

Ocean biogeochemistry in ACCESS models

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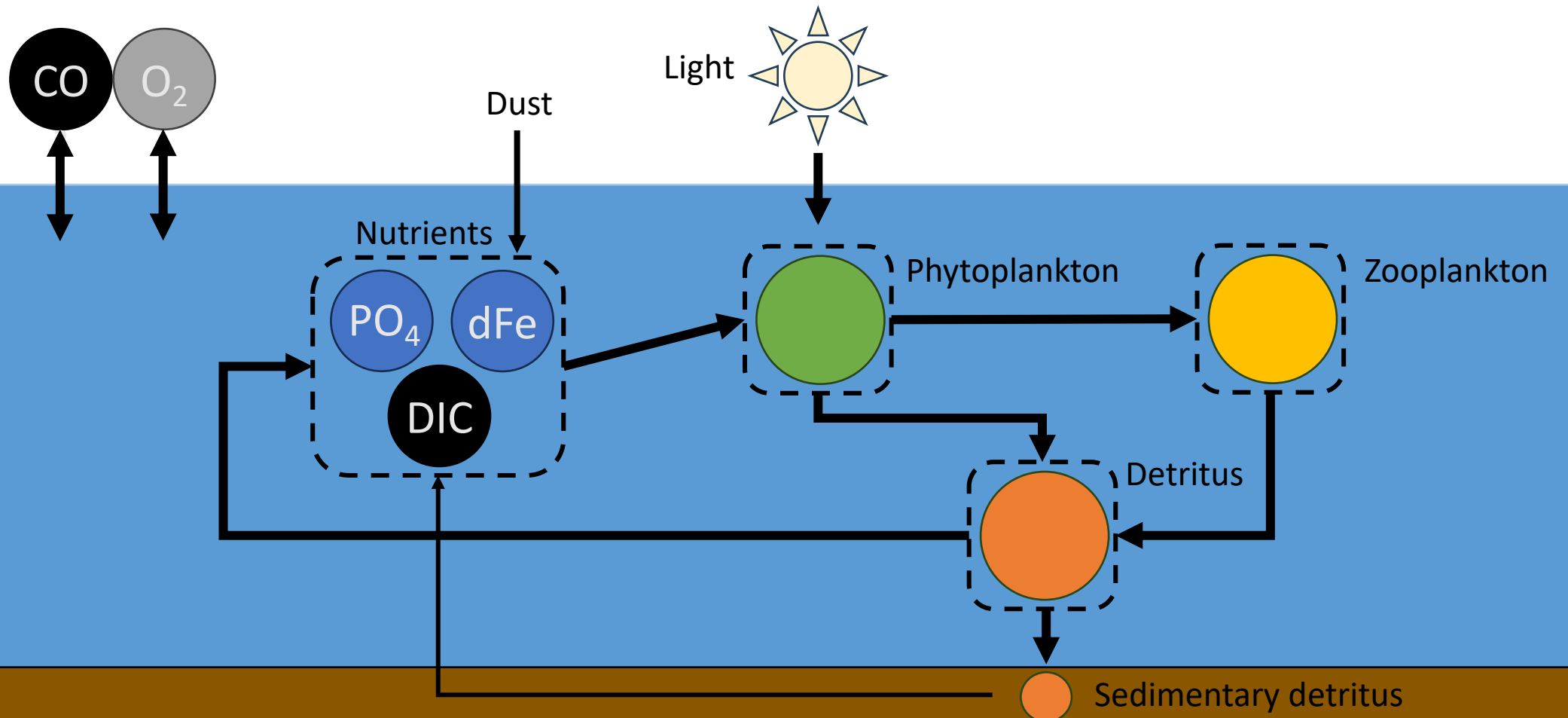
Some background

