

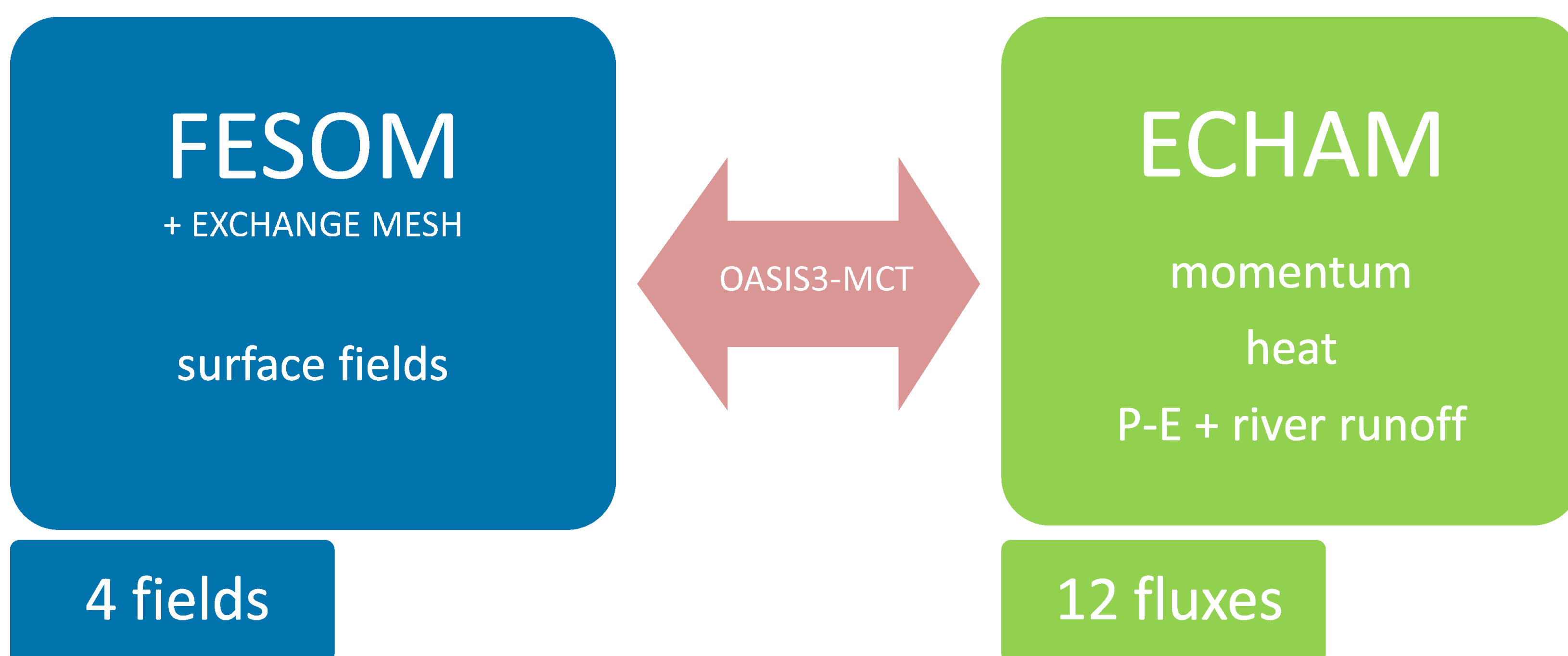
Tido Semmler, Thomas Rackow, Dmitry Sidorenko, Qiang Wang, Xuezu Wang, Sergey Danilov, Thomas Jung, Wolfgang Dorn, Dörthe Handorf, Klaus Dethloff, Wolfgang Hiller and Dirk Barbi

Summary

- ✓ We develop a global configuration of a coupled atmosphere/ocean model. ECHAM is the atmospheric component, the Finite-Element Sea-Ice Ocean Model (FESOM) is the ocean component.
- ✓ Ocean component (FESOM) allows for variable resolution (possible to downscale regions of interest, resolve narrow straits and coastlines)
- ✓ Two configurations currently exist:

1. FESOM/ECHAM5 coupled via the parallel OASIS4 coupler
 - ✓ validated for long runs with T63/L31 atmosphere and ocean resolution from 200 to 20km
2. FESOM/ECHAM6 coupled via the parallel OASIS3 MCT coupler
 - ✓ stably running but not yet validated for longer runs²

