Coupled models
at the Max Planck Institute for Meteorology
- Current Status and Strategies -

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- MPI – Earth System Model Version 1
- Development Plans
- MPI – Earth System Model Version 2
MPI – ESM Version 1

MPI-ESM1: COSMOS

- ECHAM6 – JSBACH – MPIOM¹ – HAMOCC – OASIS3
- ECHAM6 – JSBACH – MPIOM¹ – OASIS3
- ECHAM6 – JSBACH
- MPIOM¹ – HAMOCC
- MPIOM¹

Horizontal and vertical resolutions

ECHAM6/JSBACH
- T31L19
- T63L47
- T127L95
- T255L199

MPIOM/HAMOCC
- GR30L40
- GR15L40
- TP10L40
- TP04L40
- TP04L80
- TP6ML80

¹ MPIOM: ocean component including sea ice
Coupling with OASIS3

OASIS3 (CERFACS parallel version)
up to 21 coupling fields (using up to 21 OASIS3 processes)

exchange with OASIS3 via component root processes
(mainly for historical reasons)

Interpolation

Conservative remapping (fracarea, first)
• extrapolation of sending fields on the atmosphere side
• some fields with global conservation

Time Average

• locally on each process outside the prism_put_proto
MPI – ESM Version 1

MPIOM “TriPolar” Grid
Interpolation
Interpolation
Interpolation
### MPI – ESM Version 1

#### Interpolation

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Max-Planck-Institut für Meteorologie
Development plans

MPI Earth System Model

MPIOM → OASIS3 → ECHAM6

HAMOCC → Sea Ice

JSBACH
Development plans

Coupled configuration on IBM Power 6

ECHAM/JSBACH

T127L95: 24 x 32 MPI processes, 2 OpenMP threads per MPI process

MPIOM/HAMOCC

TP04L40: 2 x 64 MPI processes
TP40L80: 5 x 64 MPI processes

Coupling frequency: 1/day

Cost of coupling (prism_put/prism_get plus pre- and postprocessing): ~2.5% of total wallclock time
Development plans

MPI Earth System Model

- MPIOM
- OASIS3
- ECHAM6
- HAMOCC
- Sea Ice
- JSBACH

Development Plans

Max-Planck-Institut für Meteorologie
Development plans

MPI Earth System Model

- MPIOM
- HAMOCC
- Sea Ice
- OASIS4
- ECHAM6
- JSBACH

Work in progress
Development plans

MPI-ESM2: ICON

- Icosahedral grid
- Strategies for coupling ICON

- new dynamical core
- new software environment
- coding rules
- …
Development plans

MPI Earth System Model

MPIOM → OASIS → ECHAM6

HAMOCC  Sea Ice

JSBACH
Development plans

MPI Earth System Model

- ICON ocean
- HAMOCC
- Sea Ice
- ICON Coupler
- ICON atmosphere
- JSBACH

Development Plans

MPI-ESM1 ● Development Plans ● MPI-ESM2
Development plans

MPI Earth System Model

ICON ocean ➔ OASIS4 ➔ ICON atmosphere

HAMOCC ➔ Sea Ice

JSBACH
Development plans

- ICON atmosphere
- JSBACH
- OASIS4
- ICON ocean
- HAMOCC
- Sea Ice
- Ocean
MPI – ESM Version 2

Refinement

L. Linardarkis
Grid and Dual Grid

L. Linardakis
“Spring Dynamics”
ICON atmosphere is a joined project with the DWD

ICON ocean is developed at the MPI-M

The grid hierarchy of the ICON ocean and ICON atmosphere starts from identical base grids

First step towards coupling
- Search and exchange is based on common grid point indices
- Spring dynamics does not effect the initial search but require interpolation

With local refinement, search may still be based on the quasi-common coarse grid plus additional knowledge about the internal data structure

Implementation of the above as ICON coupler

Transfer of functionality and API into OASIS if possible

Use OASIS4 for coupling of ICON components to other models
Summary

MPI-M is in a transition phase in moving towards a new Earth system model.

A first simple and customized coupling approach (due to time constraints)

- Test bed to define and develop the API
- Test bed to develop other required functionality

Transfer of the above development steps to OASIS4