WOMBAT =



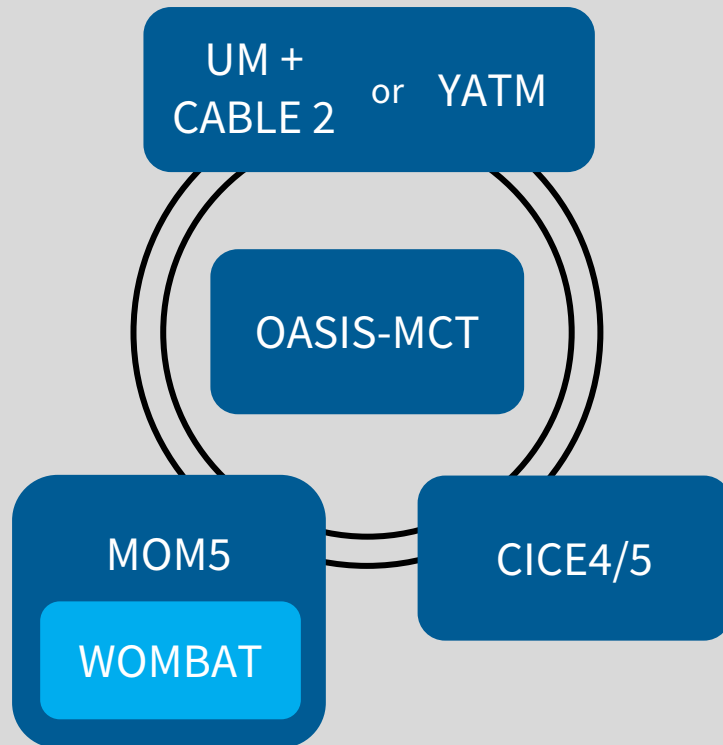
Some background

WOMBAT = Whole Ocean Model of Biogeochemistry And Trophic-dynamics

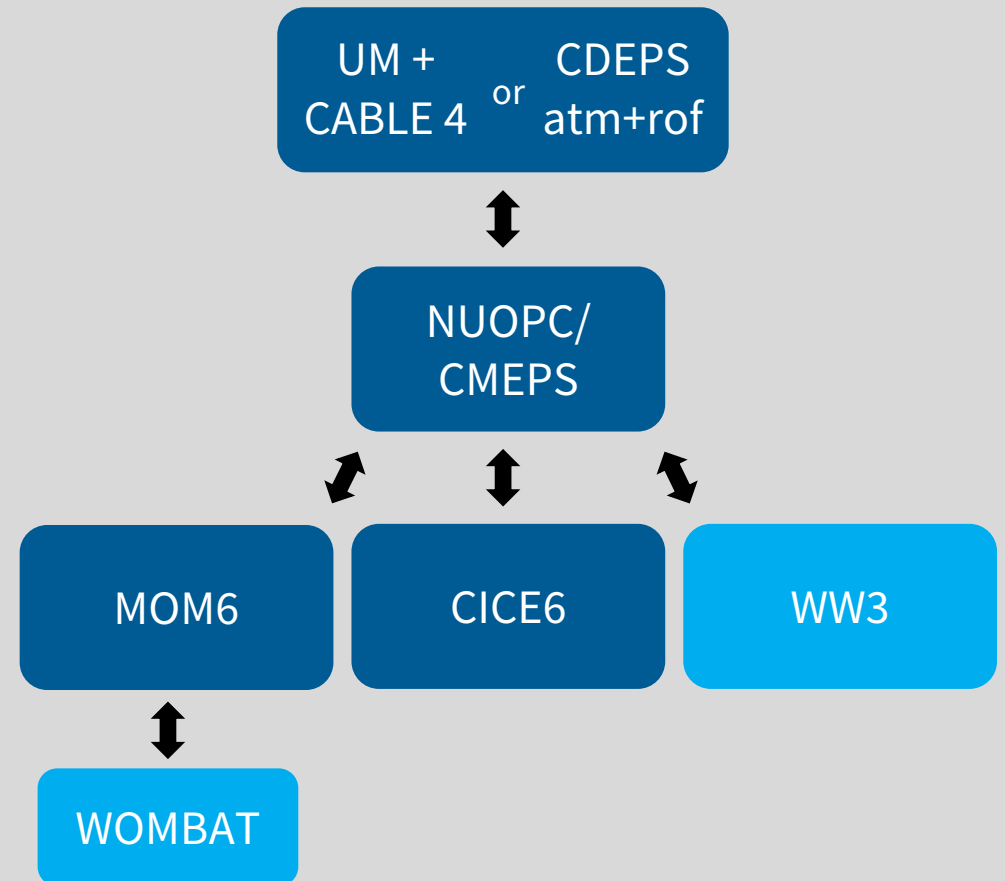


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ACCESS CMIP6-era

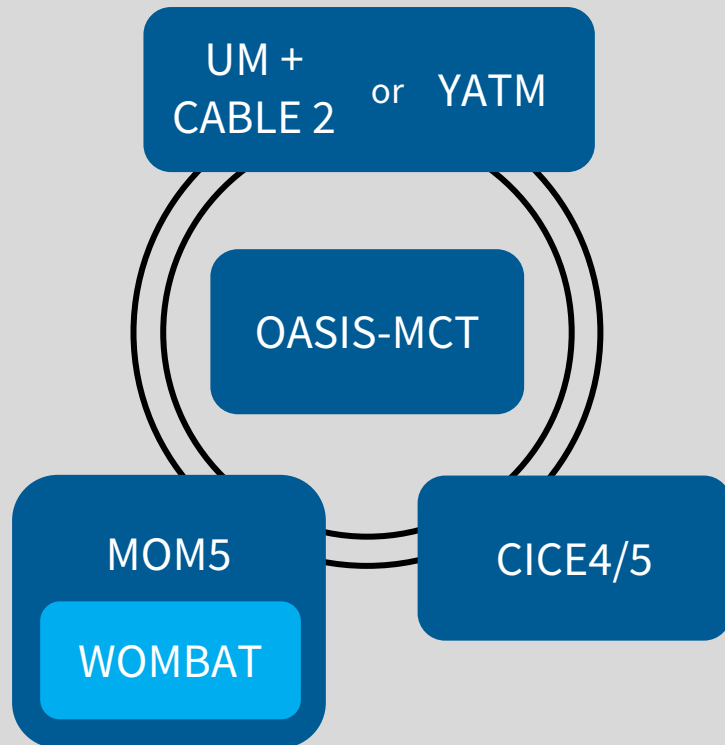


ACCESS CMIP7-era

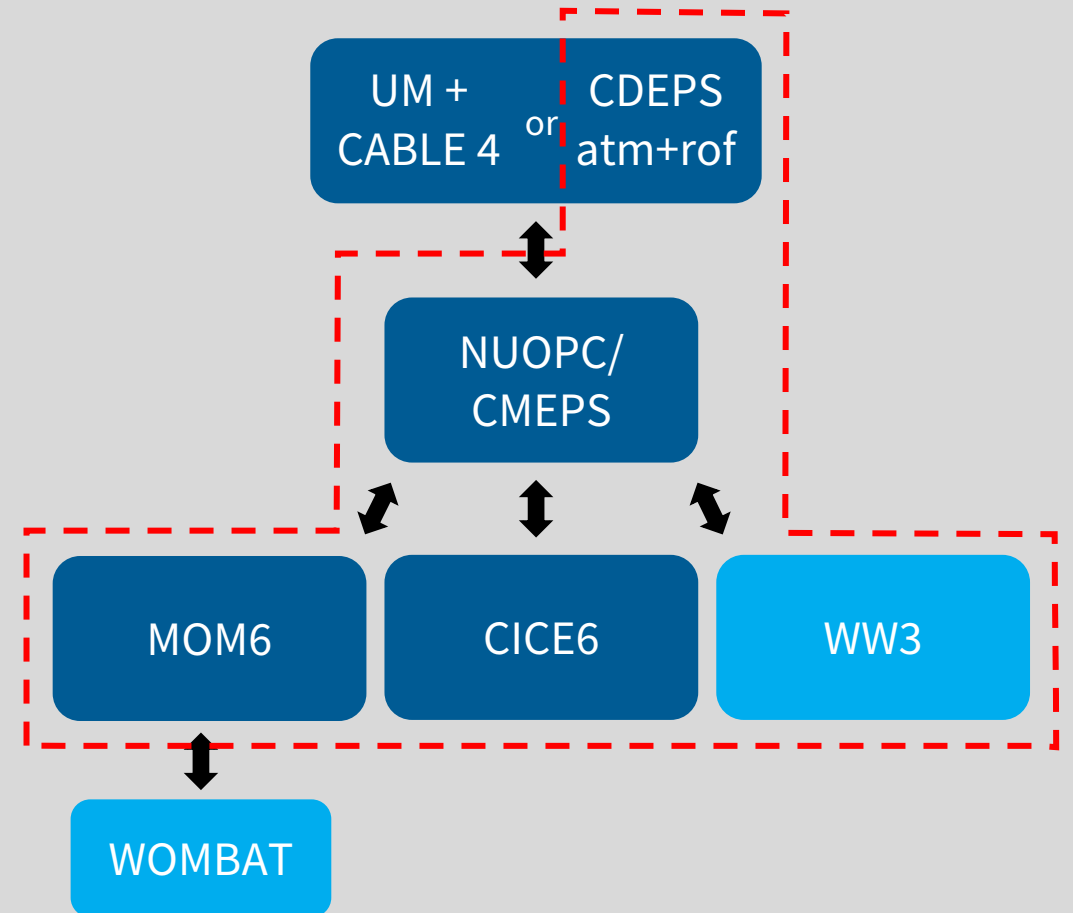


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ACCESS CMIP6-era

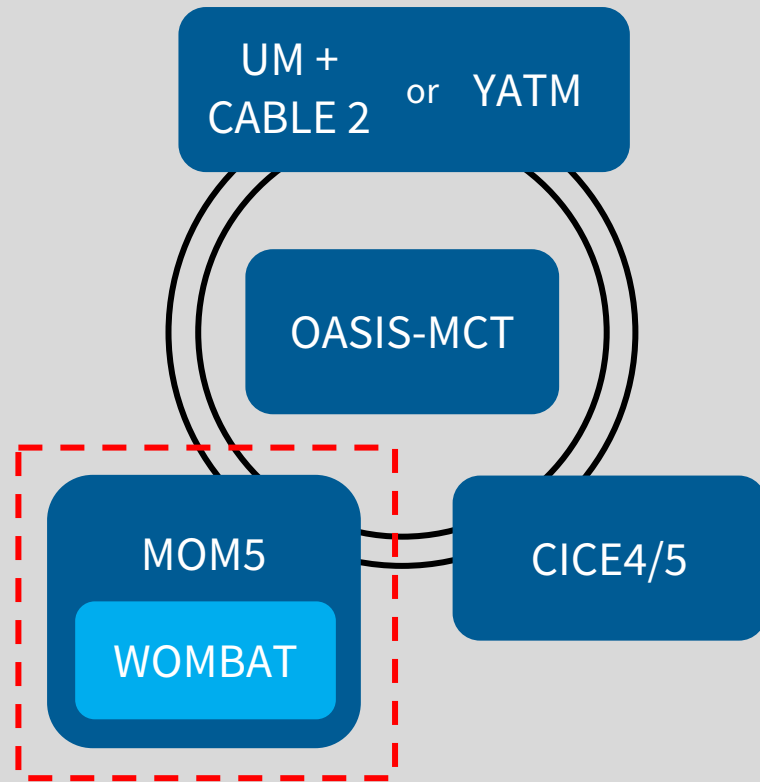


ACCESS CMIP7-era

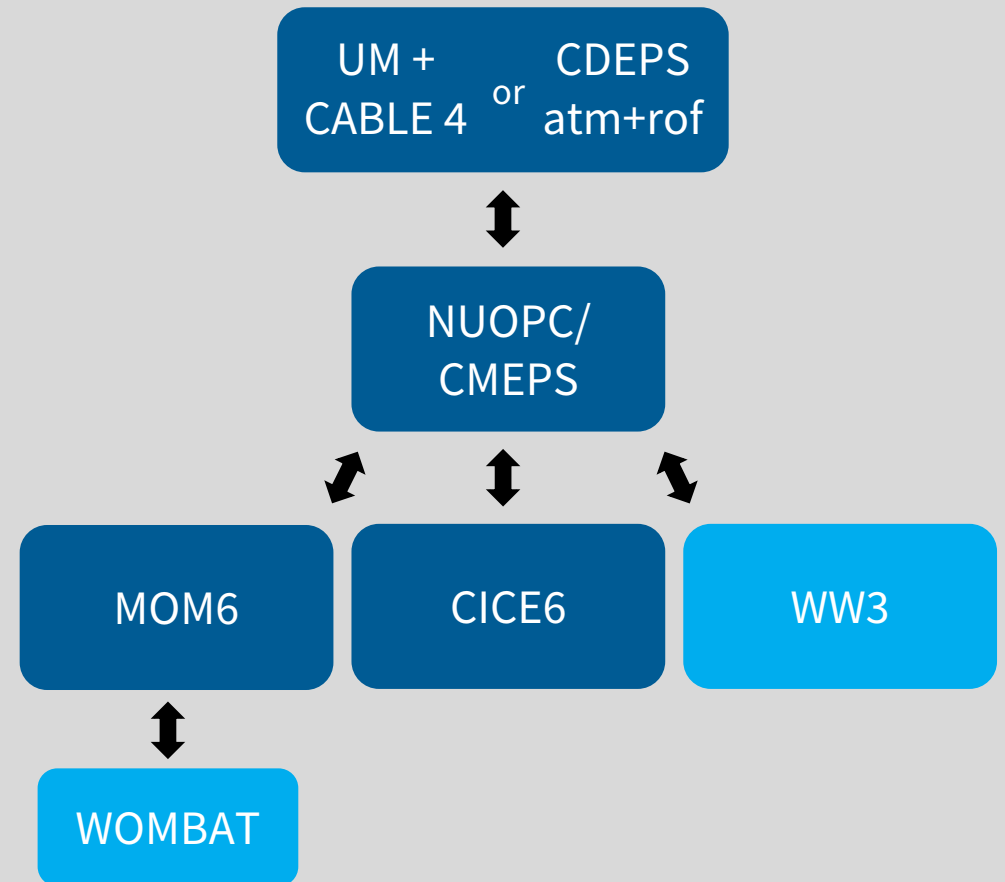


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ACCESS CMIP6-era





ACCESS CMIP7-era