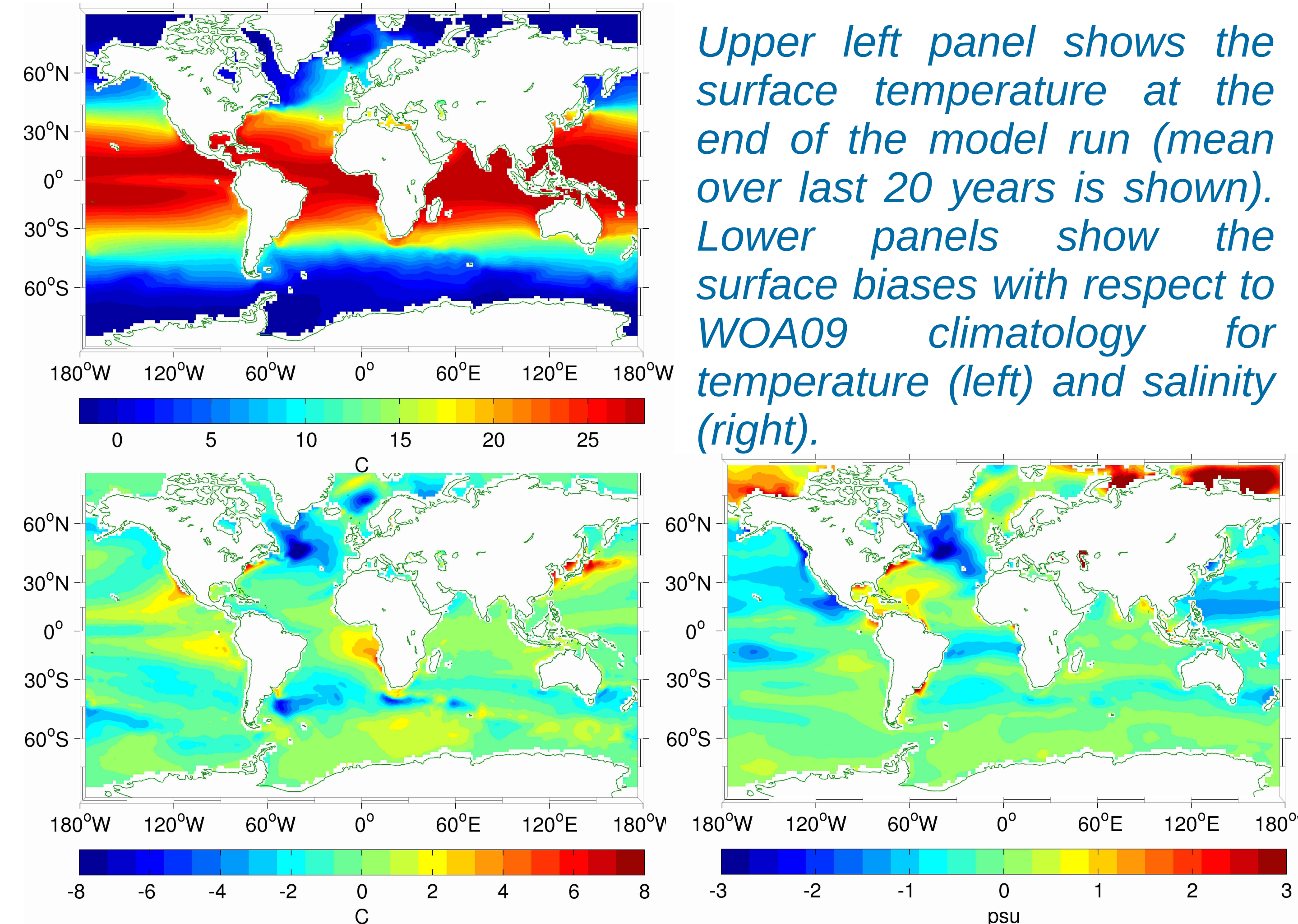
Coupling strategies/solutions



- ✓ All fluxes (and their net values) are computed in the atmospheric component
- ✓ OASIS provides exchange between atmospheric and ocean meshes (+time management)
- ✓ The fluxes are used by FESOM to drive the ocean
- ✓ Updated ocean fields are passed back to ECHAM via OASIS

