Metos3D

`model`

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1 Model interface

Metos3D [3] can be coupled to every (biogeochemical) model that conforms to the following interface:

```
subroutine metos3dbgc(ny, nx, nu, nb, nd, q, t, dt, x, dx, y, u, b, d)
    integer :: ny          ! tracer count
    integer :: nx          ! layer count
    integer :: nu          ! parameter count
    integer :: nb          ! boundary condition count
    integer :: nd          ! domain condition count
    real*8  :: q(nx, ny)   ! bgc model output
    real*8  :: t           ! point in time
    real*8  :: dt          ! ocean time step
    real*8  :: x(nx)       ! point in space
    real*8  :: dx(nx)      ! ocean step widths
    real*8  :: y(nx, ny)   ! bgc model input
    real*8  :: u(nu)       ! parameters
    real*8  :: b(nb)       ! boundary conditions
    real*8  :: d(nx, nd)   ! domain conditions
end subroutine
```

The interface decouples biogeochemical models and driver routines (ocean circulation, forcing, geometry) programmatically. It gives you the possibility to provide a free number of tracers, parameters, boundary and domain conditions. It suits well an optimization as well as an Automatic Differentiation (AD) context.

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Listing 1: Fortran 95 implementation of the coupling interface for biogeochemical models.

```
subroutine metos3dbgc(ny, nx, nu, nb, nd, dt, q, t, y, u, b, d)
    integer :: ny, nx, nu, nb, nd
    real*8  :: dt, q(nx, ny), t, y(nx, ny), u(nu), b(nb), d(nx, nd)
end subroutine
```

The interface changed slightly since it was introduced for the first time. You can find the old version in the appendix. A more detailed description of the available models can be found at [3].

References

[1] Stephanie Dutkiewicz, Andrei P. Sokolov, Jeffery Scott, and Peter H. Stone. A three-dimensional ocean-seaice-carbon cycle model and its coupling to a two-dimensional atmospheric model: Uses in climate change studies. Technical Report 122, MIT Joint Program on the Science and Policy of Global Change, Cambridge, 2005.

[2] J. Marshall, A. Adcroft, C. Hill, L. Perelman, and C. Heisey. A finite-volume, incompressible navier stokes model for studies of the ocean on parallel computers. *Journal of Geophysical Research*, 102:5753–5766, 1997.

[3] J. Piwonski and T. Slawig. Metos3d: the marine ecosystem toolkit for optimization and simulation in 3-d – part 1: Simulation package v0.3.2. *Geoscientific Model Development*, 9(10):3729–3750, 2016.

A Depricated BGC API

Listing 1 shows the BGC API as it was introduced for the first time in [3]. This form is now **deprecated**.