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Canada



CanESM5

The Canadian Earth System Model version 5

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Oleg Saenko, Nathan Gillett, Jim Christian et al.**

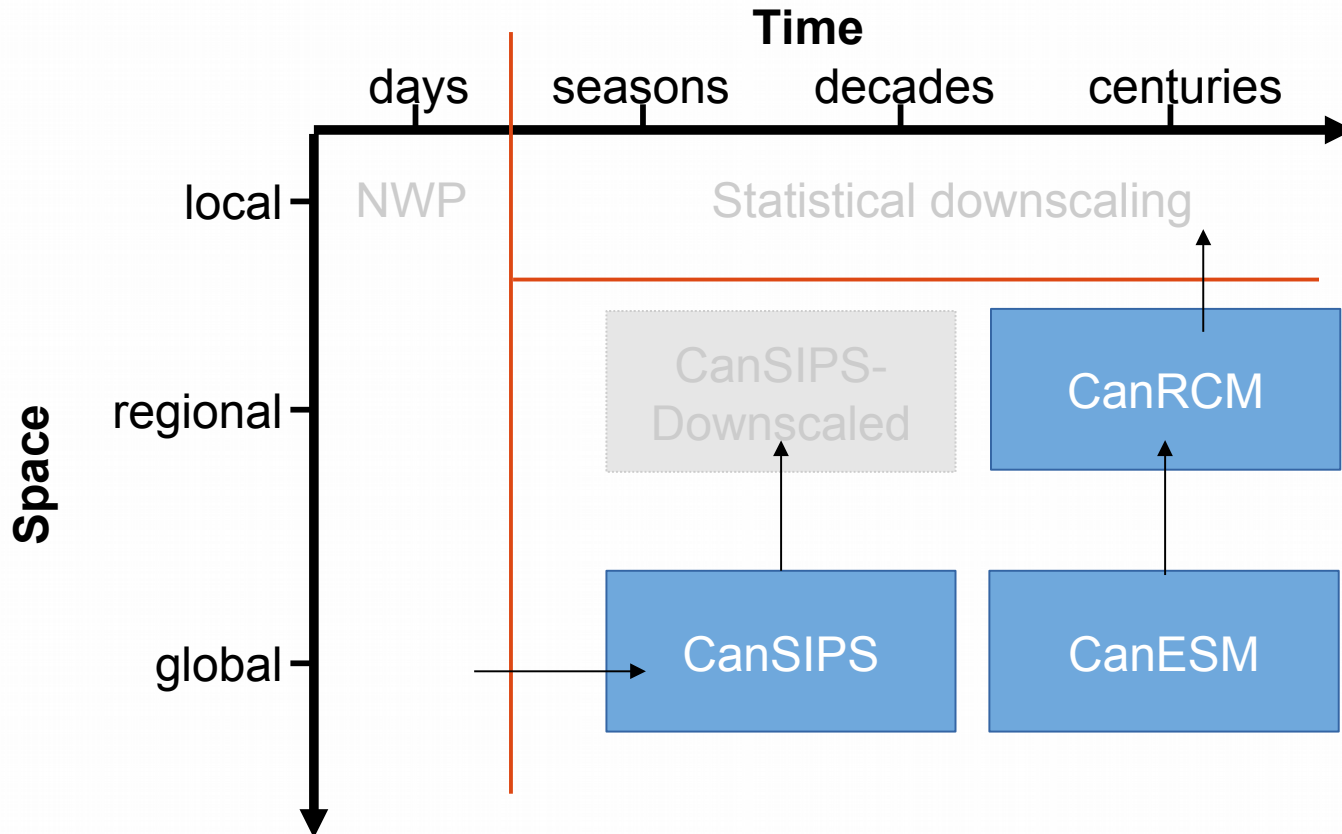
Canadian Centre for Climate Modelling and Analysis

NEMO users meeting

Toulouse

12 October 2018

Stable of models at CCCma



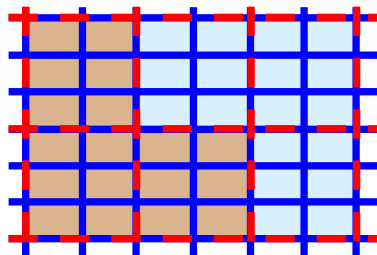
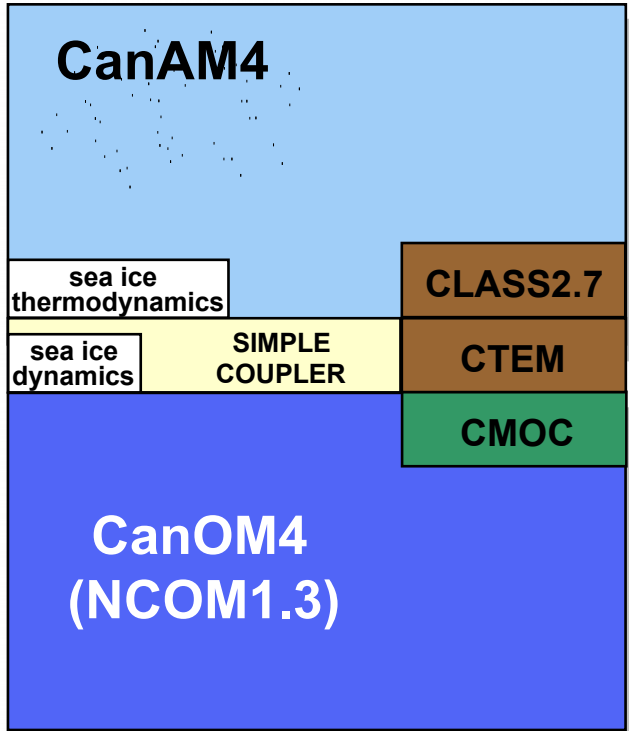
Models share a common framework and components

