Computational Green Ocean Sustainability

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Algorithmic Optimal Control – CO\textsubscript{2}-Uptake of the Ocean
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Sustainable Software Development

- Origin: Future Ocean, Sustainable Ocean
- Idea: Make research in ocean sustainability sustainable as well
- In the field of numerical experiments, make software sustainable
- How? Make software development sustainable

However, scientific software is special
  - either it’s result-oriented, one-time usage for publication
  - or it’s a huge monolithic block with decades of development
For instance,

- Investigation of the \( \text{CO}_2 \)-uptake of the ocean requires
- High-resolution simulation of marine ecosystem models
- Within the Paleo Modelling (PalMod) project we use the
  - Max Planck Institute for Meteorology Earth System Model (MPIESM)
  - Including the HAMburg Ocean Carbon Cycle (HAMOCC)
  - Consists of 887,496 lines of code
- Strategies for transition to sustainable software needed
Proof of concept for the biogeochemical component of earth system models

- We introduced an application programming interface (API) for biogeochemical (BGC) models:

  subroutine bgc(ny, nx, m, nb, nd, dt, q, t, y, u, b, d)
  integer :: ny, nx, m, nb, nd
  real(8) :: dt, q(nx, ny), t, y(nx, ny), u(m), b(nb), d(nx, nd)
  end subroutine

- We extracted HAMOCC from the MPIESM, coupled it to an off-line transport and gained a speedup factor of 30

- More, during the poster session