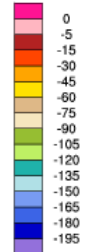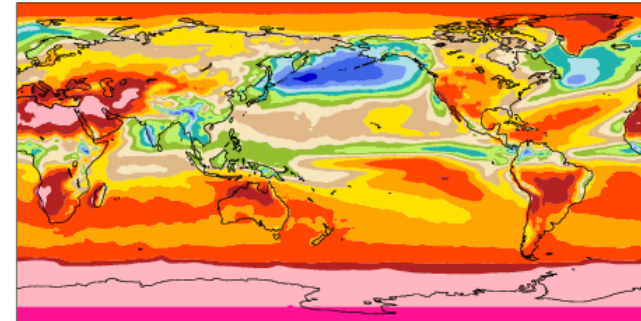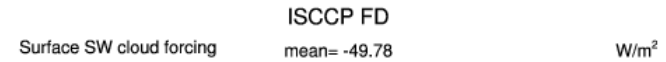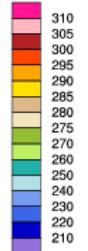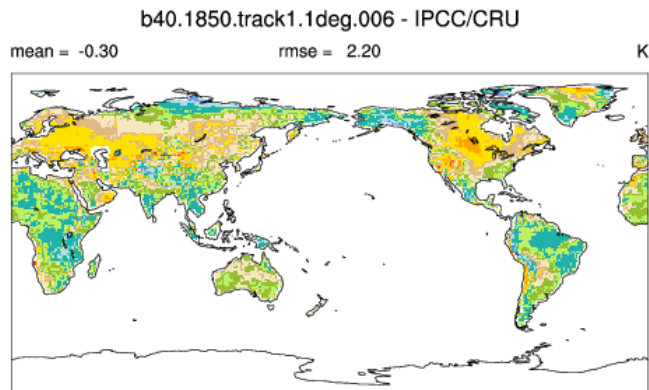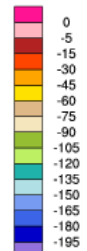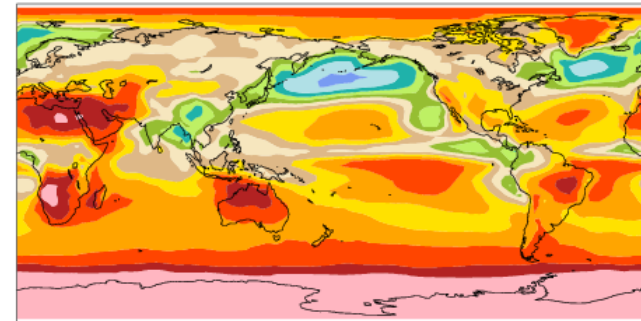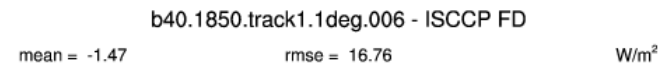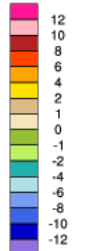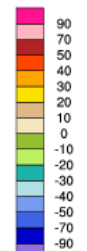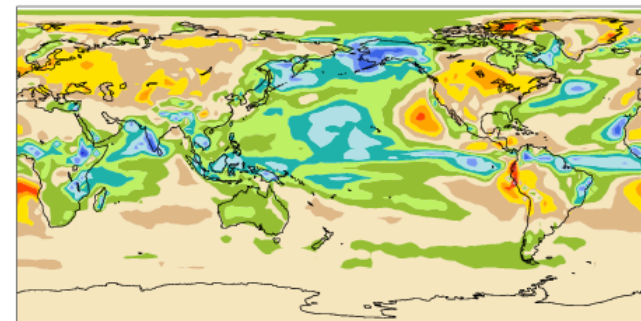
Surface Temperature

Short Wave Cloud Forcing

Conclusions

- CCSM results suggest that Milankowitch was right, and that the seaice – MOC feedback is a crucial part of the feedback
- The glacial-interglacial CO_2 variations cannot be explained by the solubility pump
- Further work has to identify the missing process
- Northern high-latitude cloud biases have to be fixed before ice-sheet modelling can begin