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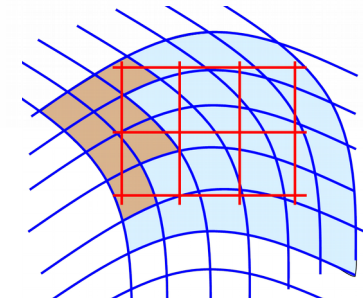
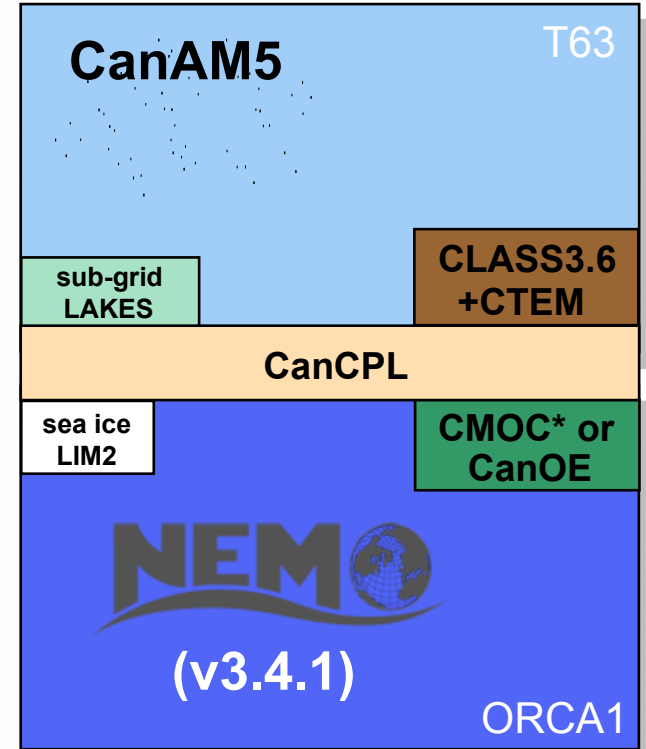


From CanESM2 to CanESM5

CanESM2 (CMIP5)



CanESM5 (CMIP6)



NEMO configuration

ORCA1 nominal 1°, refining to 1/3° in tropics, 46 levels

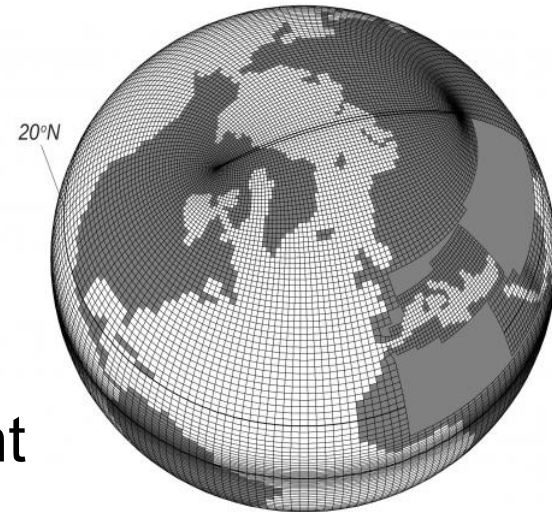
LIM2 sea-ice model, CanAM albedo

CCCma physics:

- Modified Gent McWilliams coefficient
- Lee wave mixing parameterization
- Parameter tuning

CMOC and CanOE biogeochemistry

15 years/day coupled, >100 years/day ocean only on XC40s.