WOMBAT as a “generic tracer”

GFDL “generic_tracer” API is “generic” in the sense that it can be used by different GFDL ocean models

[MOM6 / src / tracer / MOM_generic_tracer.F90](#) 

 **andrew-c-ross** and **Hallberg-NOAA** Only add runoff tracer flux to surface flux if it has not already been

[MOM5 / src / mom5 / ocean_bgc / ocean_generic_tracer.F90](#)

 **marshallward** 5.1 Tarball update

Code **Blame** 1023 lines (860 loc) · 50.2 KB

```
1  !> Drives the generic version of tracers TOPAZ and CFC and other GFDL BGC components
2  module MOM_generic_tracer
3
4  ! This file is part of MOM6. See LICENSE.md for the license.
```

Code **Blame** 620 lines (504 loc) · 25.1 KB

```
1  !-----
2  ! <CONTACT EMAIL="GFDL.Climate.Model.Info@noaa.gov"> Niki Zadeh
3  ! </CONTACT>
4  !
5  ! <REVIEWER EMAIL="GFDL.Climate.Model.Info@noaa.gov"> William Cooke
6  ! </REVIEWER>
7  !
8  ! <OVERVIEW>
9  ! This module drives the generic version of tracers TOPAZ and CFC.
10 ! </OVERVIEW>
11 !-----
```



WOMBAT as a “generic tracer”

GFDL “generic_tracer” API is “generic” in the sense that it can be used by different GFDL ocean models

Pros:

- *Modularity*: can use same WOMBAT code in different ACCESS models
- *Testing*: can compare generic WOMBAT to MOM5 version
