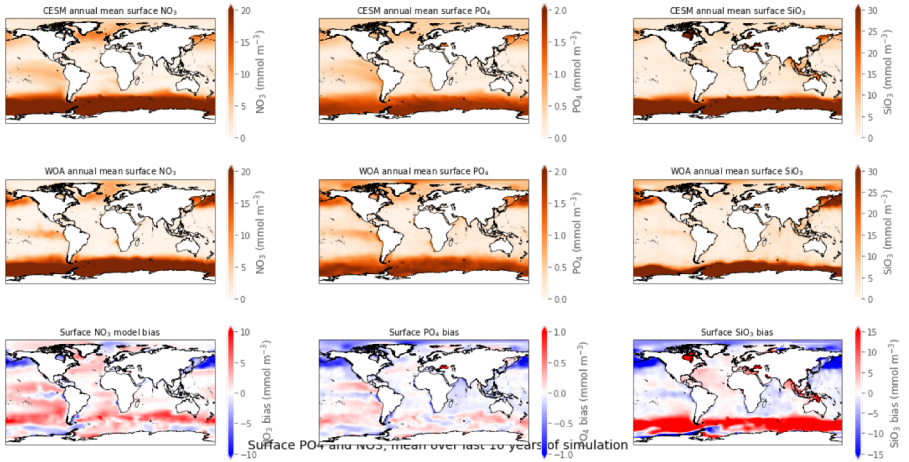
Tuning BGC in CESM 2.2

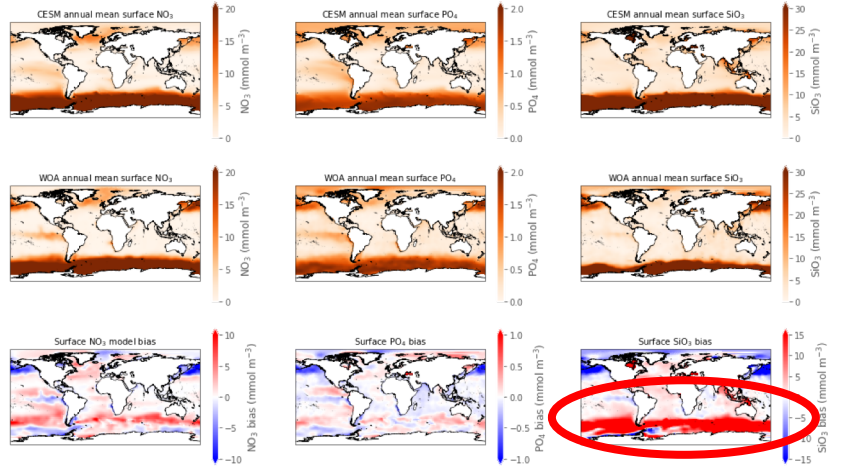
Surface nutrient distributions

Surface PO4 and NO3, mean over last 10 years of simulation

Run 1

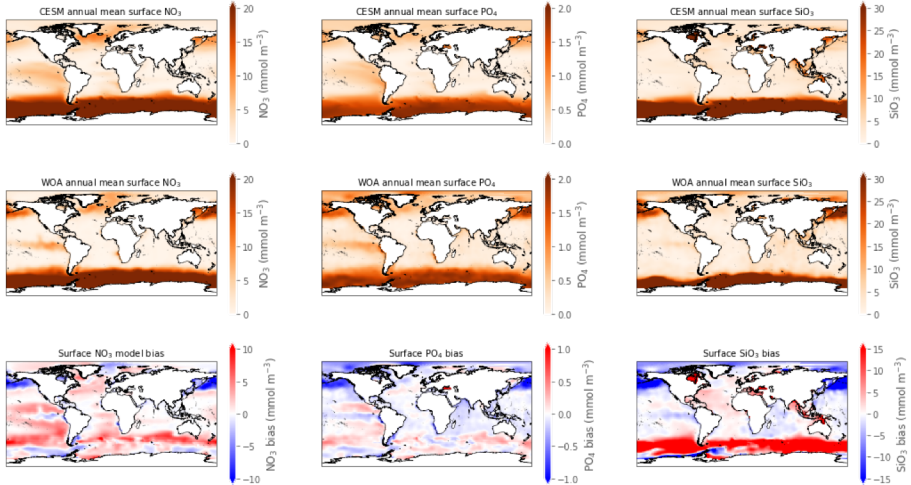


OMIP-CESM2

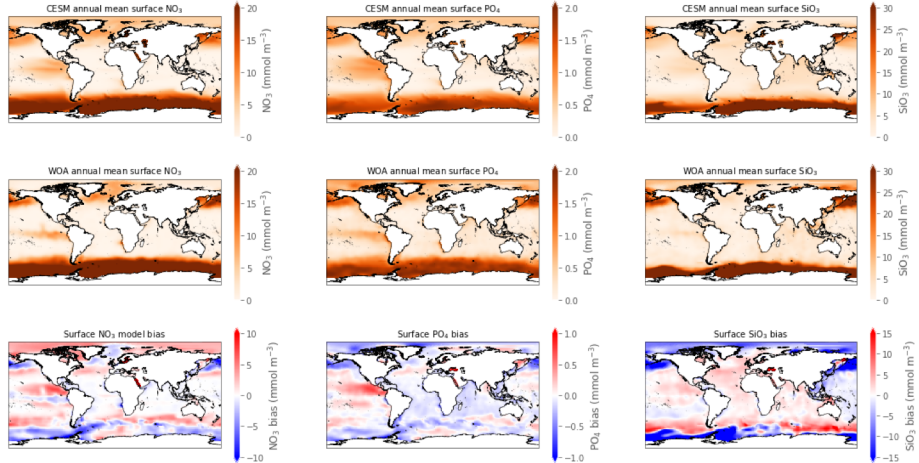


Surface PO4 and NO3, mean over last 10 years of simulation

Run 2



OMIP-CESM1



Overview (all runs are 2 JRA IAF cycles)

