Southern Hemisphere Winds and the Carbon Cycle

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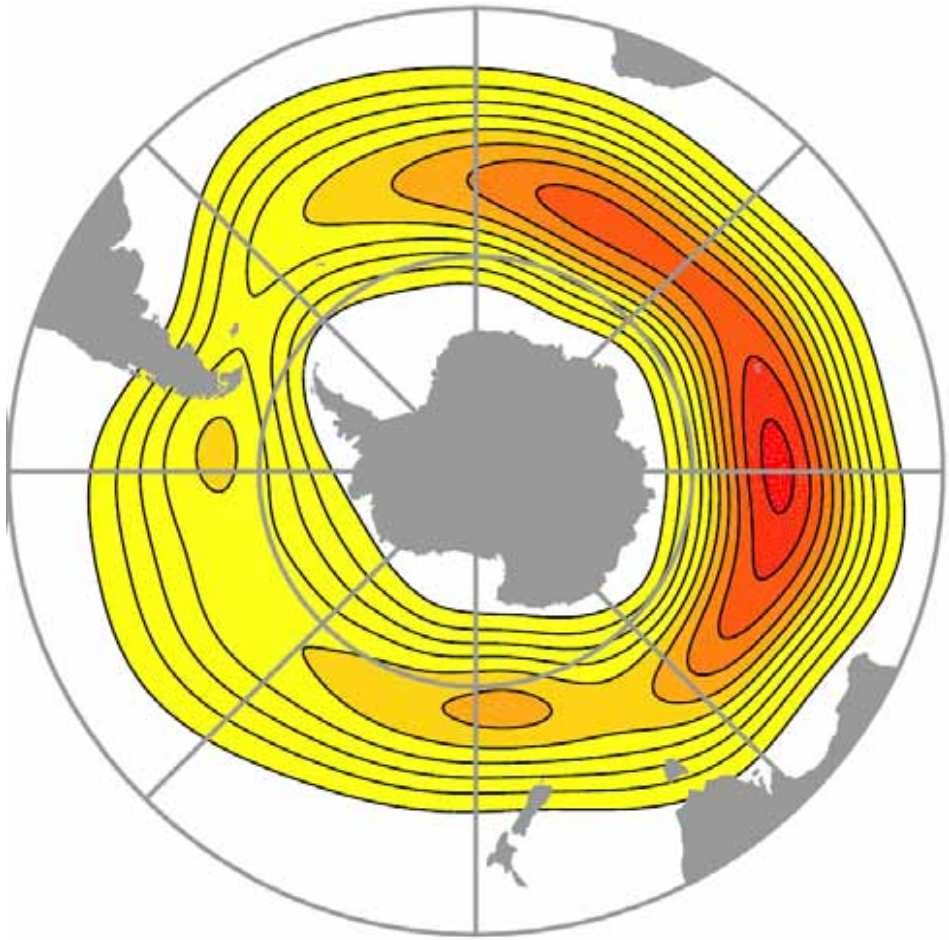
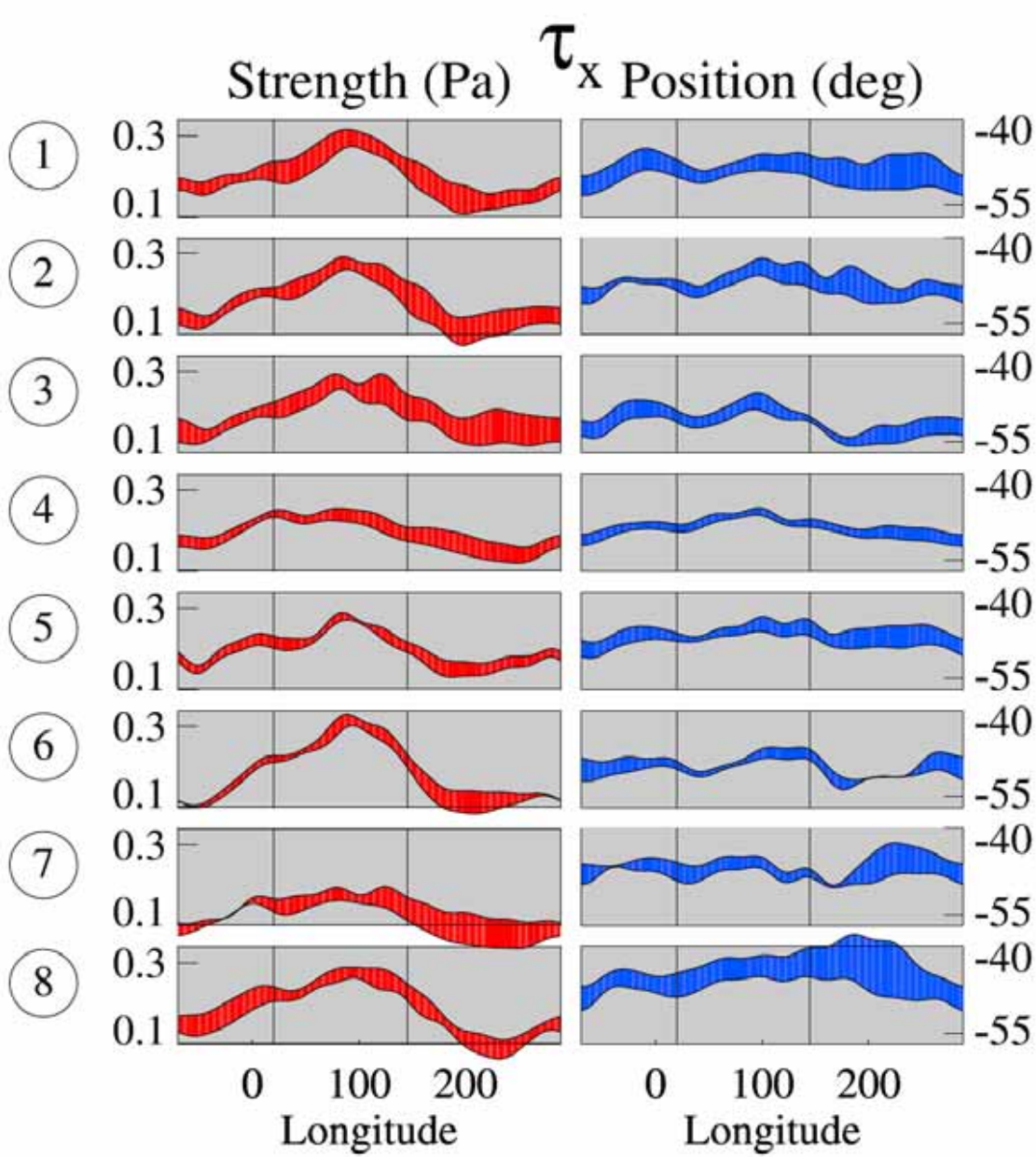
Canada

