The ICON-based Earth system model MPI-ESM-2 for CMIP6

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Outline

- MPI-ESM-2
    - Model Components and Resolution
- Roadmap
    - Current development work
    - Practicalities
- Summary

MPI-ESM-2 – Model components

- Atmosphere
  - ICON dynamics with physics equivalent to ECHAM6.3
- Land
  - JSBACH4 for land physics, vegetation and C-cycle
  - HD model for water discharge to ocean
- Ocean
  - ICON ocean dynamics with physics equivalent to MPIOM
  - AWI/FESOM sea ice model adapted for ICON
  - HAMOCC for marine biogeochemistry
- Coupler
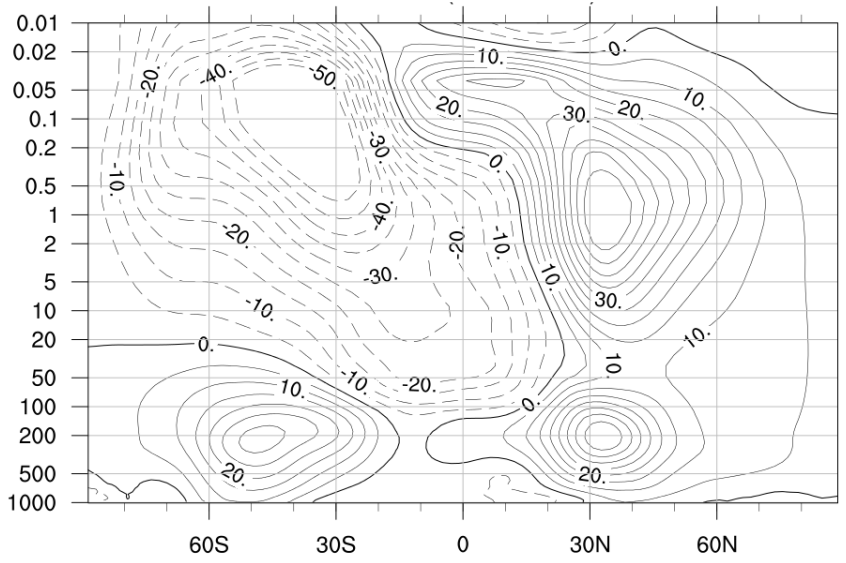 - YAC for: atmosphere ↔ ocean and land → ocean
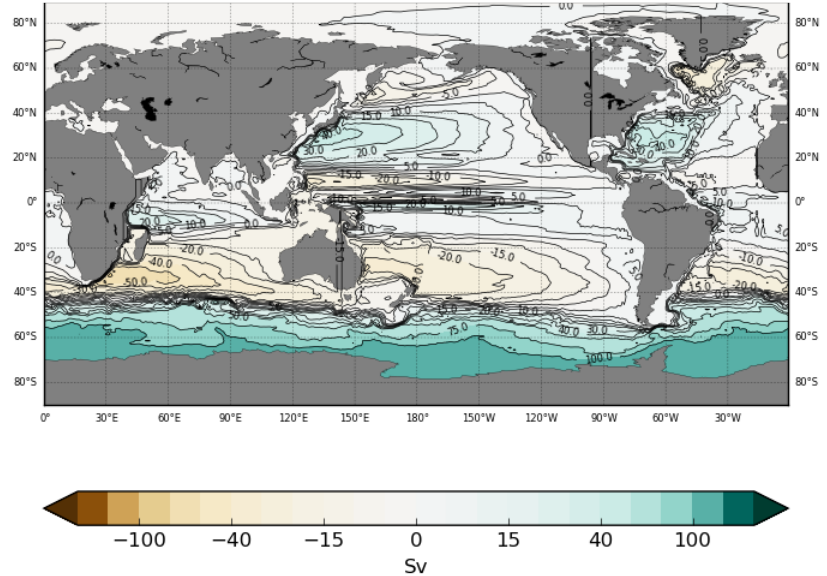
MPI-ESM-2 – Resolution

- Target resolution for CMIP6

    – Atmosphere: 160 km + 47 layers

    – Land: 160 km +   5 layers

    – Ocean: 40 km + 64 layers

- Atmospheric resolution similar to ECHAM6-LR

- The ocean resolution similar to MPIOM-HR

- Matching grids:

    – The ocean grid is derived from the atmospheric grid by two
       more refinement steps yielding a 4x better resolution.