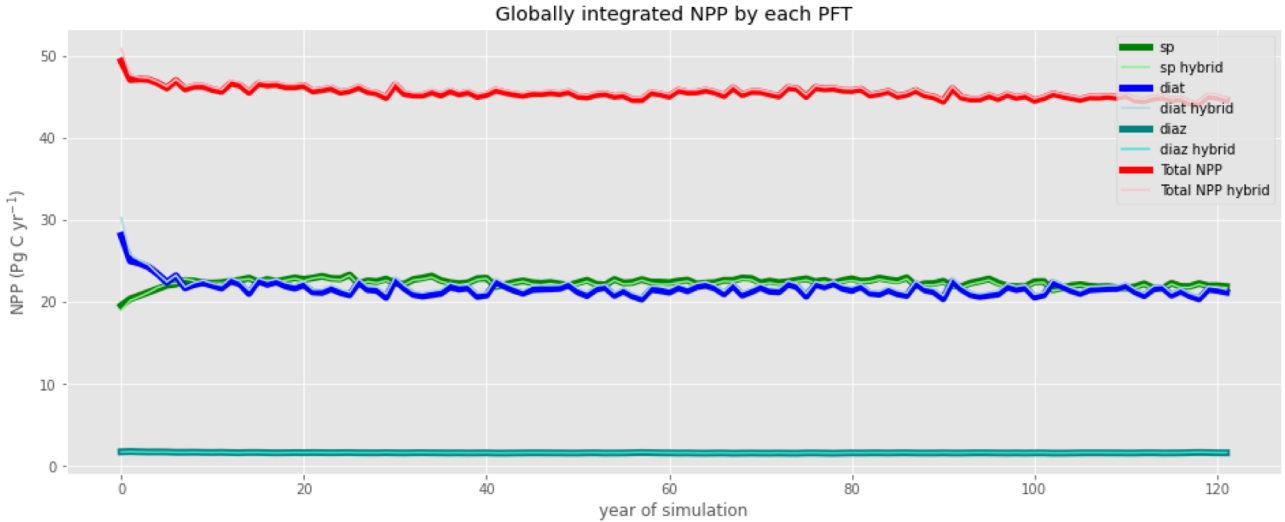
- 001 : CESM startup (best guess tuning parameters from last fall)
- 002 : hybrid (physics from 001 + initialized BGC ; best guess tunings from last fall)
- 003 : hybrid (physics from 001 + initialized BGC ; re-tuned set of parameters + new Fe forcing)
- 004 : hybrid (physics form 001 + initialized BGC ; re-tuned stet of parameters + new Fe forcing)

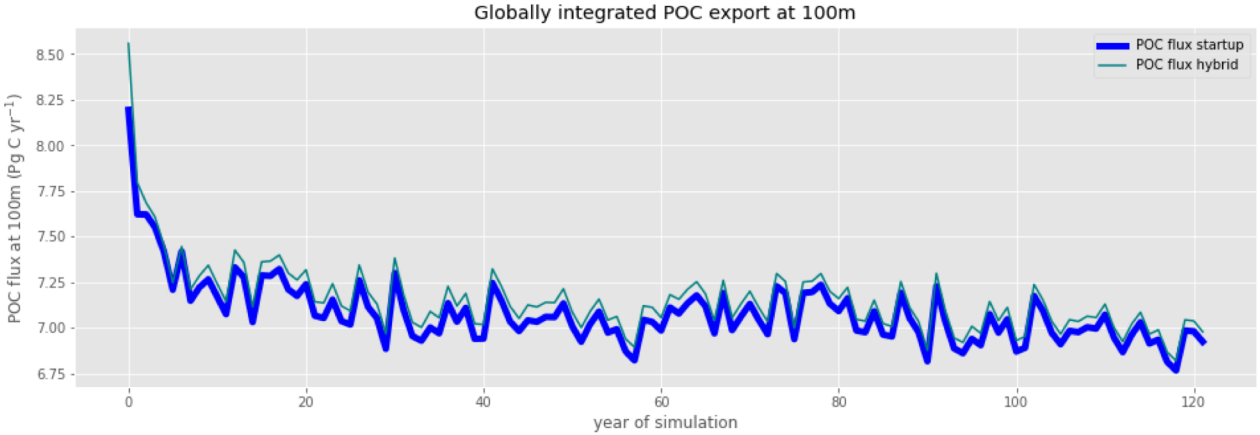
- cocco.001 : CESM startup (tunings form GCB/ALK project runs + new Fe forcing)

Goals and focus

- Reduce Southern Ocean silicate bias
- Diatoms ~40% NPP
- NPP ~50 Pg C/yr
- Surface nutrients, nutrient limitations, POC export, PFT distributions, nutrient profiles…

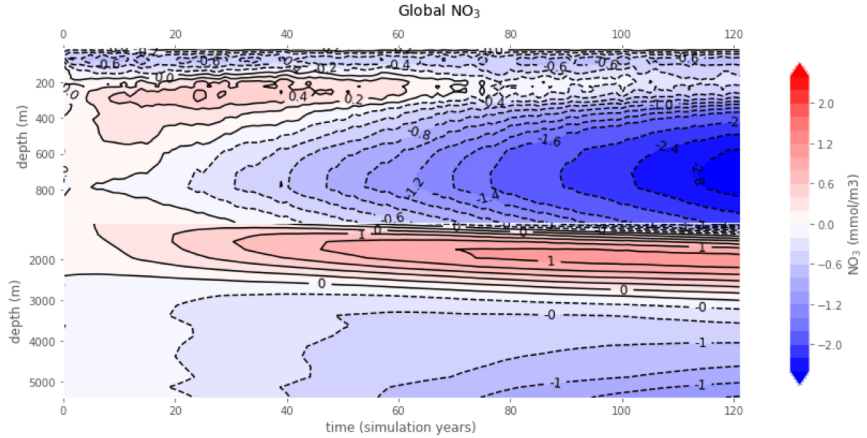
Does spinning up physics really matter? (compare 001 and 002)



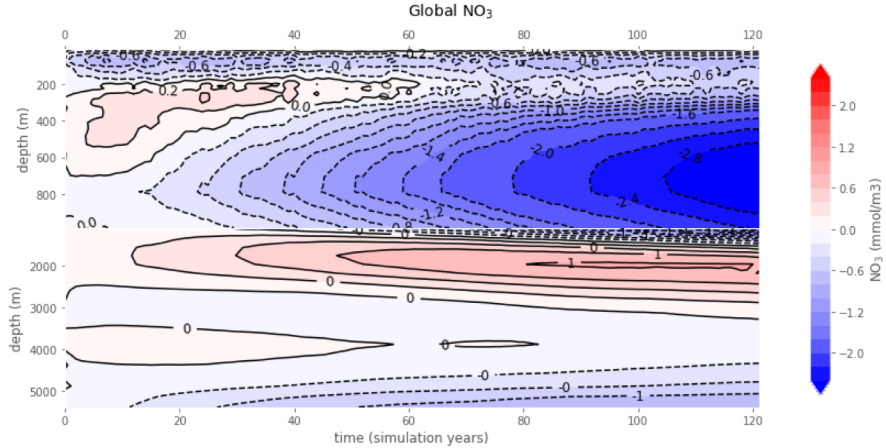


Does spinning up physics really matter? (compare 001 and 002)