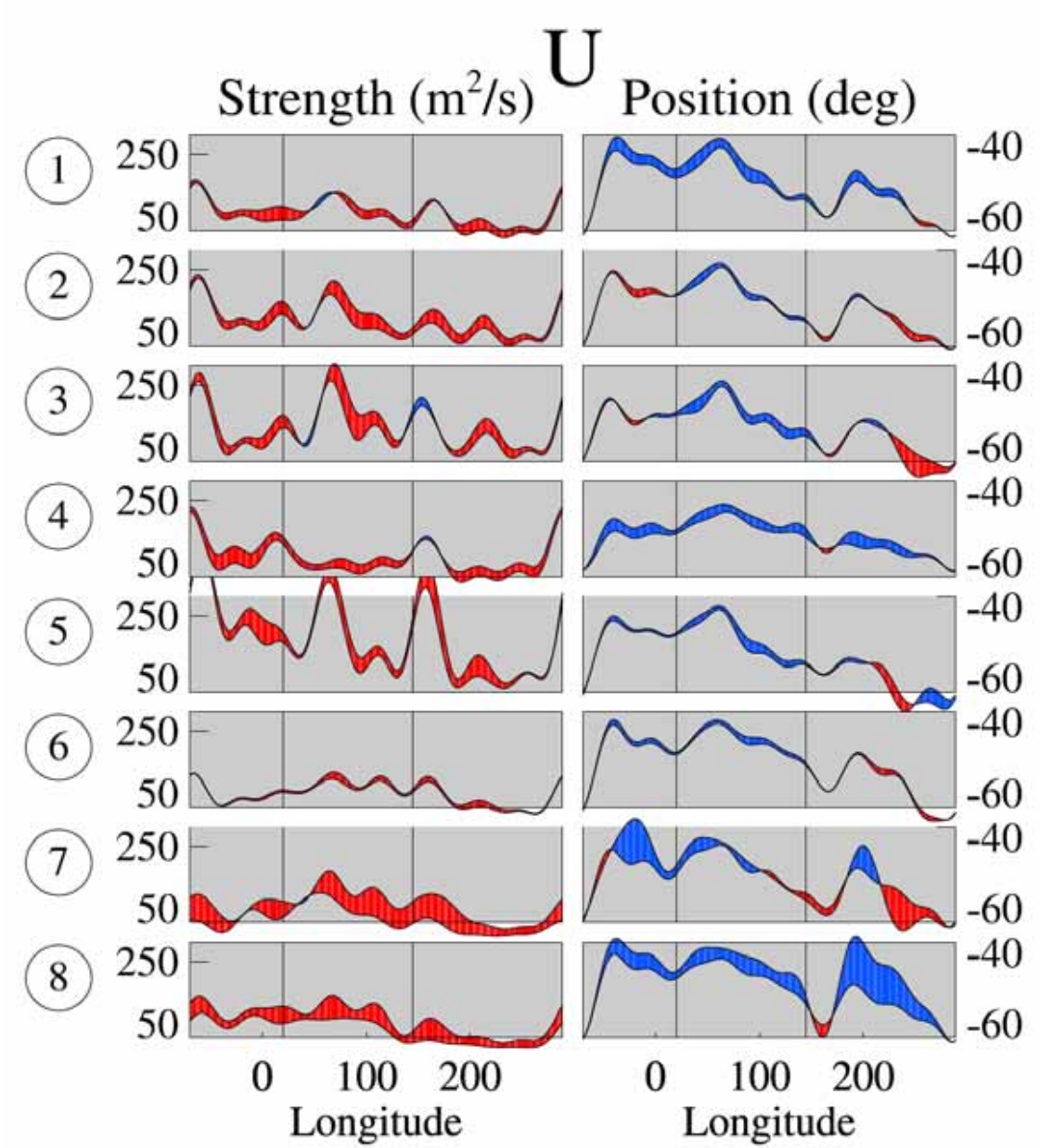
Zonal Wind Stress



Fyfe & Saenko, 2006

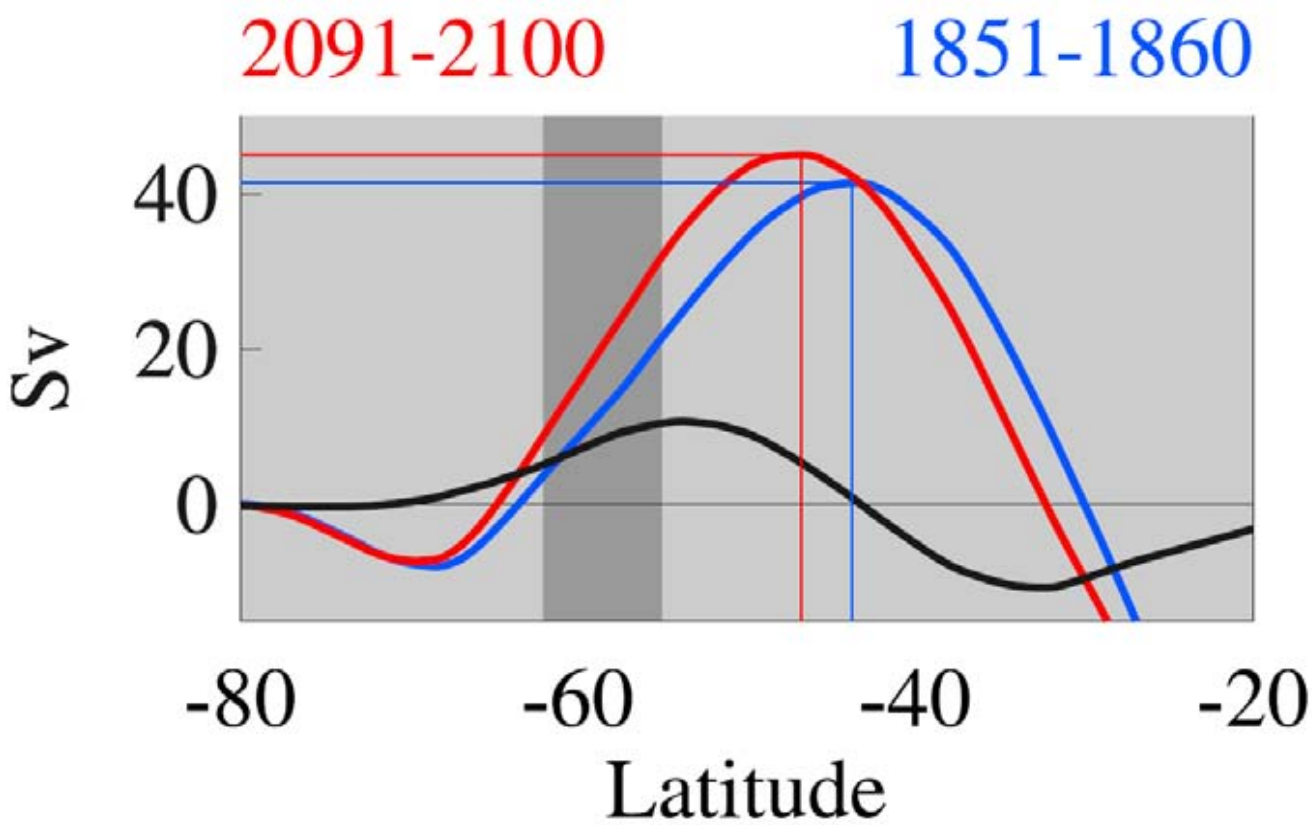


Fyfe & Saenko, 2006

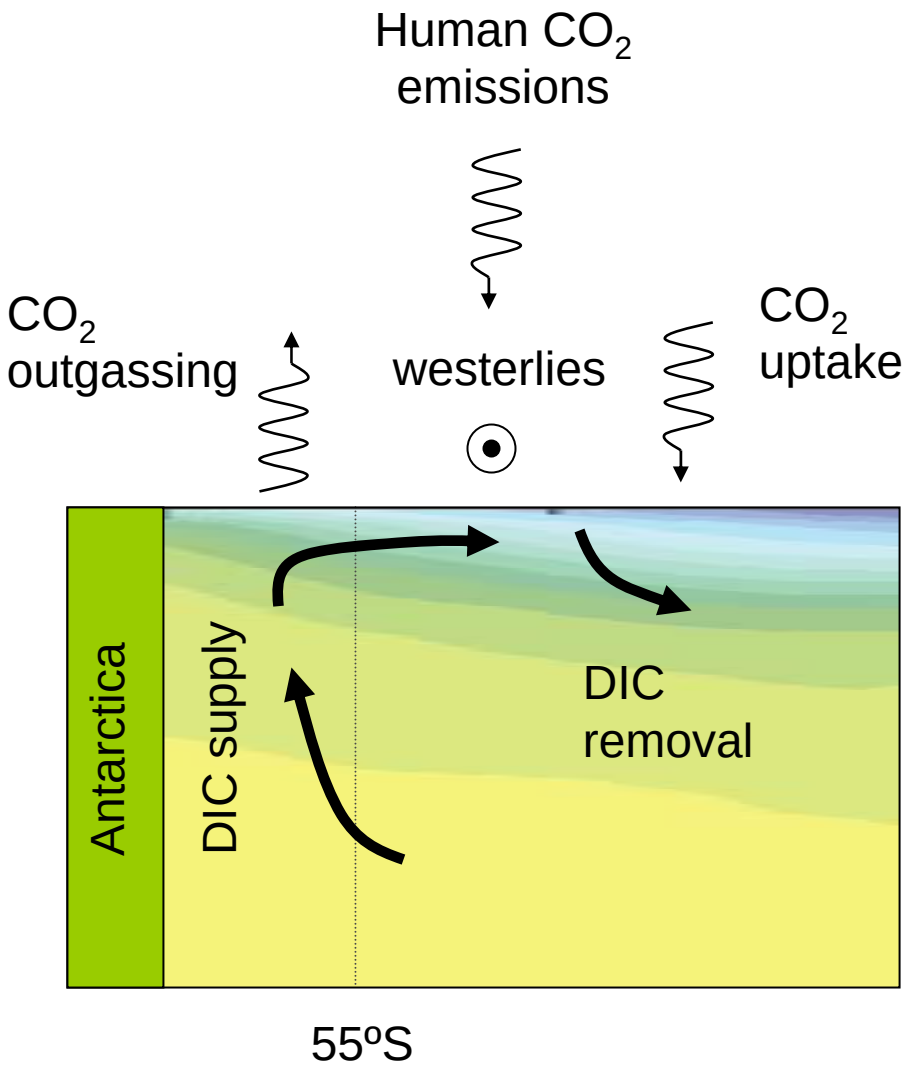


Fyfe & Saenko, 2006

Ekman Transport



Fyfe & Saenko, 2006


Human CO_2 emissions
CO_2 outgassing
westerlies
CO_2 uptake
Antarctica
DIC supply
DIC removal
55ºS

