

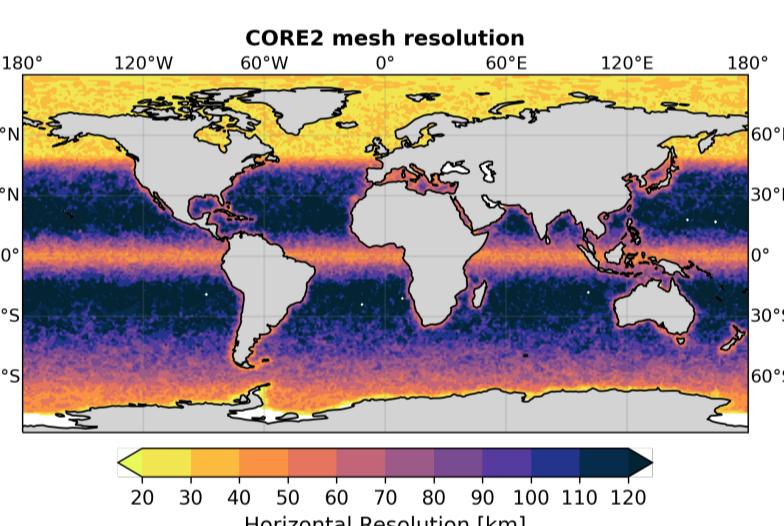
Warming Climates across time scales with AWI-ESM3

Motivation

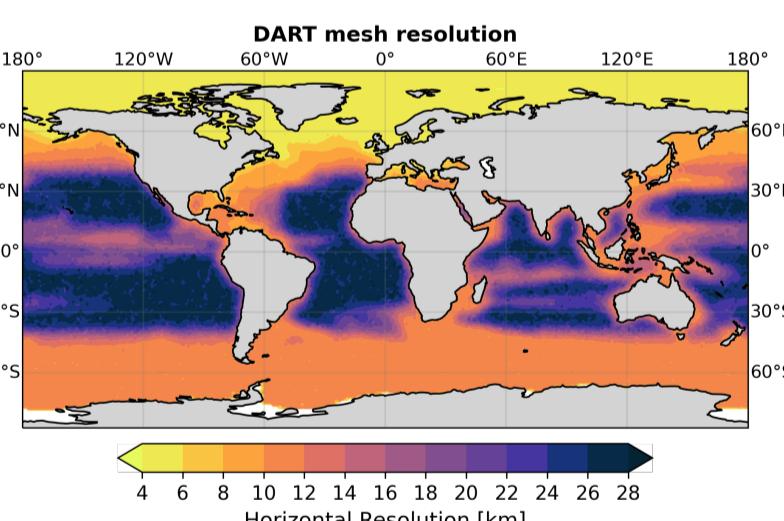
- Current AWI-CM3 model performing better compared to CMIP6 ensemble (Streffing et al., 2022)
 - Development of our Earth System Model
 - Dynamic Vegetation
 - Improved ocean model version
 - Compatible with warming climates setup