001



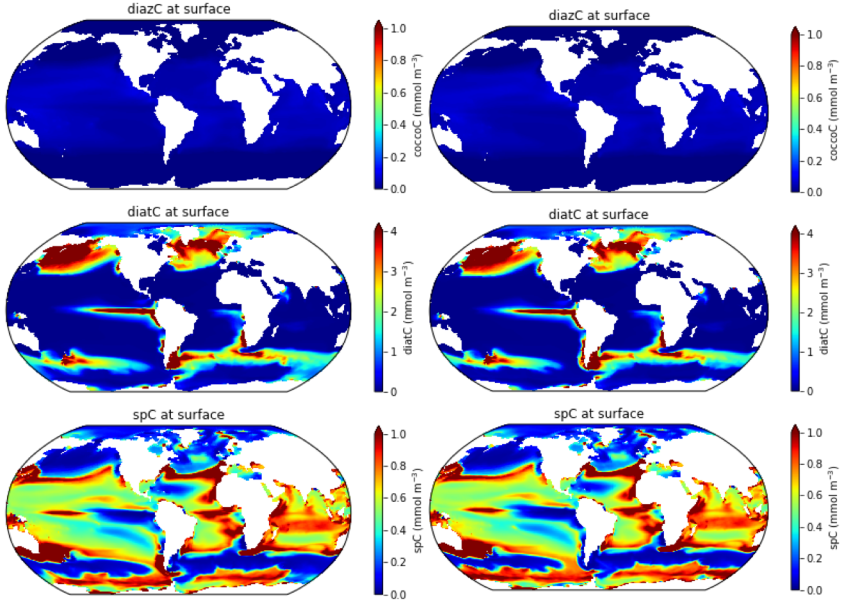
002



How did the new Fe forcing change things?

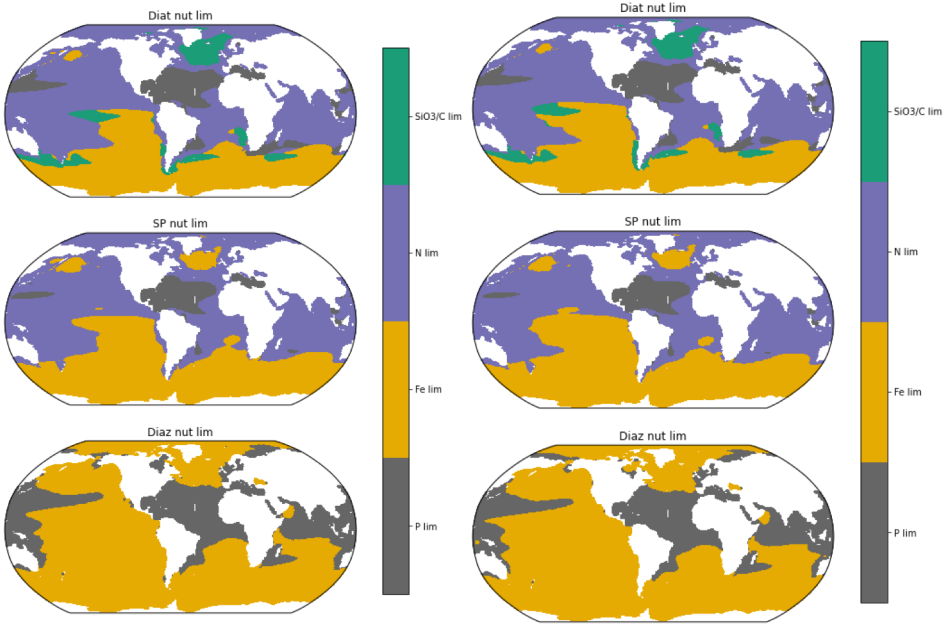
before

after



before

after



(case 004 before and after)

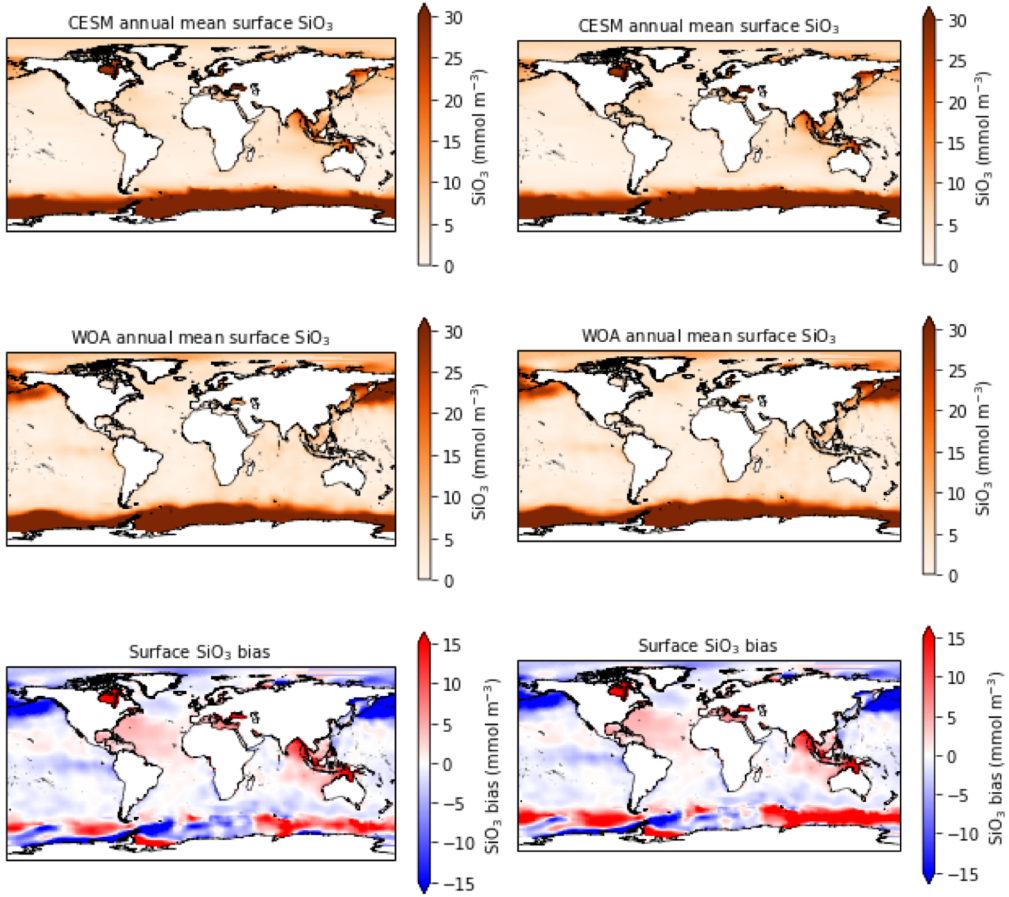
How did the new Fe forcing change things?

before

after

A bit less diatoms, and Si/C in diatoms was likely affected by the new Fe forcing.