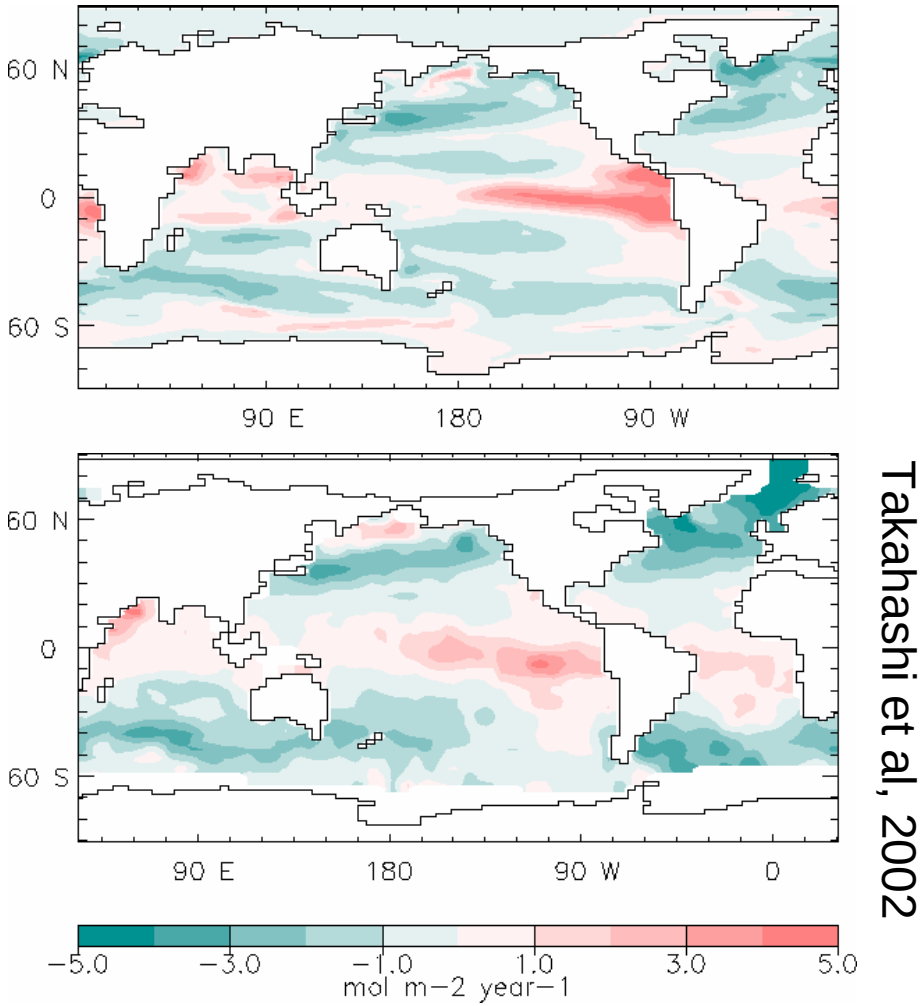
UVic ESCM

- MOSES land-surface scheme
- TRIFFID dynamic vegetation model
- OCMIP-type ocean inorganic carbon
- NPZD ocean biology model
- Marine sediment model

Sea to air CO_2 flux

