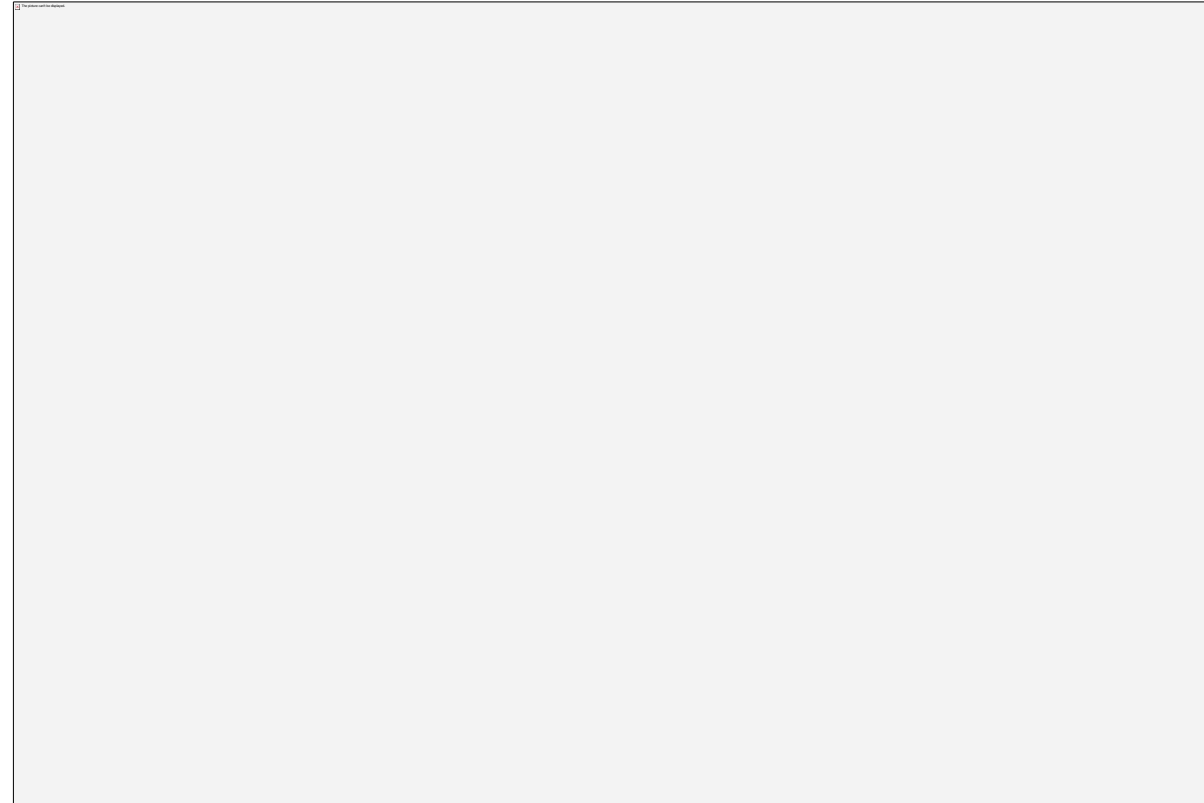


FutureEO Programme - Pioneering world-class science missions for Earth: A science perspective

Global Warming and Climate Change demands actions in Earth System Science & Social science

Observe and predict the essential variables

Loss of Biodiversity - Draught/ Flooding - Acidification - Air quality - Pollution - Deforestation - Food Security - Sea level rise - Sea ice decline - Extremes



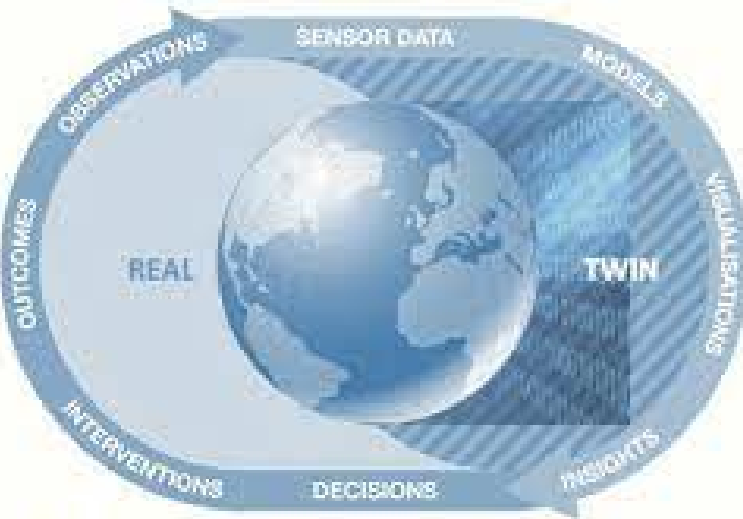
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TAKING THE PULSE
OF OUR PLANET FROM SPACE