* Currently running some tests altering the threshold of Fe concentrations that increase Si/C



▾ Data variables:

photoC_diat_zint	()	float64	18.96
photoC_sp_zint	()	float64	26.87
photoC_diaz_zint	()	float64	1.657
photoC_TOT_zint	()	float64	47.48

▸ Attributes: (0)

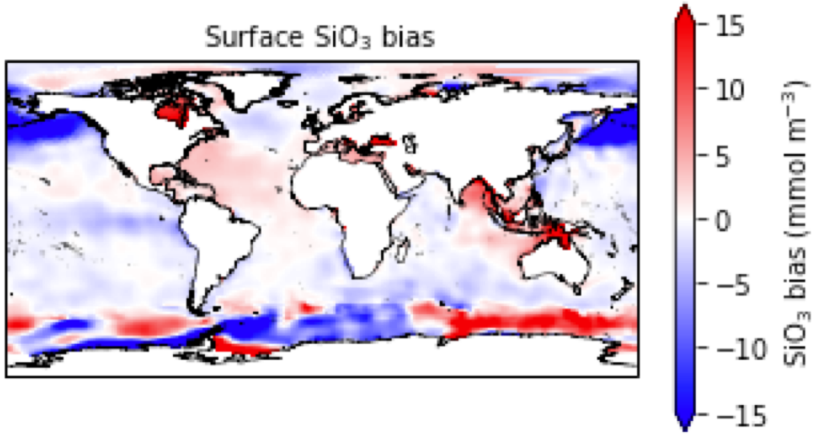
▸ Coordinates: (0)

▾ Data variables:

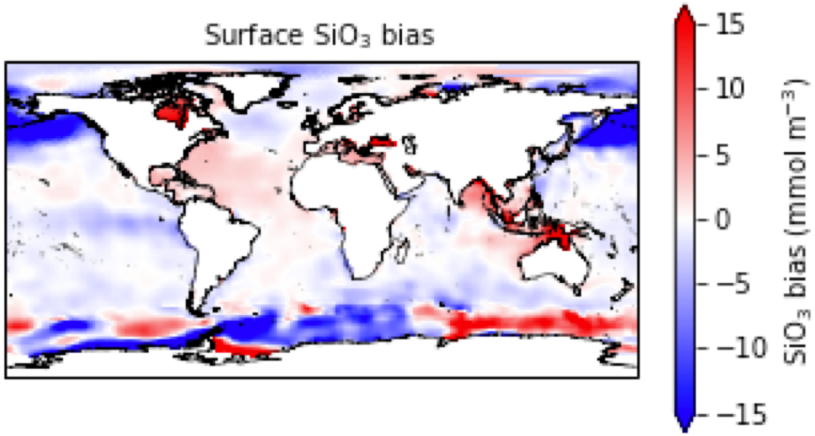
photoC_diat_zint	()	float64	18.72
photoC_sp_zint	()	float64	26.74
photoC_diaz_zint	()	float64	1.618
photoC_TOT_zint	()	float64	47.08

▸ Attributes: (0)

Same period of run,
without any change to
gQSi

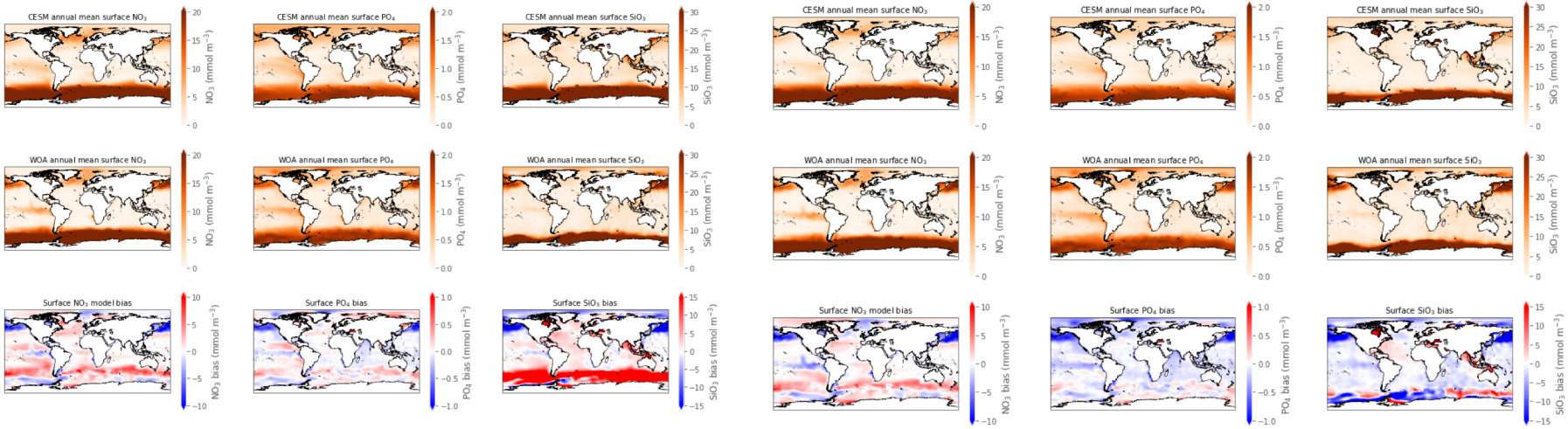


Test case, after 30 years
(10y mean),
gQFe_kFe_thres: 10 → 20



OMIP-CESM2

001 (“best guess”)

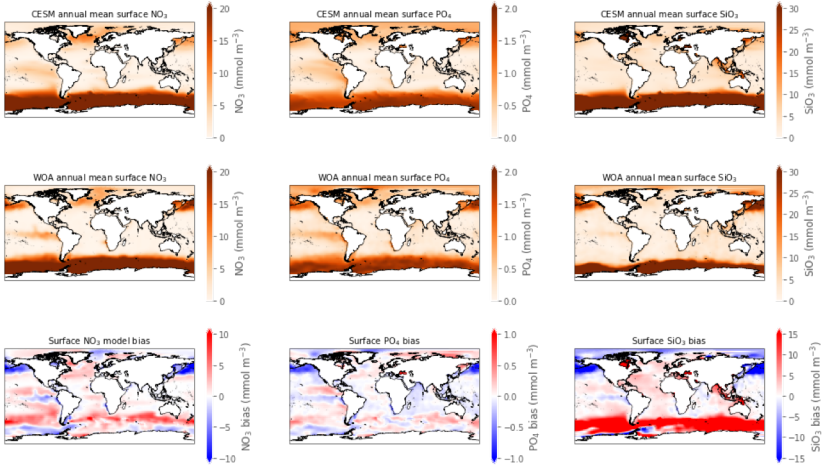


(means over 2nd IAF)