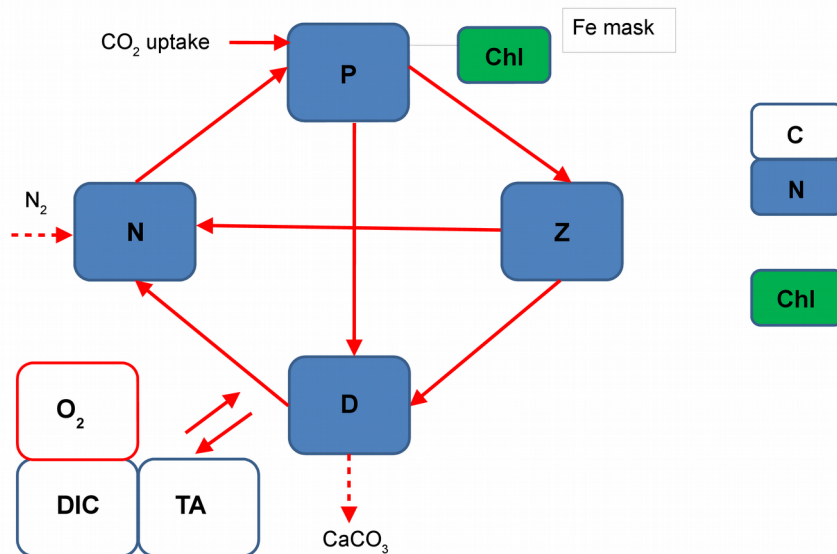


V3.4.1

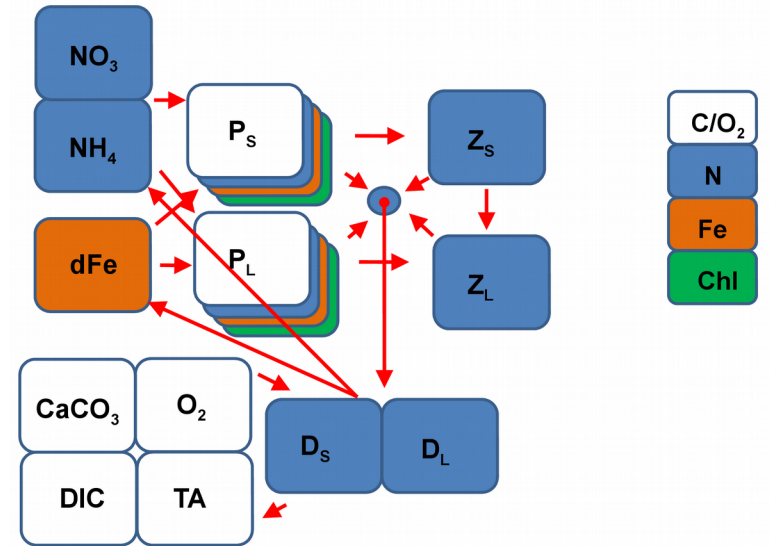


CanESM5 biogeochemistry

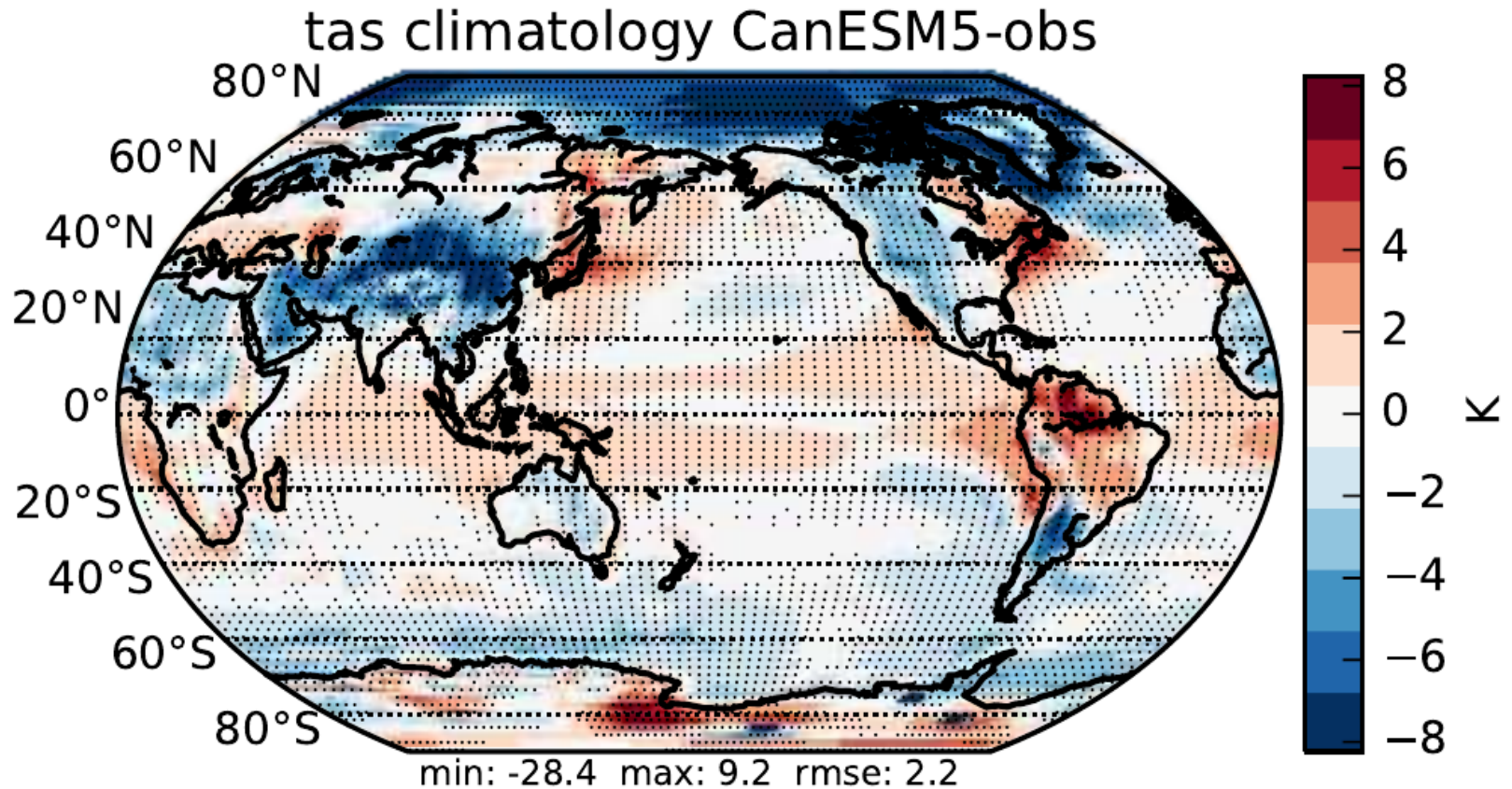
Canadian Model of Ocean Carbon (CMOC)