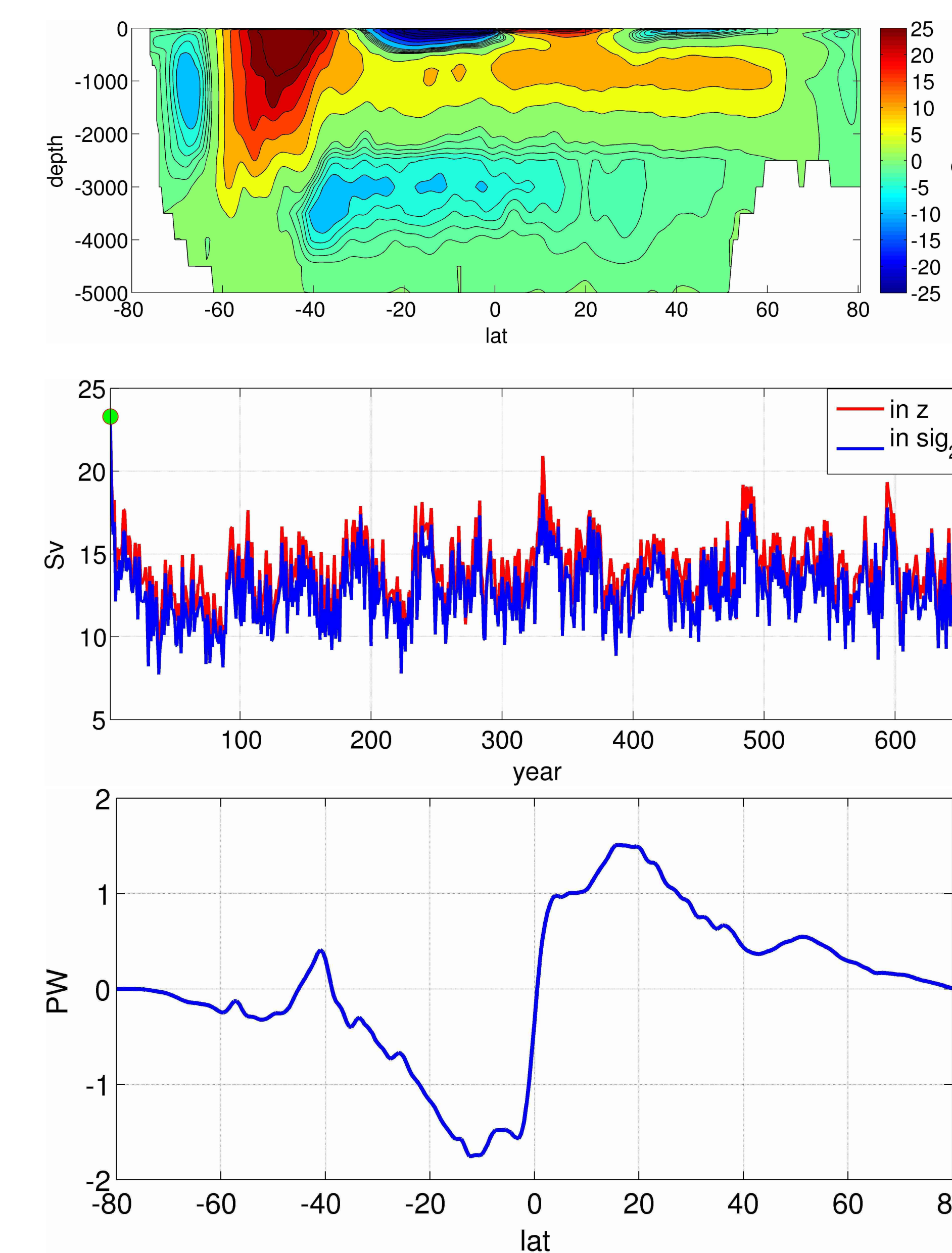
Coupling between structured (ECHAM) and unstructured (FESOM) meshes (different geometry, resolution and flux formalisms) requires flux error redistribution. Fluxes are adjusted on the ocean side to provide the same net values as suggested by ECHAM (we redistribute the interpolation error accounting for the spatial variance of the original field)

Validation



	t2m	msl	qnet	tp	ewss	nsss	SST	SSS	SICE	T	U	V	Q
var	17.5	2.5	30	30	13	6.7	29	0.5	3.2	24	7	7	8
IND	0.7	0.2	2	0.8	3.2	2.1	1.7	2.5	0.1	0.6	0.6	0.86	0.3

Performance index according to Reichler and Kim (2008). Upper row: Global average of error variance normalized with variance of observations at each grid point for 2 m temperature (t2m), mean sea level pressure (msl), net surface heat flux (qnet), zonal and meridional wind stress (ewss and nsss), SST, SSS, sea ice concentration (SICE), zonally averaged T, U, V and Q. Lower row: Values normalized with mean performance of CMIP3 models.



Upper panel shows the global meridional overturning circulation (MOC) at the end of the model run (mean over last 20 years is shown). Middle panel depicts the timeseries of the Atlantic MOC maximum at 45N°. The lower panel shows the northward heat transport.

Running configuration

ECHAM6

FESOM

OASIS3 MCT

Ocean domain seen by ECHAM6 (left) and FESOM (right).

Resolution

ECHAM: T63L47 (ca. 1.9°x1.9°)
FESOM: variable resolution from 100 to 20km (50,000 surface nodes)

Resources

ECHAM: 128 CPUs
FESOM: 128 CPUs

Performance
ca. 15 years per day