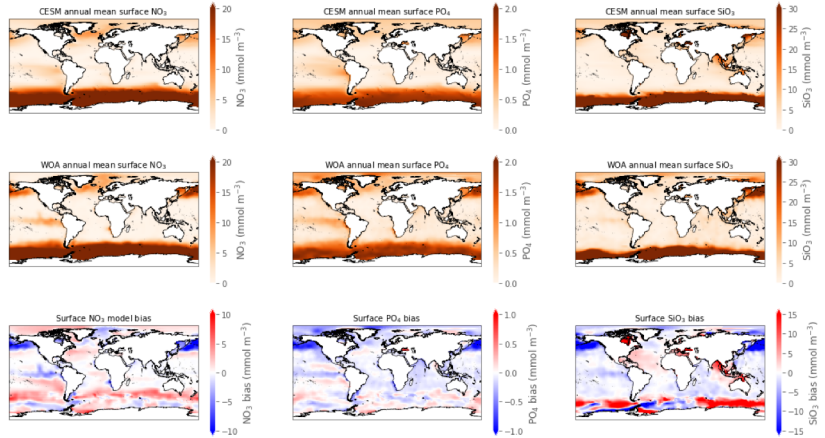
	NPP (Pg C/yr)	POC export (Pg C/yr)	%NPP diatoms
001	45.18	7.0	47%
002	45.43	7.1	48%
003	45.31	7.0	45%
004	46.95	7.4	40%
Cocco.001	50.40	5.9	37%

Surface nutrients

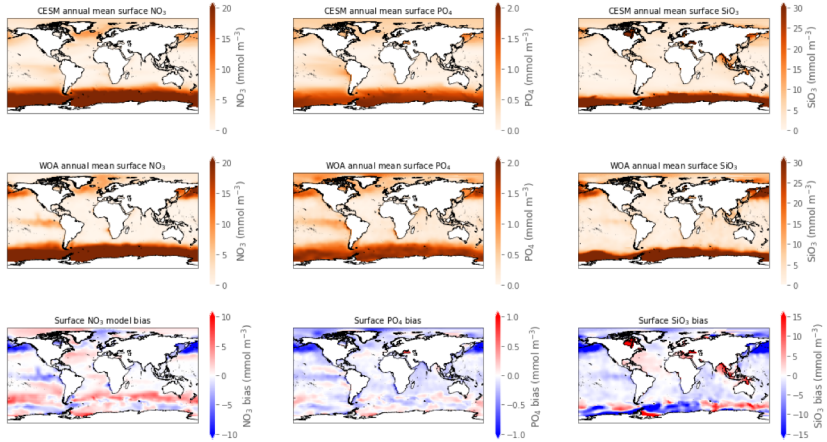
OMIP-CESM2



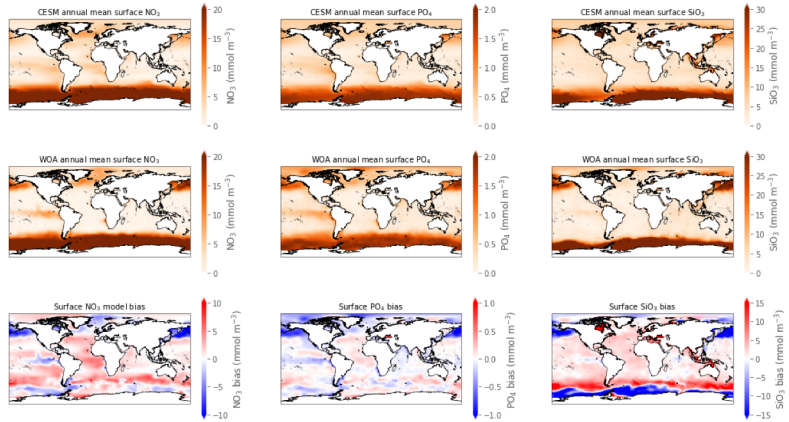
004



002

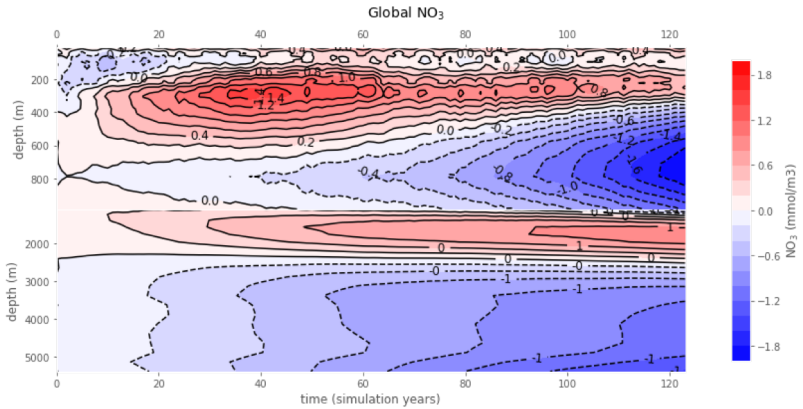


cocco.001

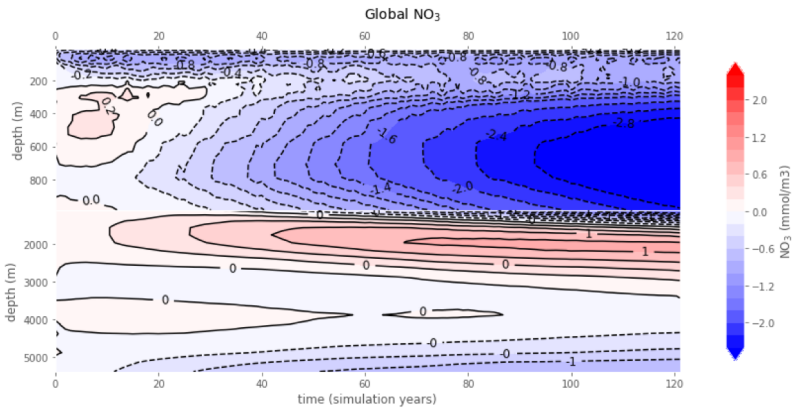


NO_3 Hovmöllers

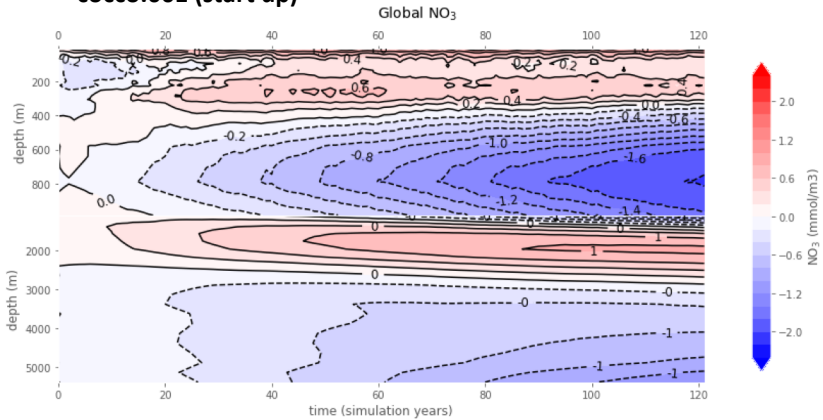
OMIP-CESM2 (CORE forced)



