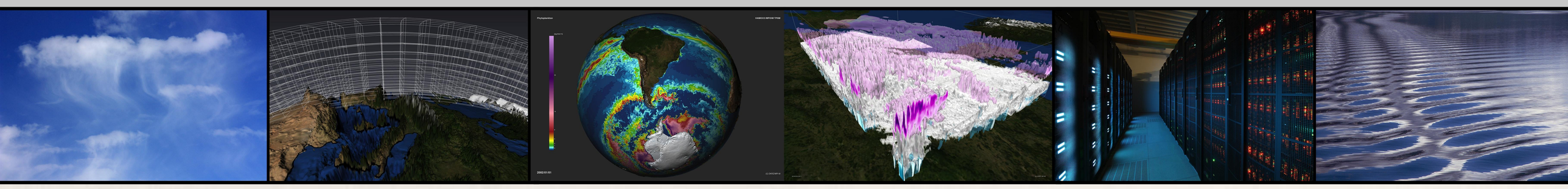
esiwace

CENTRE OF EXCELLENCE IN SIMULATION OF WEATHER AND CLIMATE IN EUROPE

DKRZ DEUTSCHES KLIMARECHENZENTRUM



PROJECT OBJECTIVES

ESiWACE (Sep 2015-Aug 2019) forms a joint scientific community around **Earth System Modelling** (ESM) from the two communities of **Weather** and **Climate** research by leveraging two established European networks:

- The European Network for Earth System Modelling
- The European Centre for Medium-Range Weather Forecasts

This includes joint activities and engagement in research and governance structures and establishing and strengthening user-driven evolution of the community software.

The main objectives of **ESiWACE** are to

- Substantially improve efficiency and productivity of numerical **Weather** and **Climate** simulation on high-performance computing (**HPC**) platforms
- Build a critical mass and create expertise to increase the community impact on hardware development towards the extreme scale as well as future international exascale initiatives

PROJECT IMPACTS

Weather and **Climate** computing has always been amongst the key drivers for **HPC** development, with domain-specific scientific and technical requirements that stretch the capability and capacity of existing software and hardware to the limits.

ESiWACE addresses three core themes on the applications' way towards exascale computing:

- **Scalability** of models and tools at extreme scale
  - Establishing extreme-scale high-resolution demonstrators
  - Single precision tests for numerical weather prediction suggest 40% runtime improvement
  - Code optimisation (vectorisation, communication, etc.)
- **Usability** of **HPC** systems for the ESM workflow
  - Handbooks for application and system software stacks
  - Spack-based solutions for software stack and model deployment
  - Improving robustness and performance of meta-scheduler Cylc
- **Exploitability** of climate data fostering new I/O paradigms
  - Business model development to address cost/benefit balance in data centres
  - Middleware development to alleviate the use of expensive and non-scalable disk resources

ESiWACE impacts the competitiveness of the European **HPC** industry by

- Opening the potential for engendering new products due to Co-Design with the science community
- Providing input regarding limits of extreme-scale test cases on state of the art hardware
- Providing opportunities for exploitation beyond the project itself
- Enhancing the skills base of staff in both industry and academia

THE CONSORTIUM

Coordinator: DKRZ Deutsches Klimarechenzentrum

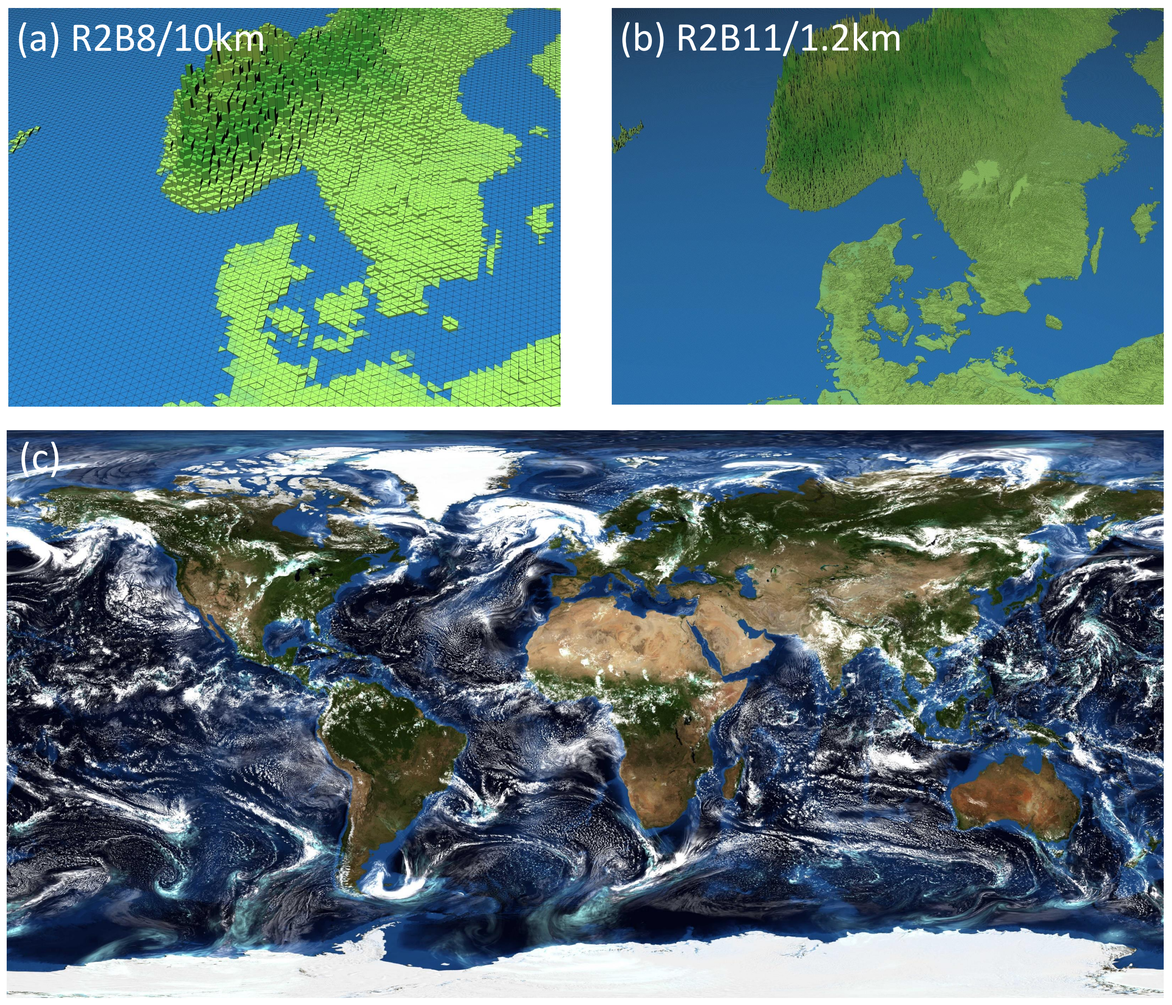
WEATHER: ECMWF; DWD Deutscher Wetterdienst Wetter und Klima aus einer Hand; Met Office; SMHI

