

WGCM 2021 Status Germany



Deutsches Zentrum für Luft- und Raumfahrt, Oberpfaffenhofen



Alfred Wegener Institut für Polar und Meeresforschung,
Bremerhaven



Max Planck Institut für Meteorologie, Hamburg



Deutscher Wetterdienst, Offenbach



Deutsches Klima Rechenzentrum, Hamburg

GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung



Max-Planck-Institut
für Meteorologie

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



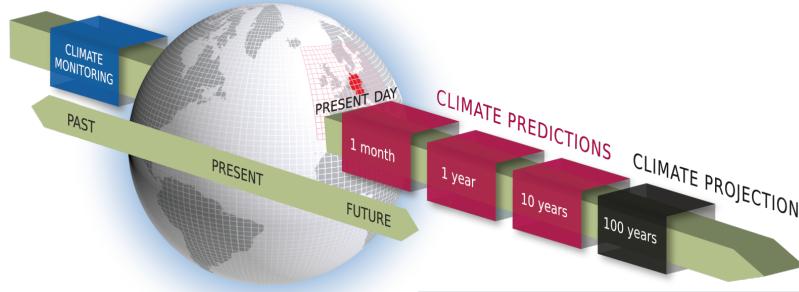
KIT
Karlsruher Institut für Technologie

DKRZ
DEUTSCHES KLIMARECHENZENTRUM

ICON-Seamless

ICON-Seamless =
Model and Data Assimilation for

- ✓ Numerical Weather Prediction (NWP)
 - ✓ Climate Prediction (Seasonal, Decadal)
 - ✓ Climate Projections
-
- One **consistent model** including Atmosphere (ICON-NWP), Ocean (ICON-O), Land (ICON-Land), ICON-ART
 - **Configurations** for different application scenarios well balanced and compatible



Time Line / Milestones

ICON-Seamless **experimental versions**
by 2022

Seasonal and Decadal Prediction pre-operational
by 2024

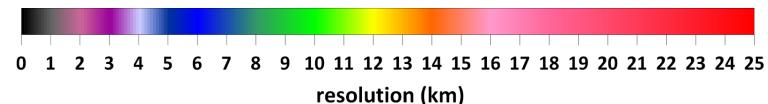
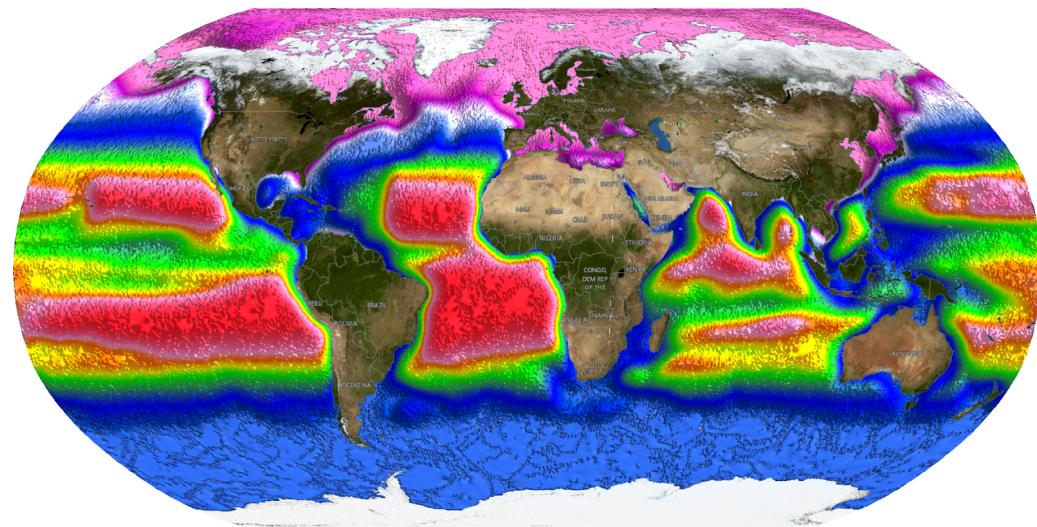
Unified **ICON-Land** for NWP and climate time scales experimental version in 2025