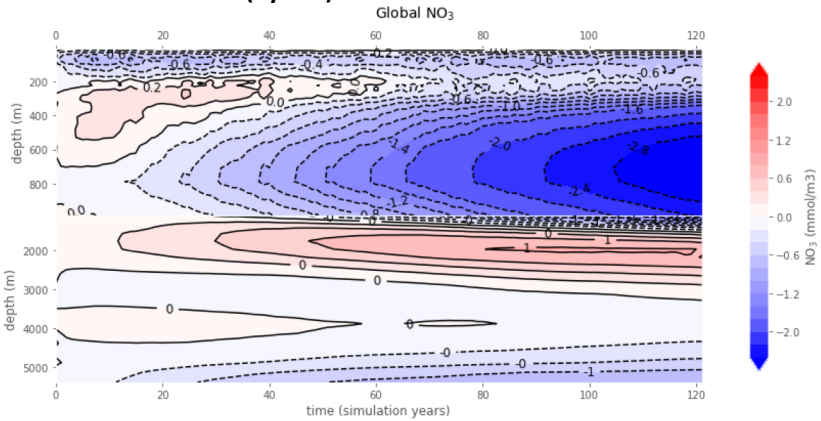
004 (hybrid)



cocco.001 (start up)

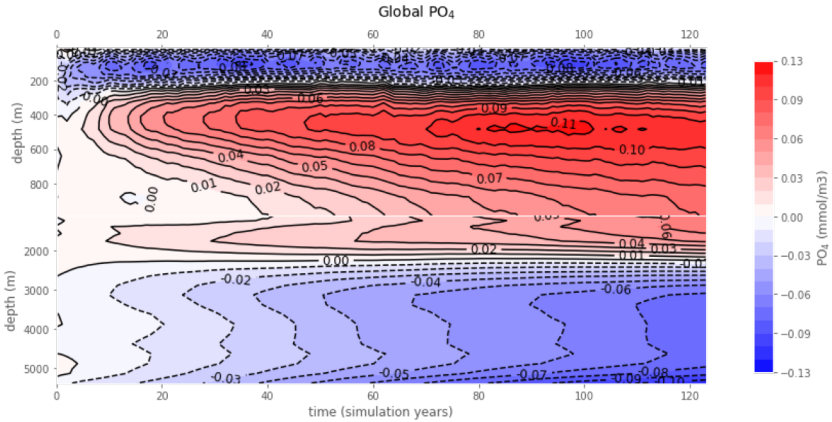


002 (hybrid)

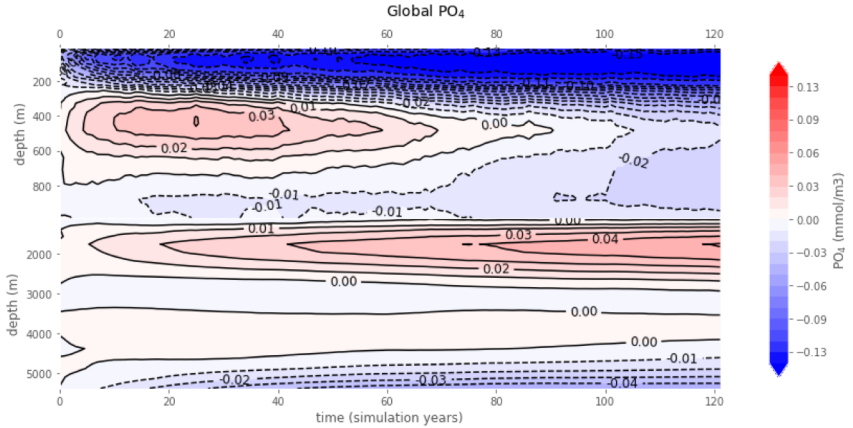


PO_4 Hovmöllers

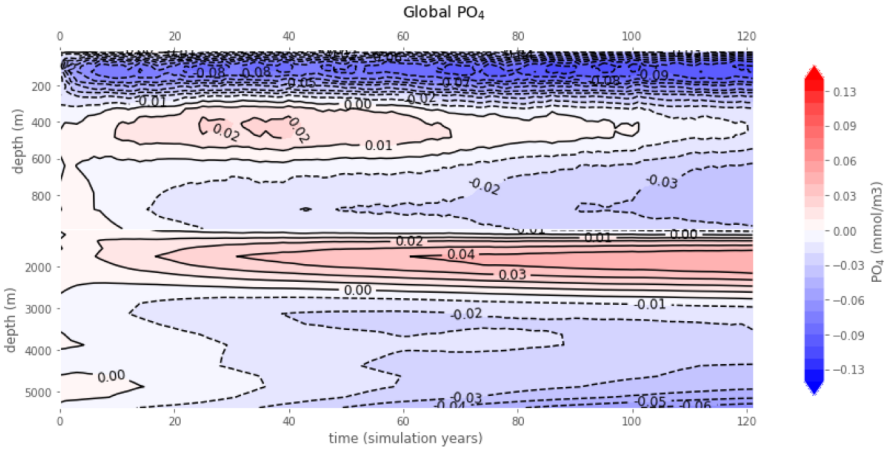
OMIP-CESM2 (CORE forced)



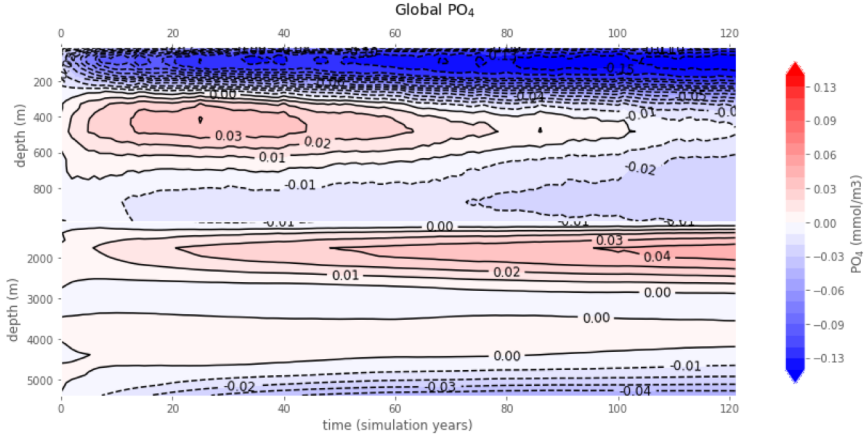
004 (hybrid)



cocco.001 (start up)