Canadian Ocean Ecosystem (CanOE)

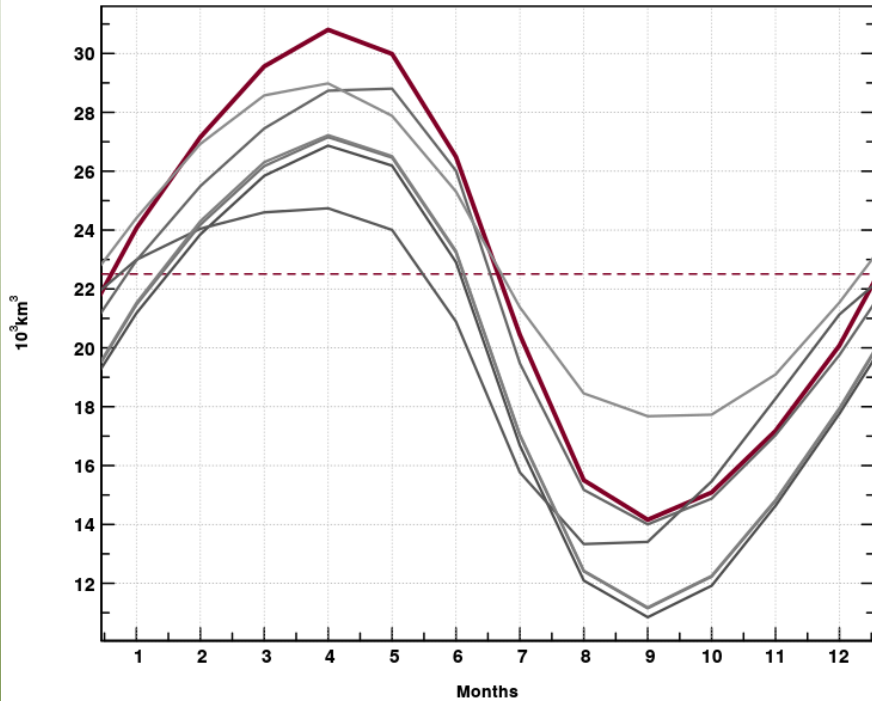


CanESM5 validation: surface temp

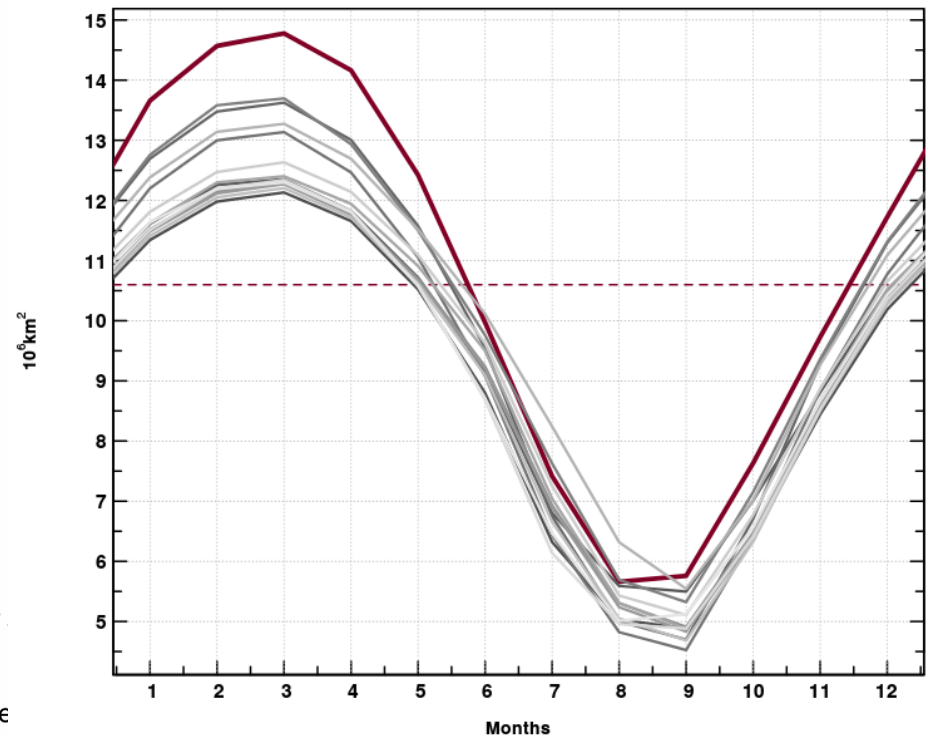


CanESM5 validation: sea-ice