CMIP7

AWI-CM/ESM in CMIP7

- Pushing the boundaries for coupled atmosphere-land-ocean-sea ice modeling (AWI-CM3: OpenIFS FESOM2) regarding resolution
- Pushing the boundaries for earth system modeling (AWI-ESM) regarding components: ice shelf cavities, ice sheets, ocean biogeochemistry, high resolution focused on polar regions
- AWI-CM-HR: DECK, ScenarioMIP, PAMIP
- AWI-ESM-MR: DECK, ScenarioMIP, PMIP

Envisaged CMIP7 ocean
resolution AWI-CM-HR:
13 Mio. surface nodes;
atmosphere resolution: 30 km
5 SYPD possible



Ongoing CMIP6 activities

EMAC

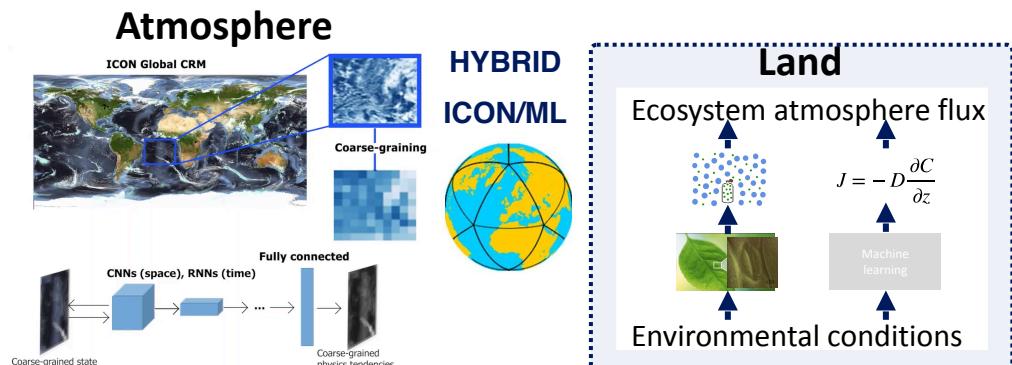
coupled atmosphere – ocean system
with interactive atmospheric chemistry
& aerosol

- major update of the radiation infrastructure
- new PSrad scheme
- improvement in CH₄ forcing
- retuning
- redo CMIP6 simulations with improved model

CMIP7

Development of an EMAC successor based on the **ICON/MeSSy** system

New ERC synergy grant (V. Eyring, M. Reichstein): *Physics-aware machine learning based Earth system modelling*