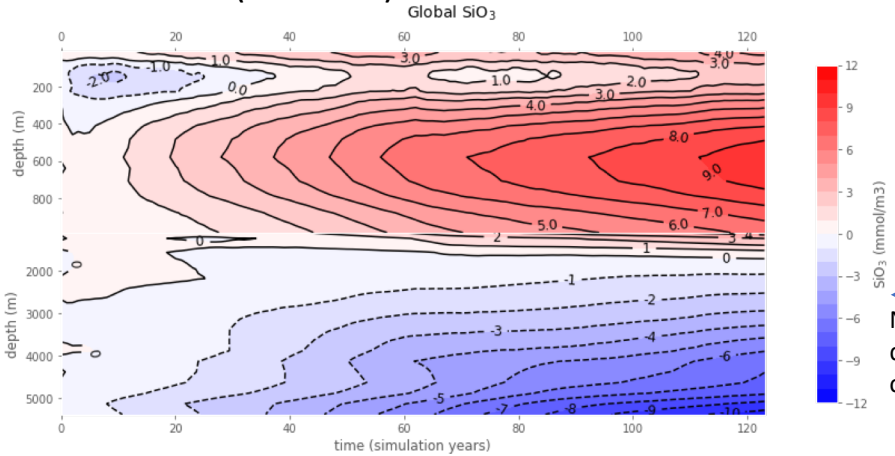


002 (hybrid)



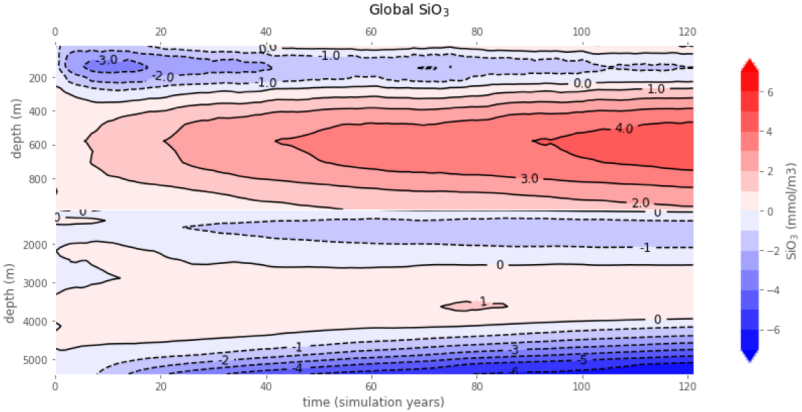
SiO_3 Hovmöllers

OMIP-CESM2 (CORE forced)

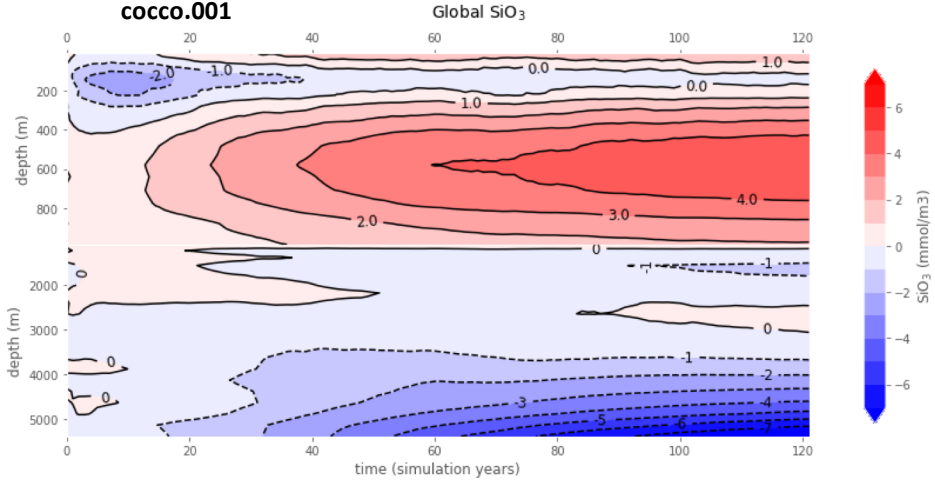


Note different color scale

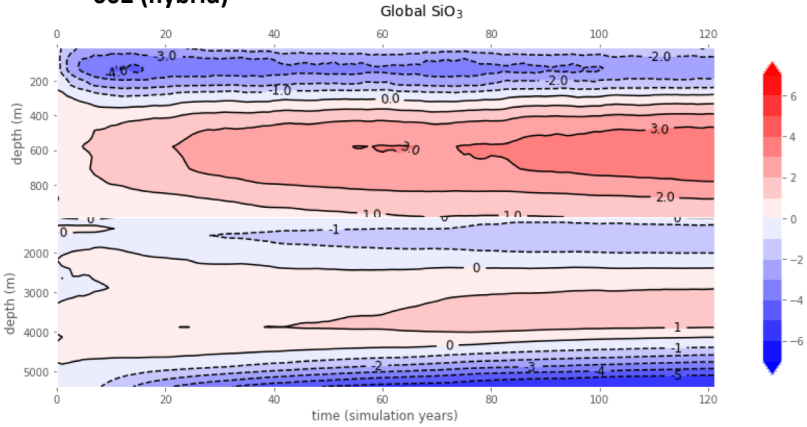
004 (hybrid)



cocco.001

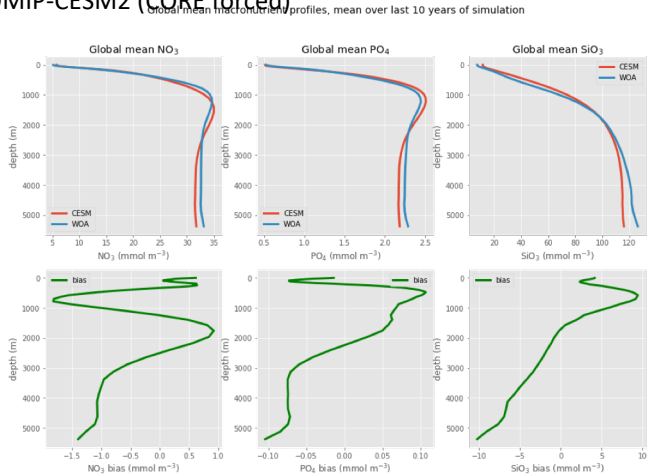


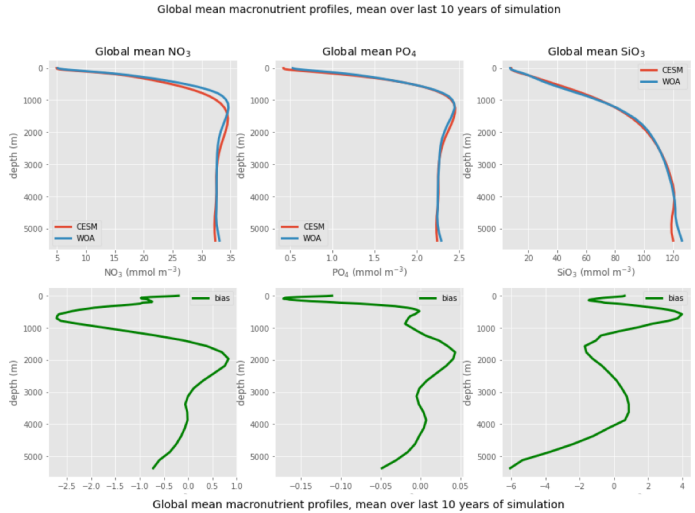
002 (hybrid)