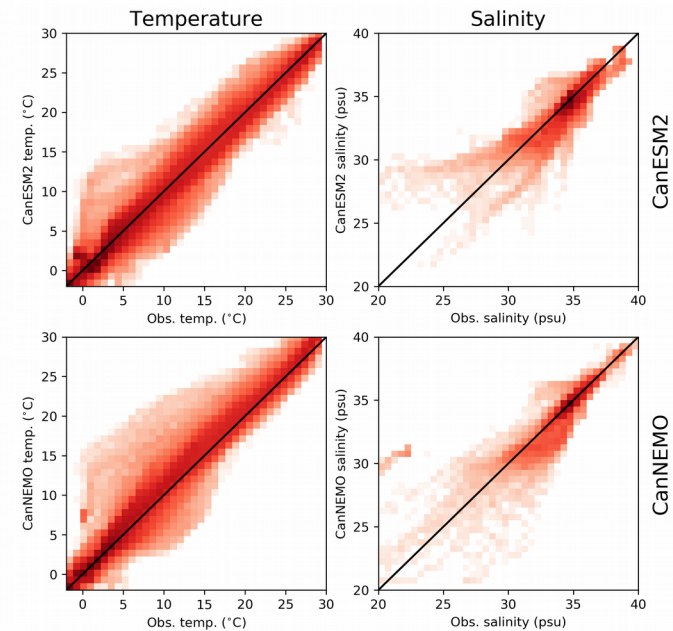
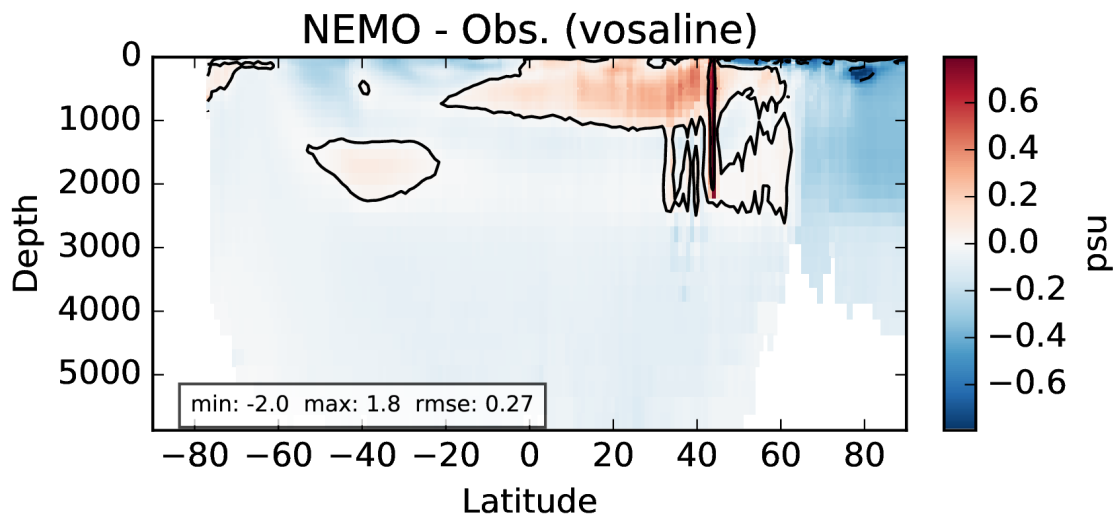
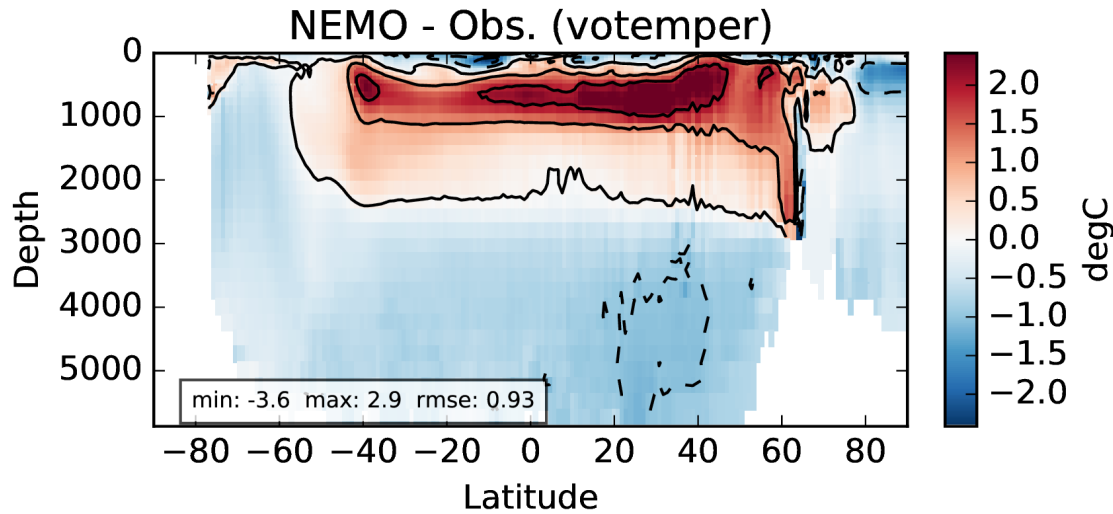
Annual cycle of NH ocean sea ice volume