    – Over open ocean 16 ocean columns are covered
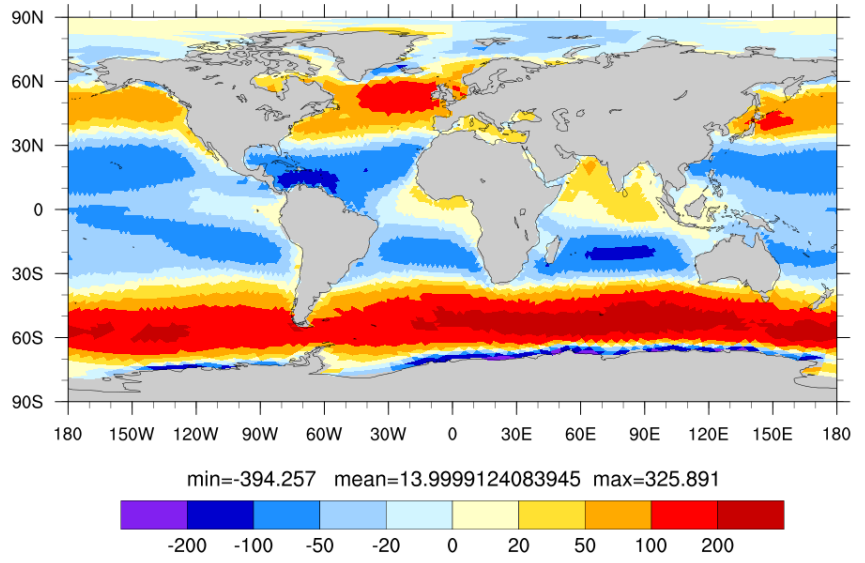   exactly by 1 atmospheric column.

AMIP@160km: U [m/s] in DJF, 30yr

YAC: Tau$_U$ [mN/m^2], annual

min=-394.257   mean=13.9999124083945   max=325.891

OMIP@40km: Psi [SV]
after 200 years

Sv

MPI-ESM-2 – Roadmap

- Started in October 2015 based on "1.0.00" versions of ICON atmosphere, land and ocean.

- Aims at 1st version MPI-ESM-2.00 in Nov. 2016 by way of a series of preliminary versions "pre01" to "pre05".

- Current work:

  - "pre03": Improve atmosphere + ocean params.

  - "pre04": Add C-cycle + surface tiles

    - Tile based surface coupling for fractional water, ice, and land coverages

    - C-cycle processes in land + coupling to atmosphere

    - Coupling of HAMOCC to atmosphere

  - To be followed by "pre05": tuning

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MPI-ESM-2 – Practicalities

- Turnover on Mistral 1 for physical model (no C-cycle)
    - 32 nodes for ocean + sea ice
    - 24 nodes for atmosphere + land
    - 30-40 years sim. / 24 h wall clock
- Forcing data for DECK, historical, scenarios etc.
    - Construction ongoing, as for MPI-ESM-1.2.
- Output structure
    - On model grid or re-mapped lon-lat grid?
    - To be processed by tools developed at DKRZ

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Summary

- Develop the new ICON-based Earth System Model MPI-ESM-2 is under way.

- Test of the physical coupled system have been integrated with some simplifications up to 200 years.

- Completion of the coupling (tiles) and the model (C-cycle) is ongoing.

- Target for a 1st tuned MPI-ESM-2.00 is Nov. 2016

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