Nutrient profiles & bias

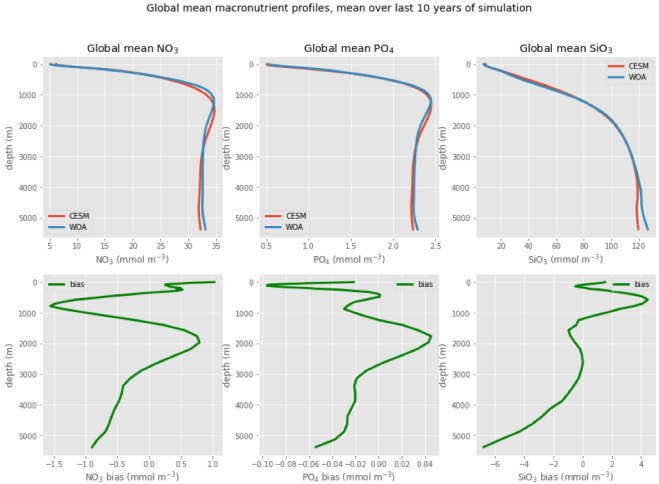
OMIP-CESM2 (CORE forced)

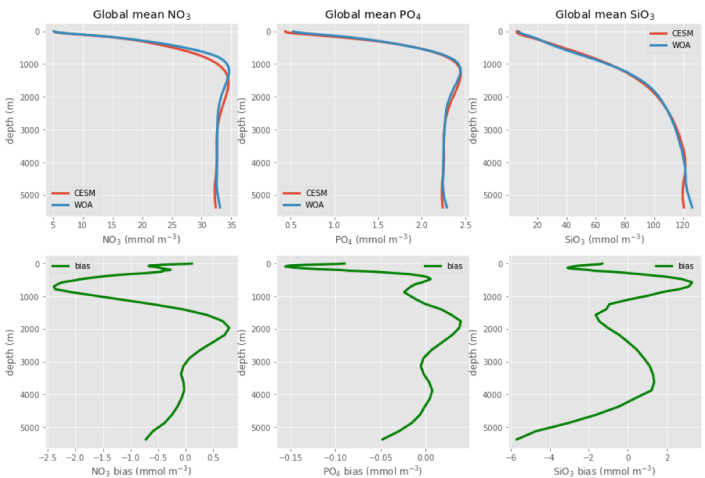




004

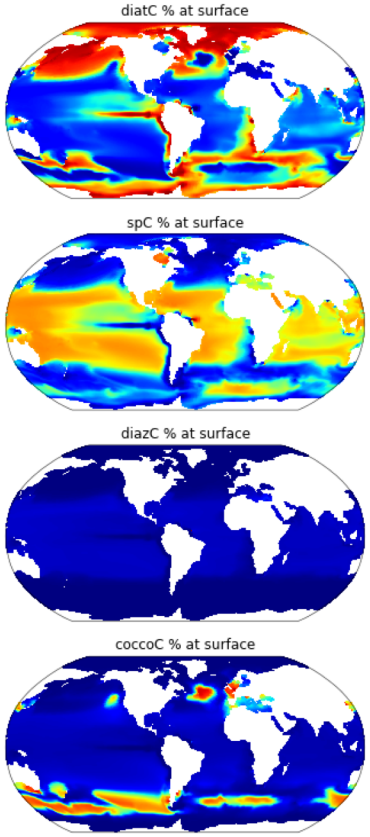
cocco.001
(start up)



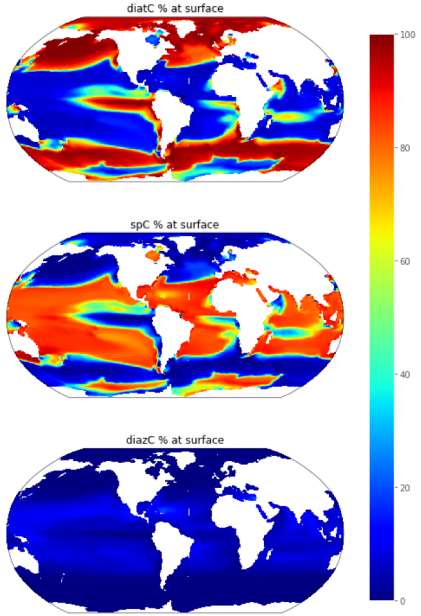


002

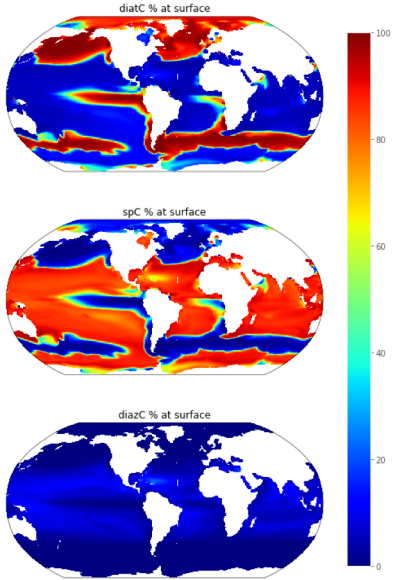
cocco.001 (start up)



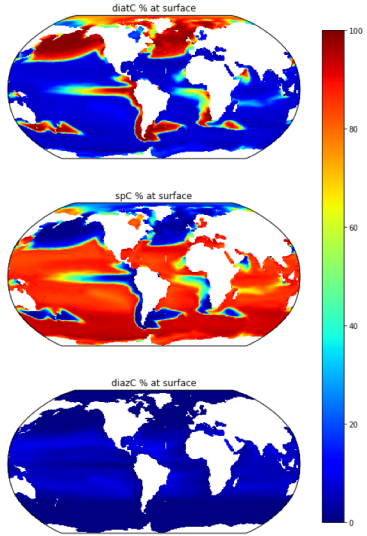
002



004



OMIP



Conclusions about 3 PFT tuning so far

001 and 002 (first “best guess” parameters):

- too many diatoms
- strong negative NO3 biases 400-800m
- surface SiO3 slightly low

003 and 004 (recent tuning runs):

- **s**imilar in surface nutrient biases
- 003 has too many diatoms (45%)
- negative NO3 bias still there in both runs but worse in 004