Annual cycle of NH ocean sea ice area

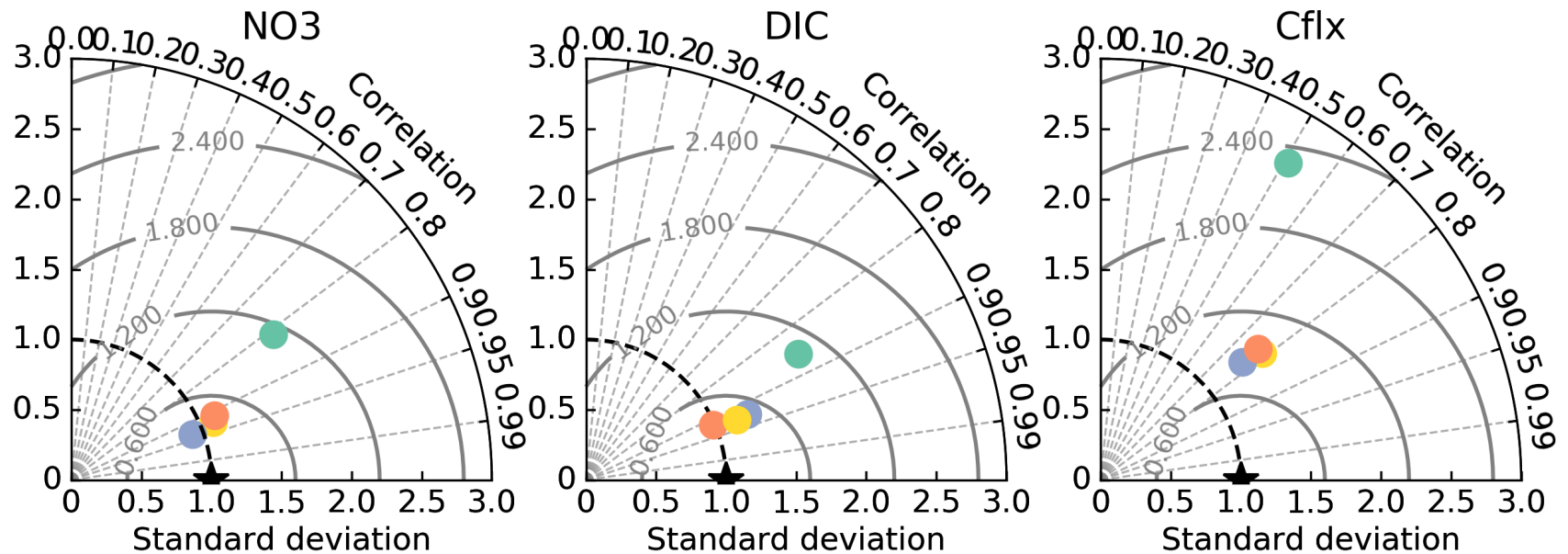


CanESM5 validation: ocean physics

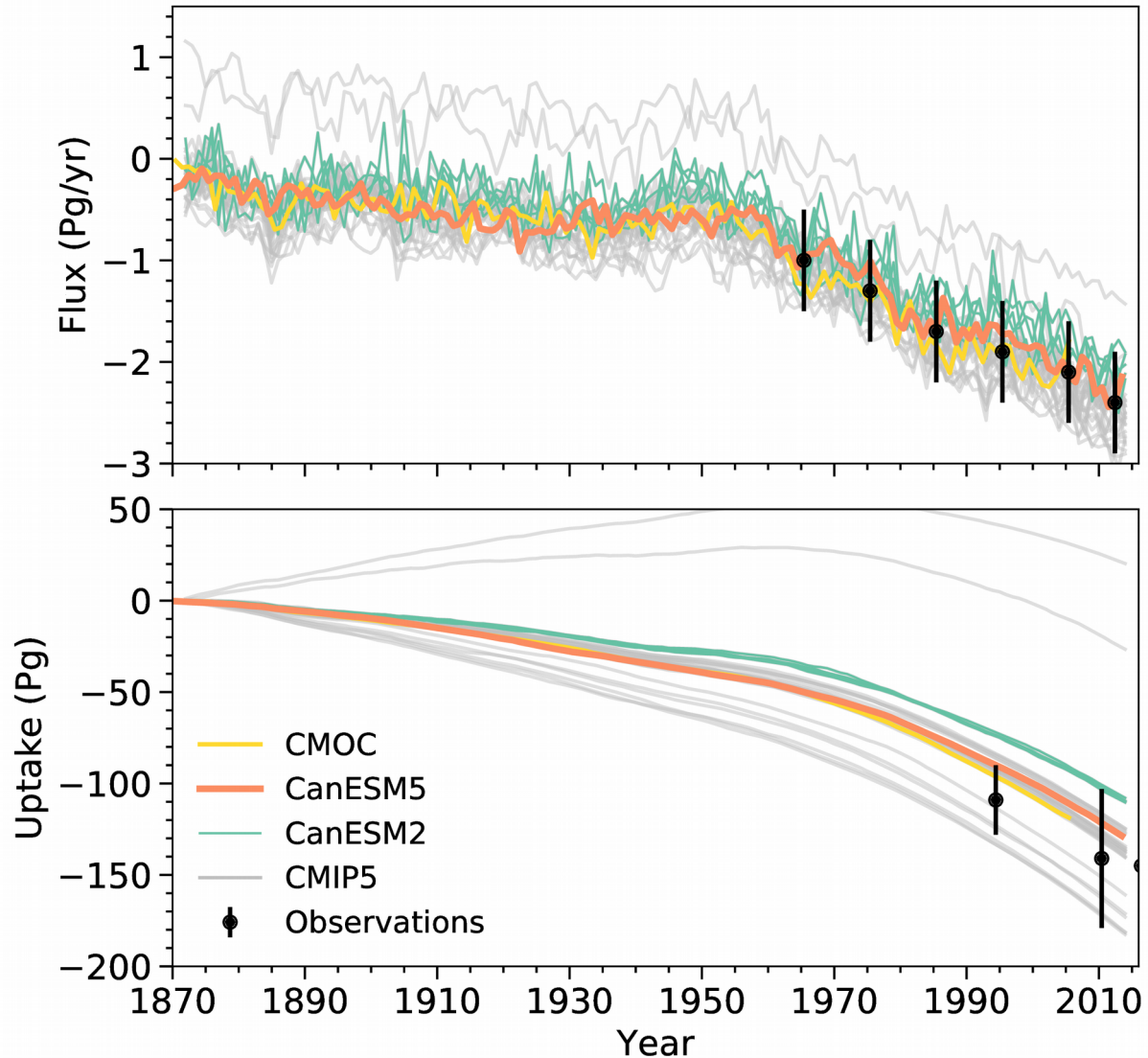


CanESM5 validation: ocean BGC

★ Obs. ● CanOE ● CMOC ● CanESM2 ● CanESM5



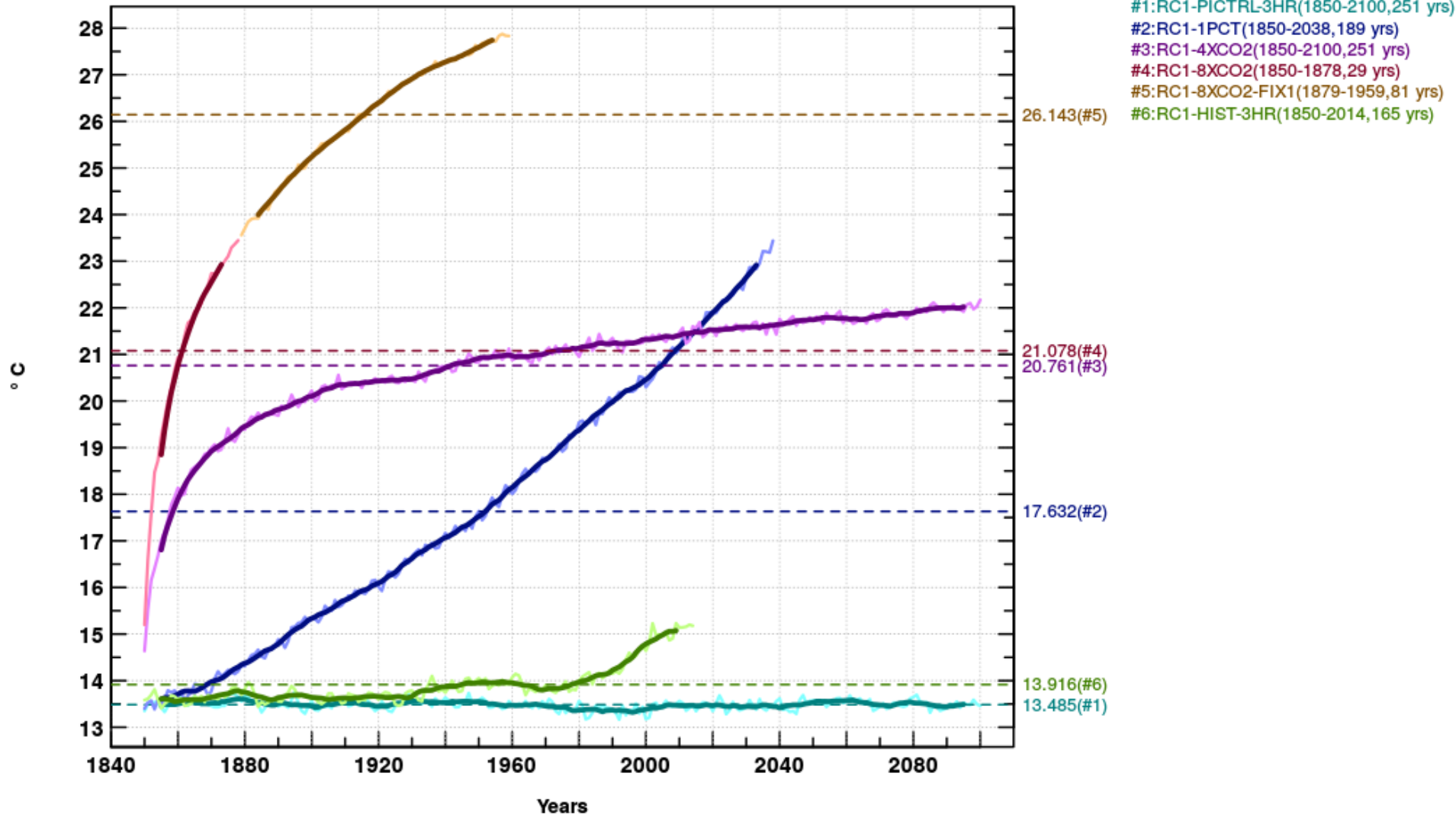
CanESM5 validation: ocean BGC