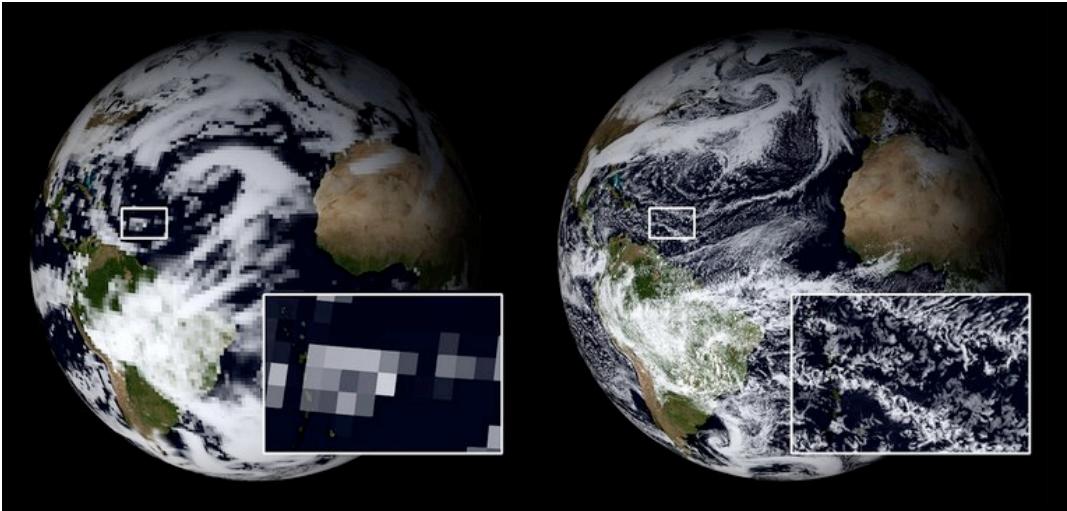




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Next**GEMS**



ICON @ 80km and 5km

EU H2020 **NextGEMS**

- two prototype storm-resolving ESMs (**ICON-A/O, FESOM**, and IFS from ECMWF)
- produce multi-decadal projections of future climate change.

AWI-CM-XR: OpenIFS/FESOM:
globally 3-4 km atm./ocean
ICON-ESM: ICON-A/ICON-O:
globally 2.5-5 km atm./ocean

ESM2025: Earth System Models for the Future

informing an effective operationalisation of the Paris Agreement
connecting Earth system modelling to society

Societal choices, mitigation strategies:

GDP, Population, Technology,
mitigation measures,
carbon-dioxide removal, ...

Emissions:

Anthropogenic GHG and
aerosol emissions, landuse patterns

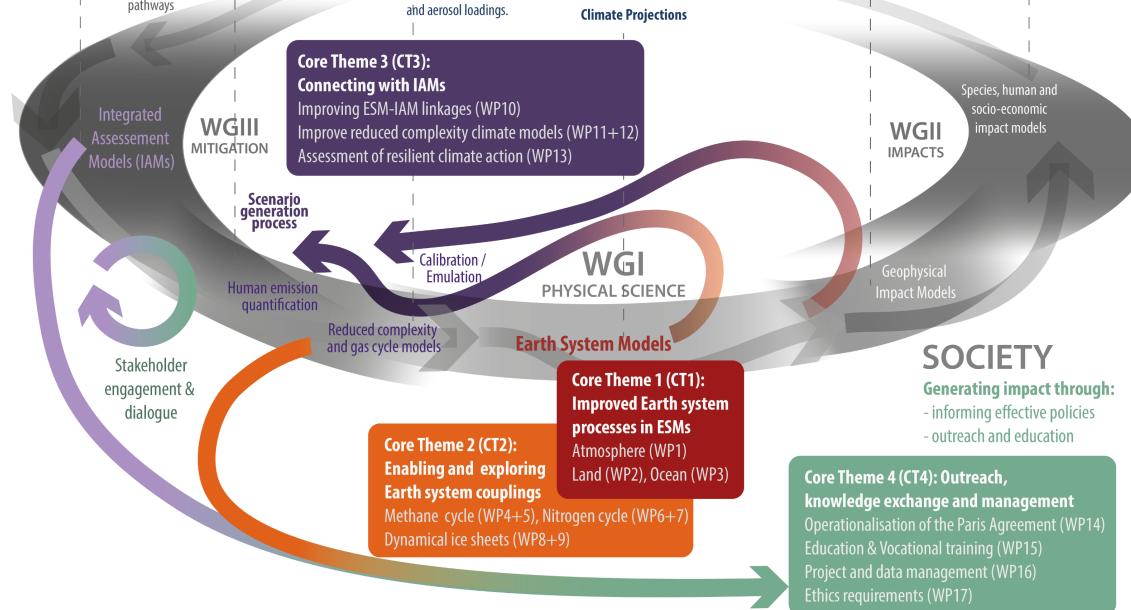
Concentrations:

GHG concentrations,
and aerosol loadings.

Climate Projections

Species-level and Human impacts (incl. infectious diseases, heat stress, species distributions)

Geophysical impacts, constraints (wildlife modelling, water and nutrients scarcity, heatwave, loss of productivity etc.)



EU H2020 ESM2025

- Improving processes realism in ESMs (ICON-ESM)
- Enabling and exploring new couplings between Earth system components
- Connecting with IAMs
- Applications: e.g., operationalisation of the Paris Agreement