Model Setup

- FESOM2.5 ocean + OpenIFS 43
 - Mesh CORE II+TC95L91



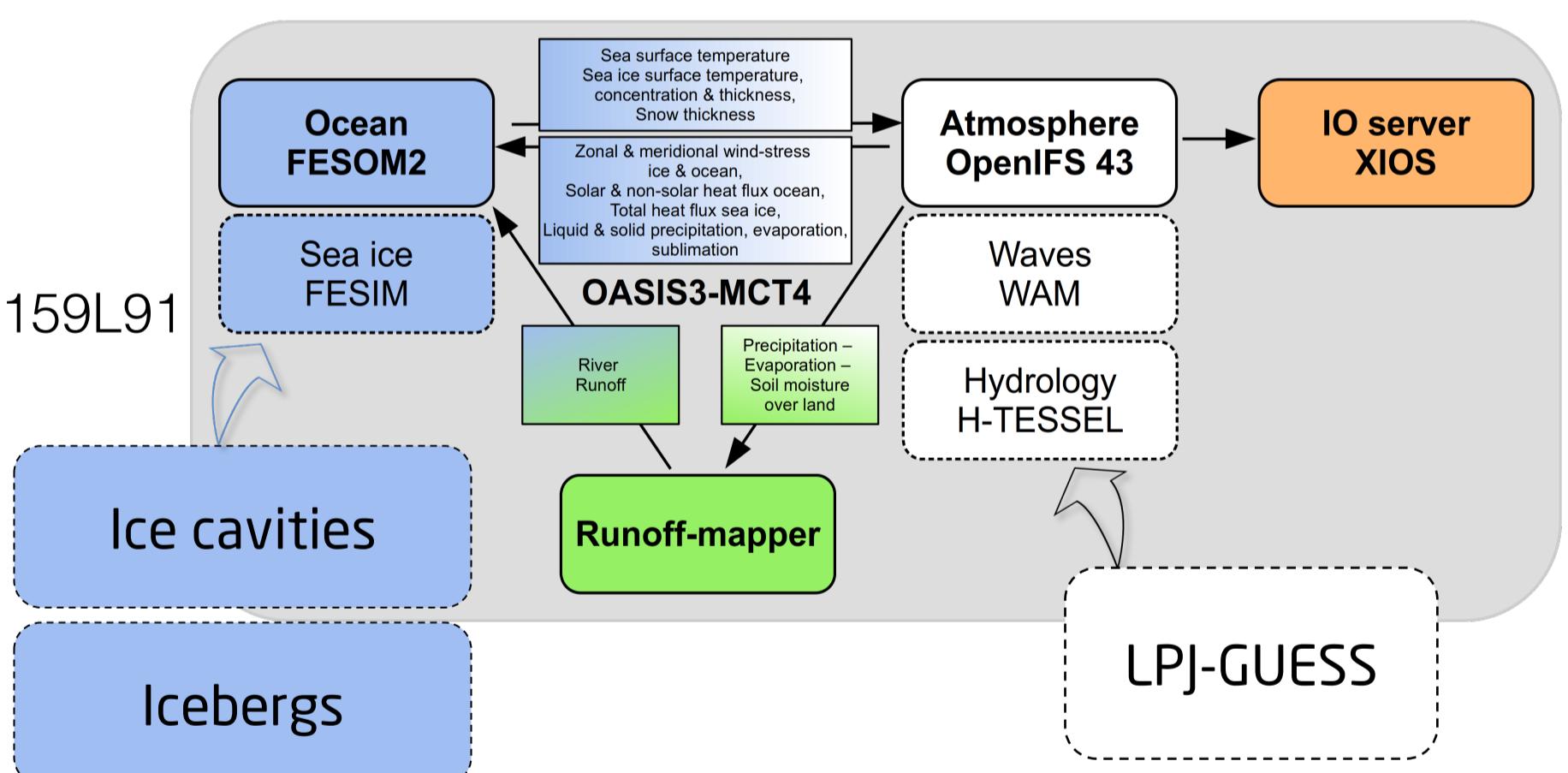
- Future setup: Mesh DART+TCo159L91



AWI-CM3.1_SPP CMPI: 0.895

| | arctic MAM | arctic JJA | arctic SON | arctic DJF | northmid MAM | northmid JJA | northmid SON | northmid DJF | tropics MAM | tropics JJA | tropics SON | tropics DJF | nino34 MAM | nino34 JJA | nino34 SON | nino34 DJF | outhmid MAM | outhmid JJA | southmid SON | southmid DJF | southarctic MAM | southarctic JJA | southarctic SON | southarctic DJF |
|----------|------------|------------|------------|------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|------------|------------|------------|------------|-------------|-------------|--------------|--------------|-----------------|-----------------|-----------------|-----------------|
| siconc | 1.40 | 0.68 | 0.48 | 1.26 | 0.81 | 1.09 | 1.00 | 0.80 | | | | | | | | | 0.85 | 1.08 | 0.88 | 0.98 | 0.90 | 0.49 | 0.52 | 0.79 |
| tas | 1.62 | 0.64 | 0.76 | 1.27 | 0.91 | 0.71 | 0.74 | 0.90 | 0.94 | 0.98 | 0.89 | 0.95 | 1.36 | 2.47 | 1.69 | 1.03 | 0.81 | 0.71 | 0.70 | 0.85 | 0.70 | 0.35 | 0.52 | 0.43 |
| clt | 1.01 | 1.20 | 1.24 | 1.17 | 0.69 | 0.79 | 0.67 | 0.76 | 0.81 | 0.78 | 0.63 | 0.68 | 0.81 | 0.44 | 0.66 | 0.67 | 0.82 | 0.79 | 0.72 | 0.87 | 1.01 | 1.00 | 0.82 | 0.81 |
| pr | 0.68 | 0.68 | 0.88 | 1.00 | 0.81 | 1.21 | 1.07 | 0.99 | 1.05 | 1.00 | 0.86 | 0.82 | 1.47 | 0.97 | 1.01 | 1.11 | 1.35 | 0.77 | 1.10 | 1.31 | 0.80 | 0.82 | 0.86 | 0.81 |
| rlut | 1.48 | 1.19 | 1.12 | 1.22 | 1.10 | 0.66 | 0.68 | 1.01 | 1.13 | 1.08 | 0.93 | 0.87 | 1.55 | 0.91 | 0.85 | 1.10 | 0.58 | 0.96 | 0.87 | 0.45 | 0.70 | 1.00 | 0.84 | 1.08 |
| uas | 0.60 | 0.80 | 0.57 | 0.81 | 0.63 | 0.77 | 0.41 | 0.56 | 1.04 | 0.86 | 0.82 | 0.87 | 1.45 | 1.37 | 0.54 | 1.05 | 0.83 | 0.76 | 0.82 | 0.54 | 0.53 | 0.47 | 0.50 | 0.48 |
| vas | 0.68 | 0.70 | 0.63 | 0.73 | 0.61 | 0.68 | 0.54 | 0.62 | 0.95 | 0.87 | 0.78 | 0.78 | 1.21 | 1.64 | 0.86 | 0.70 | 0.67 | 0.81 | 0.65 | 0.52 | 0.56 | 0.53 | 0.50 | 0.51 |
| 00hPa ua | 0.59 | 0.96 | 0.59 | 0.66 | 0.69 | 1.08 | 0.51 | 0.66 | 0.83 | 0.70 | 0.65 | 0.71 | 0.54 | 0.77 | 0.48 | 0.61 | 0.64 | 0.77 | 0.96 | 0.56 | 0.74 | 0.58 | 0.61 | 0.71 |