- *Suite of BGC models*: COBALT, TOPAZ, BLING and more



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But:

- Written under assumption that one is using GFDL’s FMScoupler
- Specifically, use FMS coupler types to handle surface tracer fluxes



Coupled tracer fluxes in FMScoupler

Three coupler data structures carried by FMScoupler:

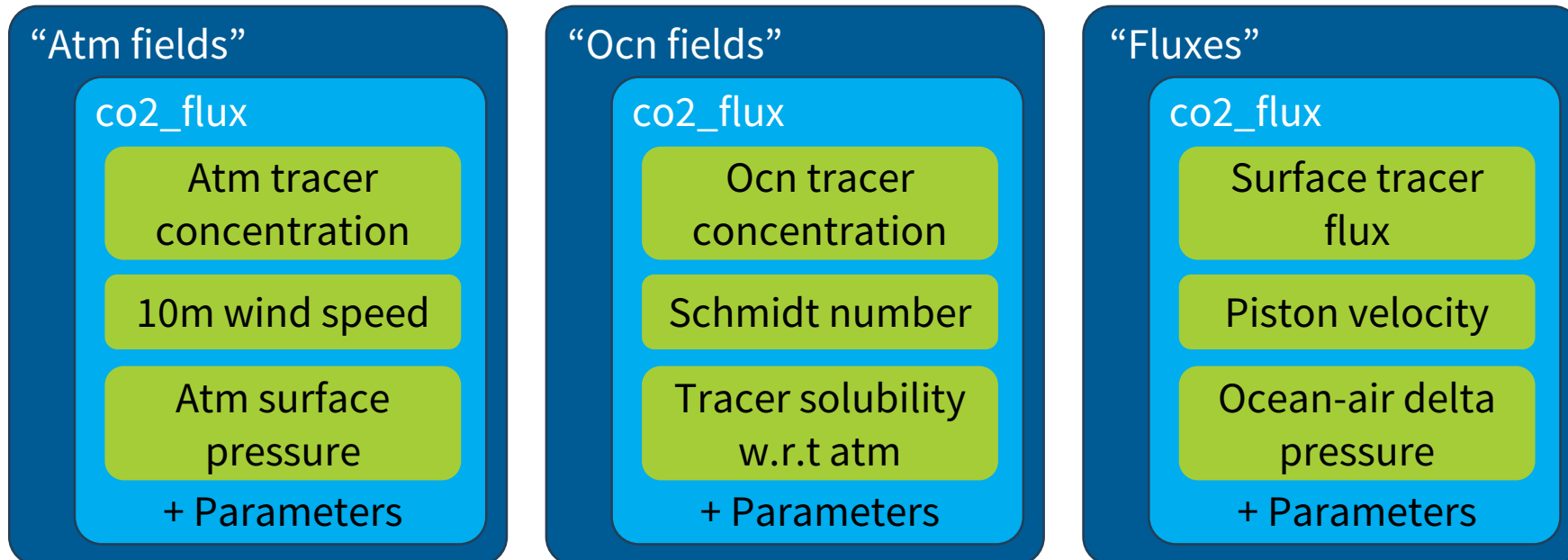
1. “Atm fields” structure for atmospheric surface fields and related parameters
2. “Ocn fields” structure for ice top/ocean surface fields and related parameters
3. “Fluxes” structure for tracer fluxes and related fields computed from 1. and 2.