Simulated

Observed



Takahashi et al, 2002

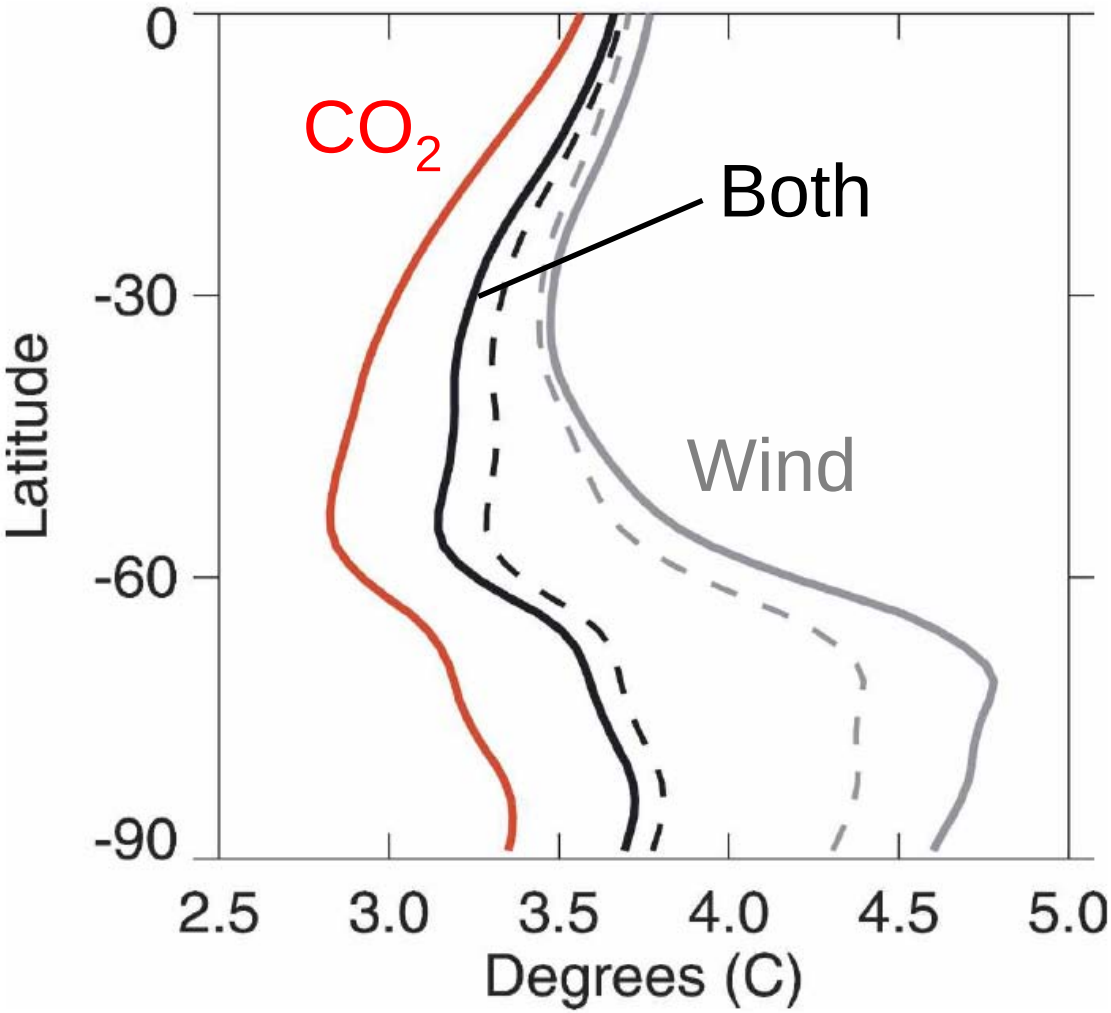
Model Simulations

Control	CO_2	wind
CO_2	$CO_2 + \Delta CO_2$	wind
Wind	CO_2	wind + Δwind
Both	$CO_2 + \Delta CO_2$	wind + Δwind