| 00hPa zg | 0.43 | 0.47 | 0.56 | 0.35 | 0.64 | 0.35 | 0.26 | 0.63 | 0.50 | 0.56 | 0.27 | 0.60 | 0.67 | 0.61 | 0.30 | 0.66 | 0.46 | 1.30 | 1.26 | 0.32 | 0.24 | 0.64 | 0.40 | 0.19 |
| dev. zos | 0.64 | 0.45 | 0.63 | 0.62 | 0.90 | 0.96 | 0.92 | 0.90 | 1.08 | 1.05 | 1.09 | 1.11 | 1.43 | 1.57 | 1.80 | 1.86 | 0.95 | 0.98 | 0.99 | 0.98 | 0.90 | 0.81 | 0.97 | 0.97 |
| dev. tos | 1.25 | 1.10 | 1.13 | 1.23 | 1.20 | 1.94 | 1.63 | 1.38 | 1.30 | 1.27 | 1.08 | 1.46 | 0.28 | 0.32 | 0.26 | 0.39 | 1.85 | 1.12 | 0.98 | 1.99 | 1.82 | 0.82 | 0.97 | 1.83 |
| mlotst | 0.93 | 0.45 | 0.59 | 0.94 | 2.93 | 0.55 | 0.77 | 2.48 | 1.41 | 1.06 | 1.66 | 1.05 | 0.54 | 0.72 | 0.79 | 0.64 | 0.58 | 2.30 | 3.18 | 1.13 | 1.00 | 2.57 | 1.34 | 0.36 |
| m thetao | 1.09 | 1.00 | 0.83 | 1.06 | 0.91 | 0.81 | 0.72 | 0.90 | 1.09 | 1.18 | 1.03 | 0.93 | 1.57 | 2.08 | 1.45 | 1.26 | 1.00 | 0.93 | 0.92 | 1.00 | 1.29 | 0.77 | 0.82 | 1.43 |
| m thetao | 0.89 | 0.87 | 0.86 | 0.84 | 1.05 | 1.04 | 1.00 | 1.04 | 1.13 | 1.14 | 1.11 | 1.12 | 0.83 | 0.74 | 1.19 | 1.07 | 0.96 | 1.00 | 1.01 | 0.96 | 1.16 | 1.40 | 1.65 | 1.44 |
| m thetao | 1.31 | 1.31 | 1.31 | 1.31 | 0.47 | 0.47 | 0.48 | 0.48 | 0.45 | 0.45 | 0.45 | 0.45 | 0.07 | 0.07 | 0.08 | 0.06 | 0.52 | 0.52 | 0.52 | 0.52 | 0.60 | 0.63 | 0.61 | 0.59 |
| 10m so | 0.98 | 0.85 | 0.77 | 0.94 | 0.96 | 0.95 | 0.95 | 0.96 | 0.98 | 0.95 | 0.95 | 0.95 | 0.63 | 0.62 | 0.67 | 0.81 | 0.73 | 0.70 | 0.73 | 0.72 | 0.63 | 0.97 | 0.88 | 0.68 |
| 100m so | 0.41 | 0.43 | 0.45 | 0.42 | 1.16 | 1.18 | 1.15 | 1.16 | 0.94 | 0.95 | 0.94 | 0.95 | 1.11 | 1.06 | 1.07 | 1.08 | 0.78 | 0.75 | 0.75 | 0.77 | 1.42 | 1.42 | 1.40 | 1.44 |
| 000m so | 0.46 | 0.50 | 0.50 | 0.44 | 1.16 | 1.16 | 1.16 | 1.16 | 0.97 | 0.97 | 0.97 | 0.97 | 1.03 | 1.04 | 1.05 | 1.04 | 0.52 | 0.52 | 0.51 | 0.52 | 0.65 | 0.65 | 0.64 | 0.64 |

Improvements



Experiments

1. Pre-Industrial (CMIP6 DECK)
 2. Mid-Holocene, Last Interglacial, Last Glacial Maximum and mid-Pliocene experiments (PMIP4, PlioMIP2)
 3. Historical and future SSP scenarios (CMIP6 DECK and ScenarioMIP)
 4. Higher resolution simulations