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E.g. air-sea gas exchange of CO₂ using OCMIP2 method





Generic tracers in MOM6 with NUOPC

We've modified the MOM6 NUOPC cap to:

- **Initialise** FMS coupler **data structures** for tracer atm fields, ocn fields and fluxes required by generic tracer module
- **Populate** the required **atm fields** from arrays received from the coupler
- **Calculate** the required tracer **fluxes**
- Also include **override** capability

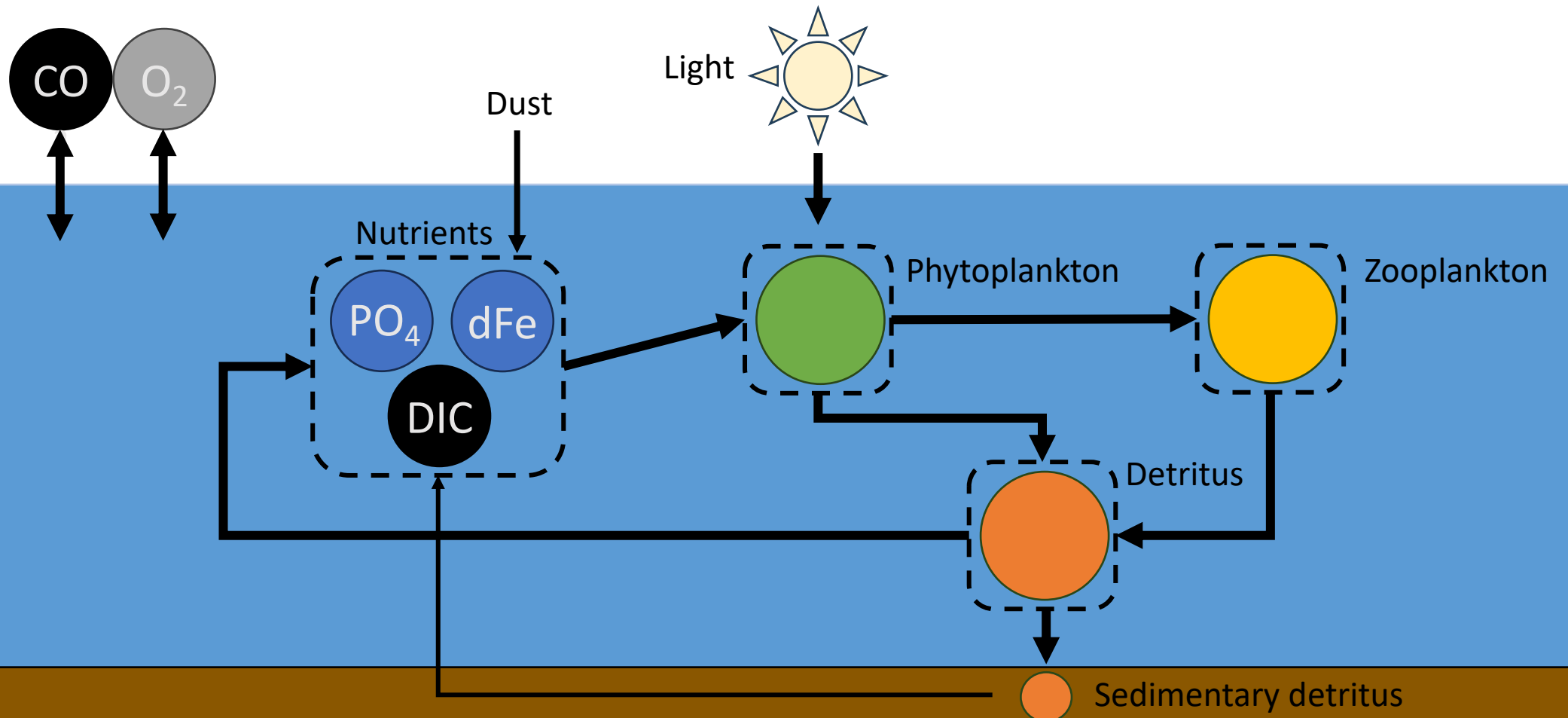
Outstanding issues:

- Generic tracer API is restrictive, e.g. no generic tracer API for applying virtual flux corrections
- FMS coupler data structures are restrictive, e.g. coupling sea-ice BGC

WOMBAT developments

(Pearse Buchanan, CSIRO)

- **CMIP6-era WOMBAT** → “WOMBATlite”

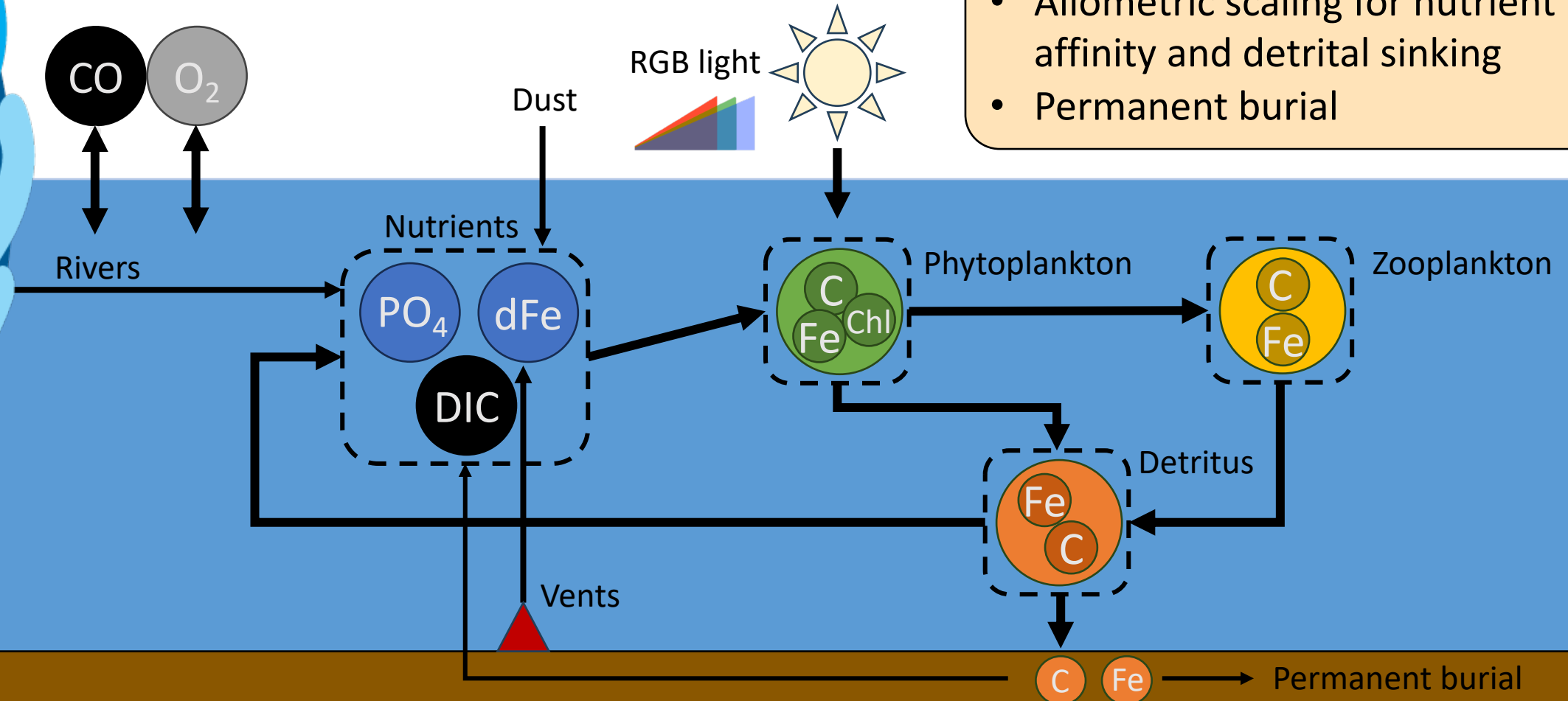


WOMBAT developments

(Pearse Buchanan, CSIRO)