CLIMATE: Max-Planck-Institut für Meteorologie; Institut Pierre Simon Laplace; CMCC Centro euro-Mediterraneo sui Cambiamenti Climatici; National Centre for Atmospheric Science Natural Environment Research Council

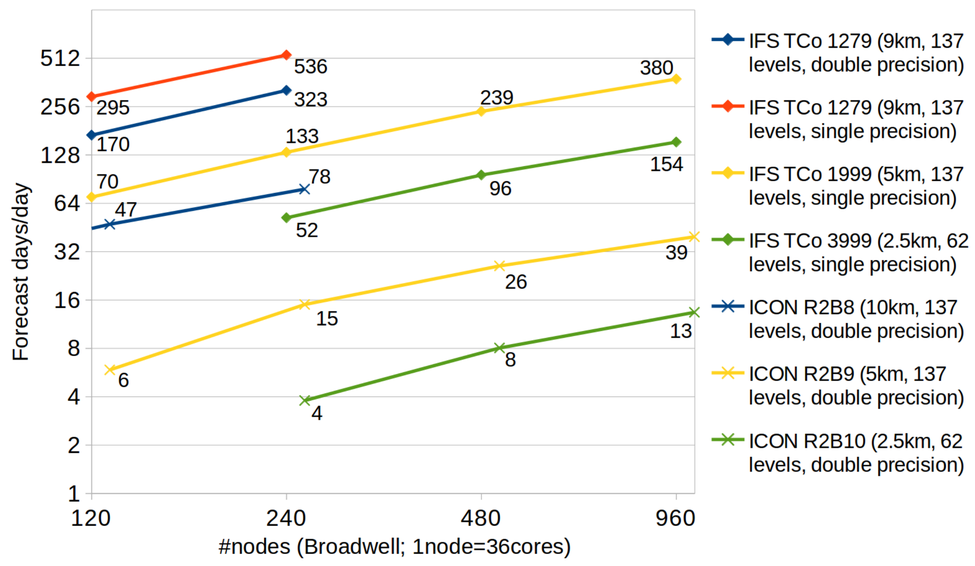
HPC: BSC; Bull atos technologies; Seagate; CERFACS; allinea Now part of ARM; Science & Technology Facilities Council; ICHEC Irish Centre for High-End Computing

THE CENTRAL DELIVERABLE: GLOBAL HIGH-RESOLUTION DEMONSTRATORS

ESiWACE will deliver **global high-resolution demonstrators** of atmosphere-only, ocean-only and coupled ocean-atmosphere simulations; a key target is to reach spatial resolutions (ca. 1 km) that allow simulating convective clouds and small-scale ocean eddies. This will provide much more fidelity in the representation of high-impact regional events. The demonstrators will allow for computability estimates for these configurations at exascale. They are based on widely used European models (IFS, ICON, NEMO, EC-EARTH).



(a)-(b) Extraction from global ICON grids. (c) Global ICON-based weather forecast, run at a resolution of 2.5km.



Scalability of the models IFS and ICON for global high-resolution atmosphere-only predictions (no I/O), suggesting improved through-put at extreme scale (for the 1km case). However, significant effort is required to push the models towards production readiness at these extremely high resolutions (target= ca 365 forecast days/day).

UPCOMING AND RELATED ACTIVITIES

- June 24-28 2018: ISC HPC, Frankfurt/Germany
  - BoF "ESiWACE: What is special about HPC for weather and climate"
  - Session "Tornados, Disaster and Early Warnings"
  - Project poster "ESiWACE"
- July 2-4 2018: PASC, Basel/Switzerland
- November 11-16 2018: Supercomputing, Dallas/USA

ESiWACE Contacts

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