Natural

Total

Surface temperature change to 2100

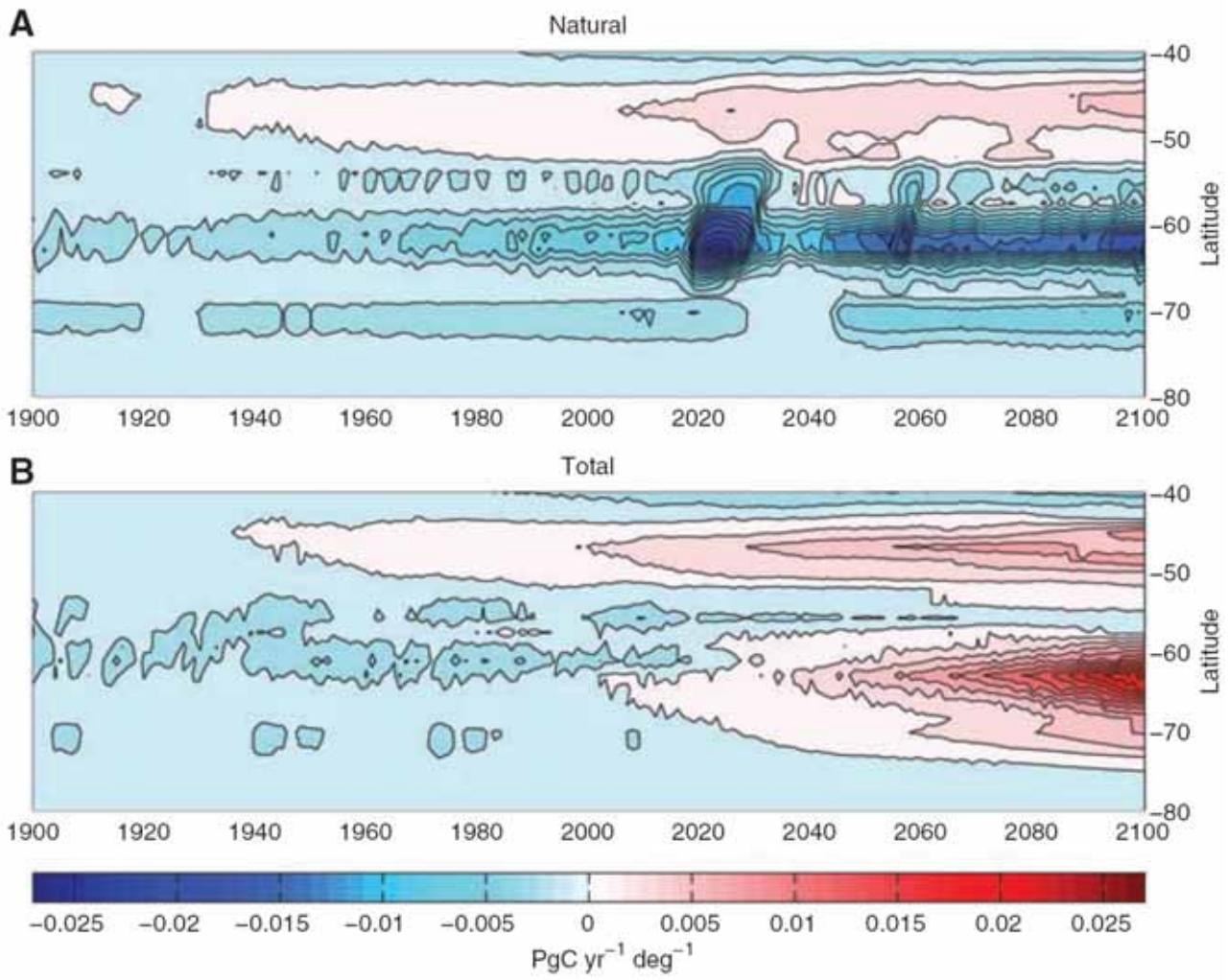


Fyfe et al, 2007

Air to sea CO_2 flux

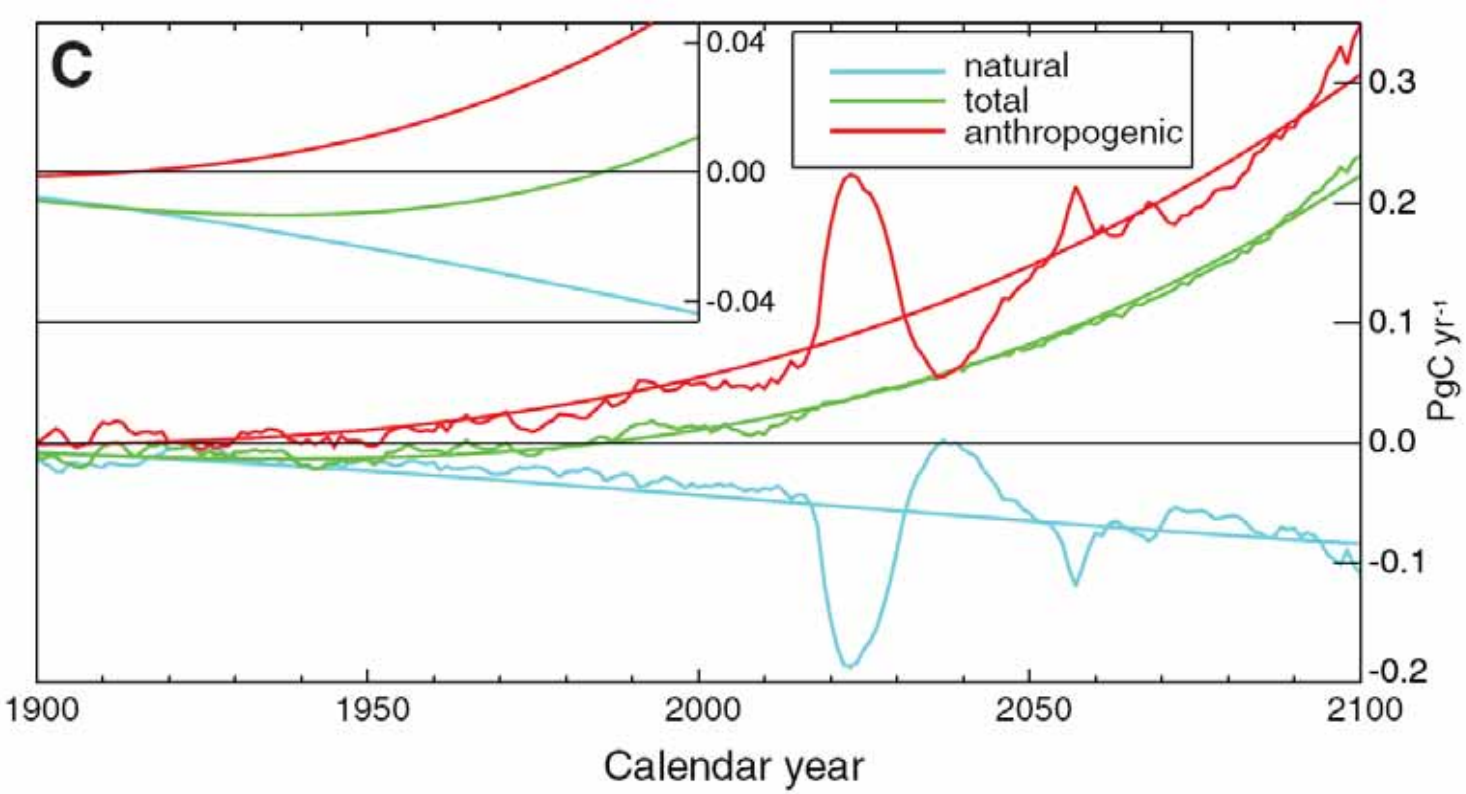
Natural

Total