CanESM5 simulations for CMIP6

Annual screen temperature over globe

Annual 11-yr moving mean

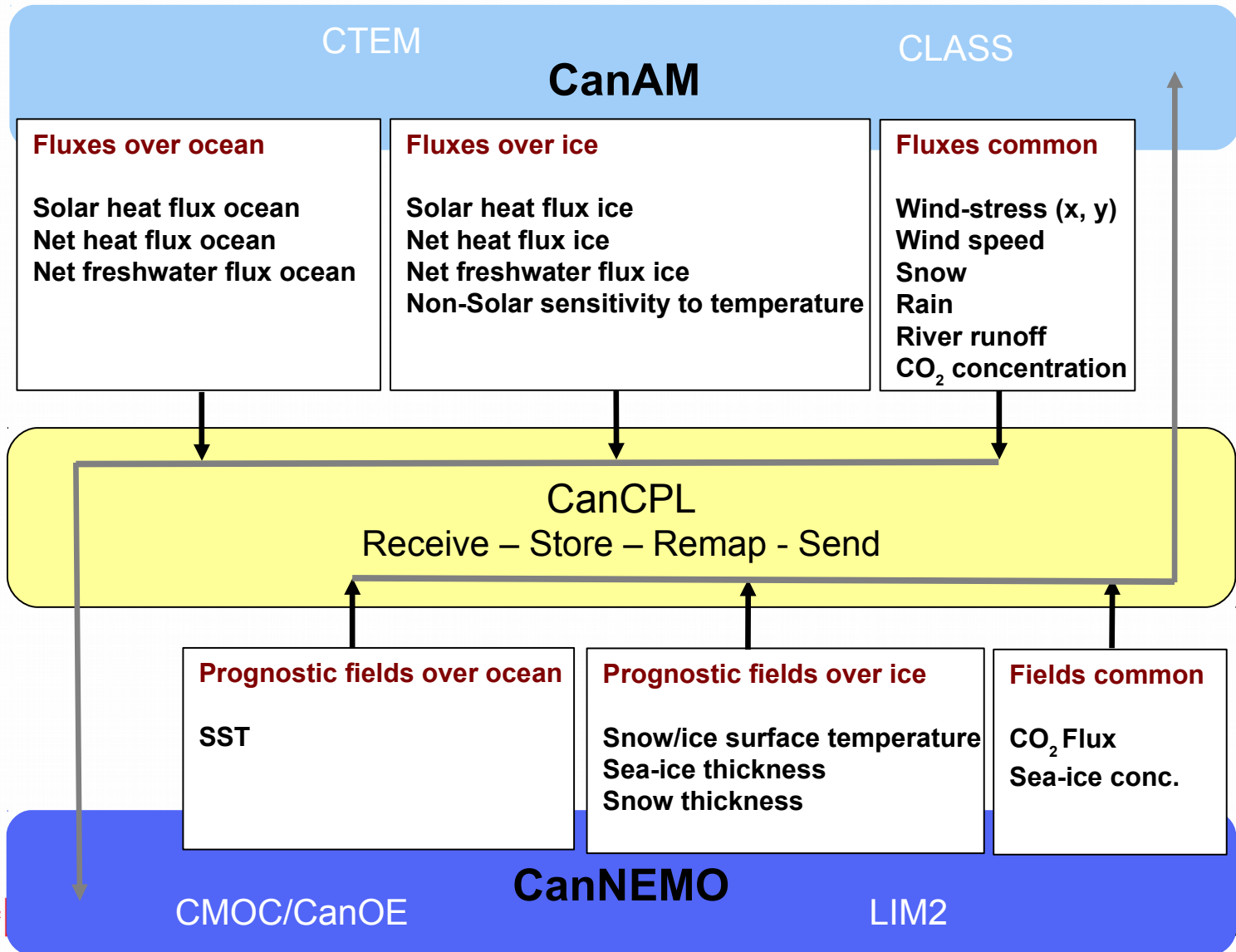


CanESM5 summary

- New version of CanESM, based on NEMO / LIM2
- Two biogeochemical models: CMOC & CanOE
 - CanOE and CMOC have similar skill at simulating large-scale distributions of DIC and nutrients, though differences exist locally.
- Preliminary CMIP6 simulations show
 - Improvement in skill over CanESM2, especially for BGC.
 - Fairly high climate sensitivity $O(5K)$
 - Cold bias in the Arctic. Too much heat in the thermocline.



CanCPL exchanges



Drake Passage transport

#1