- CMIP6-era WOMBAT → **“WOMBATlite”**

- RGB light scheme
- Updated Fe cycle
- Explicit Chl:C and Fe:C ratios
- Allometric scaling for nutrient affinity and detrital sinking
- Permanent burial

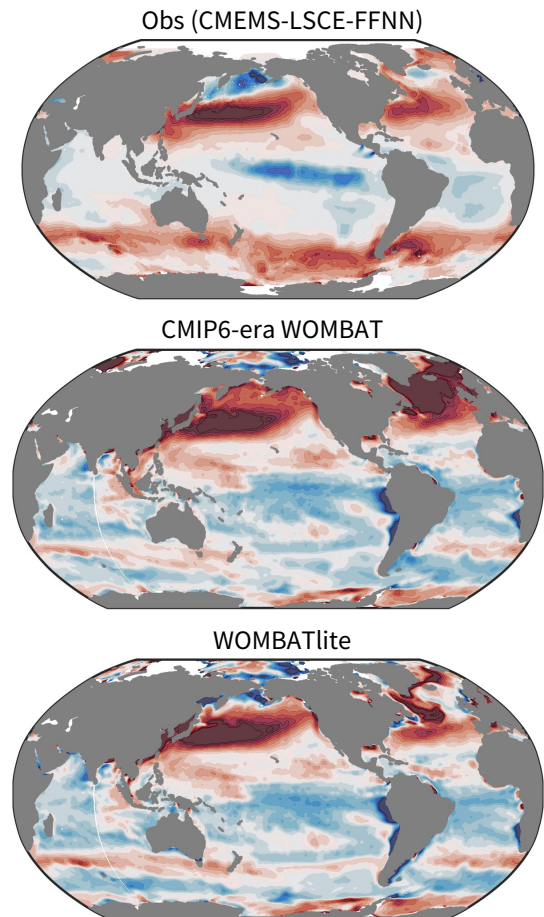


WOMBAT developments

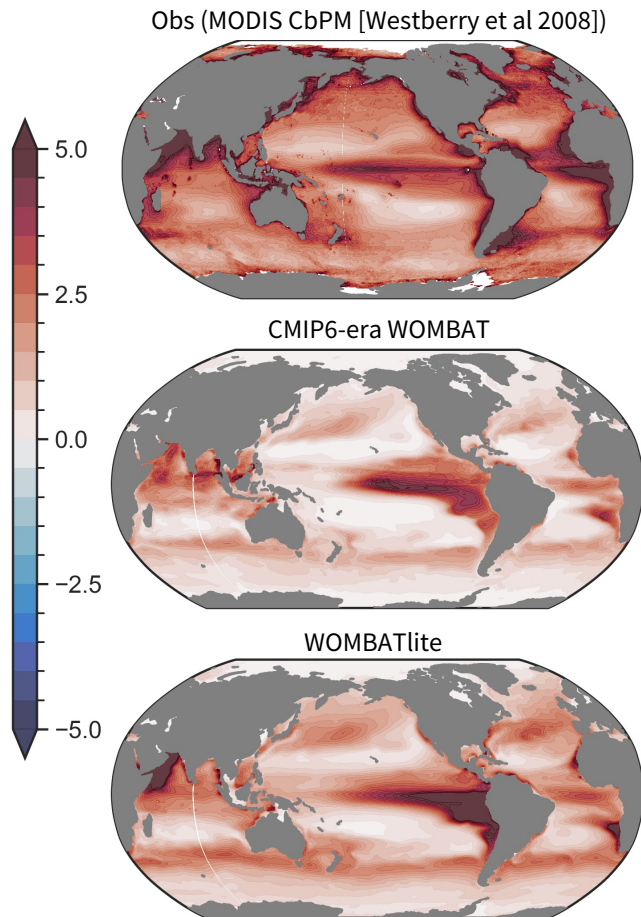
(Pearse Buchanan, CSIRO)

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DJF air-sea CO₂ flux [mol m⁻² yr⁻¹]



Annual integrated NPP [mg C m⁻² day⁻¹]



Annual surface dFe [μmol m⁻³]