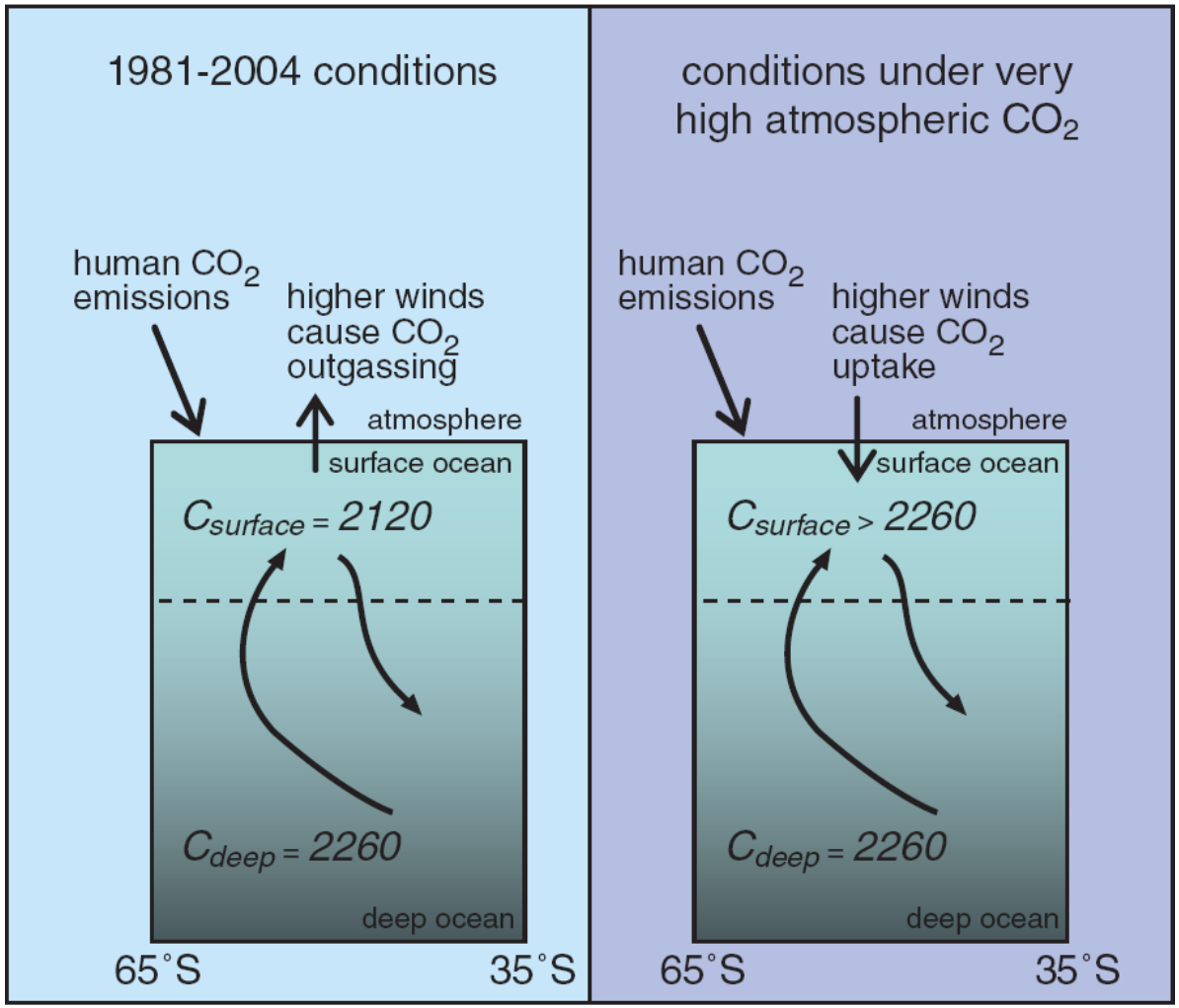


Zickfeld et al, 2008

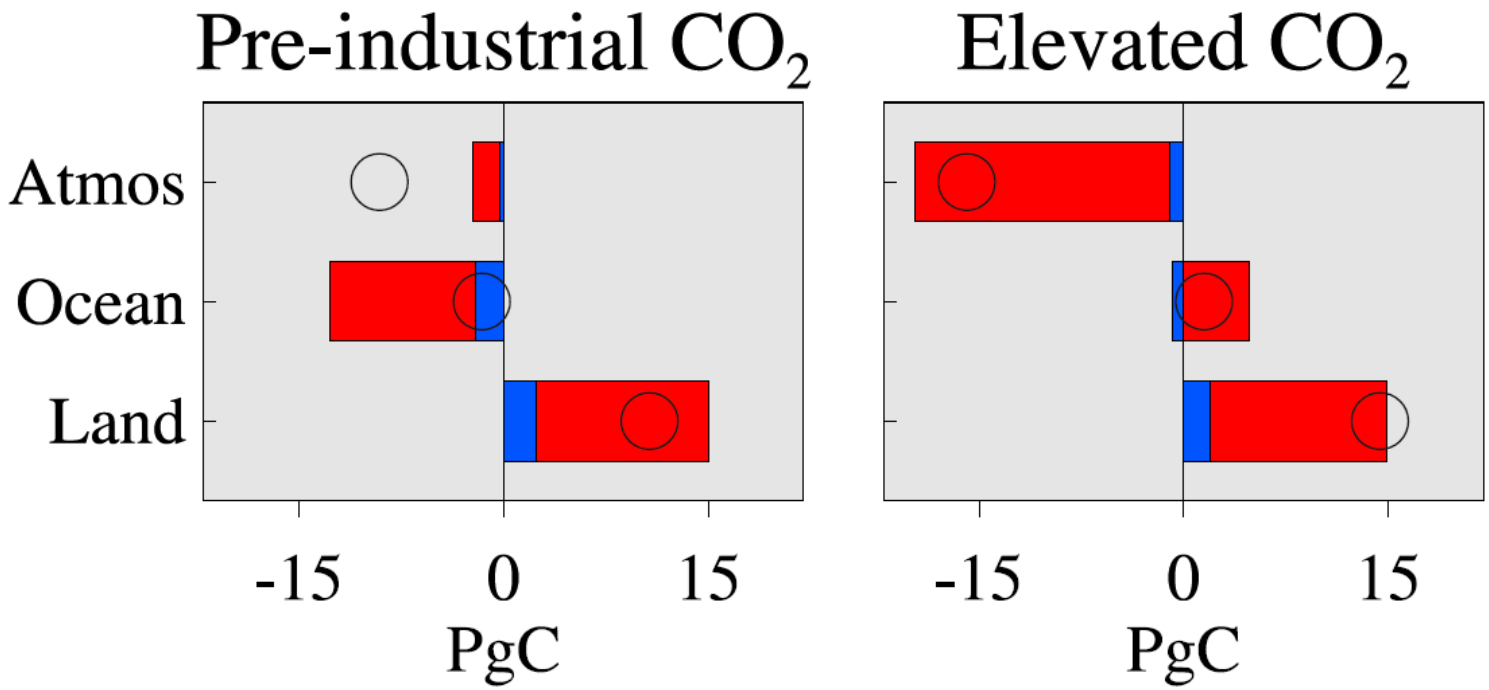
Air to sea CO_2 flux averaged from 40ºS to 90ºS



Zickfeld et al, 2008



Le Quére et al, 2008



◯ = Mesoscale eddies

Zickfeld et al, 2007

Conclusions

- Winds provide a small negative feedback on future atmospheric CO_2
- The small negative feedback reflects an increase in oceanic and terrestrial uptake