living planet
symposium | BONN
23-27 May
2022

World Climate Research Programme (WCRP): Grand Challenges



Melting Ice and Global Consequences

Clouds, Circulation and Climate Sensitivity

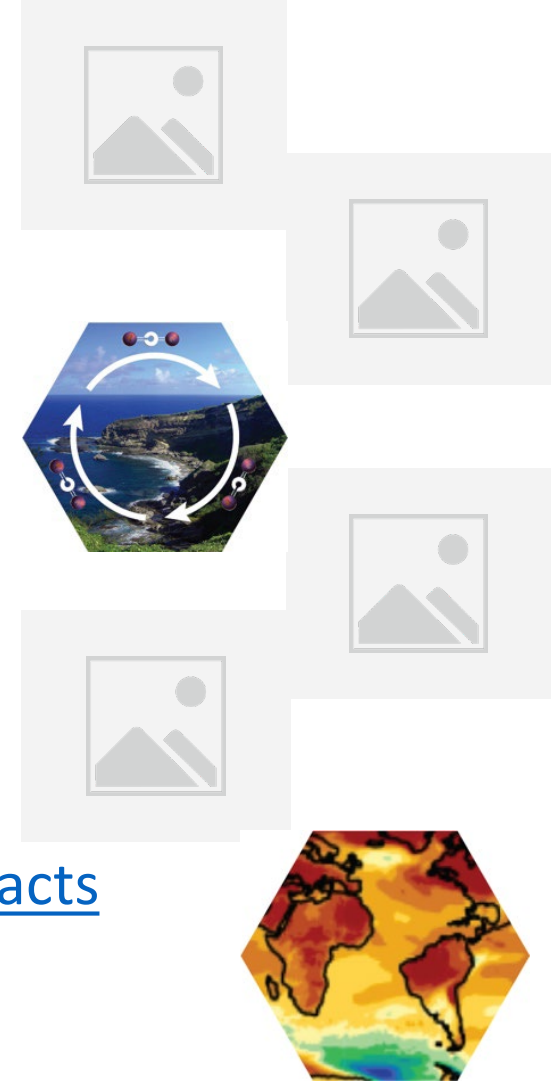
Carbon Feedbacks in the Climate System

Weather and Climate Extremes

Water for the Food Baskets of the World

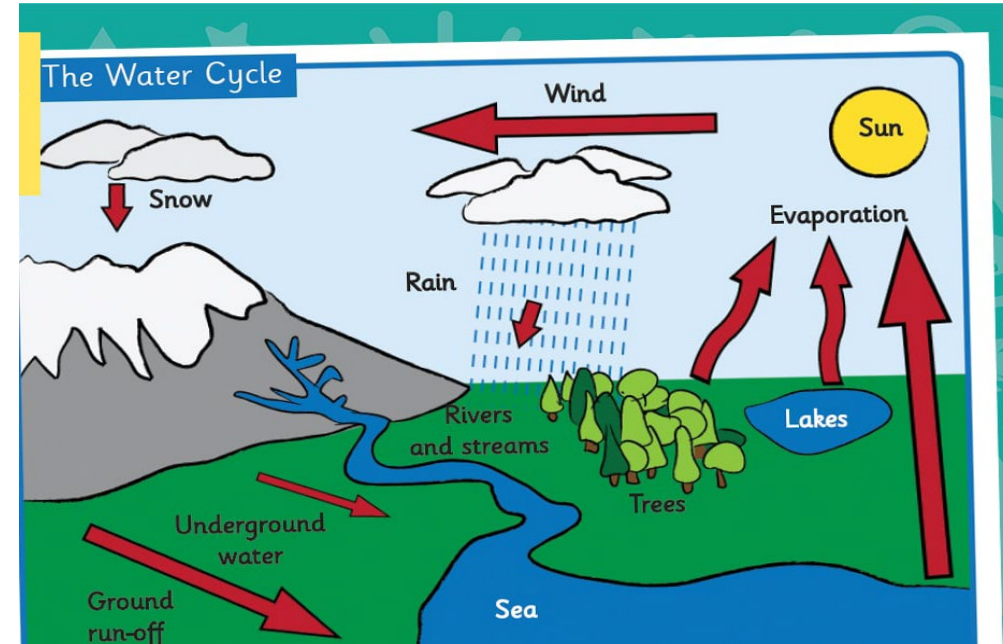
Regional Sea-Level Change and Coastal Impacts

Near-term Climate Prediction



Earth System Science – Targeting the Natural Cycles

- Carbon Cycle
- Energy Cycle
- Water Cycle



Movement of water between storages:

- oceans, seas, lakes, rivers, reservoirs;
- atmospheric water (water vapor, clouds);
- subsurface water (soil moisture, groundwater);
- frozen water (glaciers, ice sheets, sea ice, snow, permafrost);
- biosphere water (storages in vegetation).

Fluxes linking the storages:

- evaporation and sublimation;
- precipitation;
- Uptake/release in cryosphere, lakes, reservoirs/aquifers;
- surface water runoff;
- recharge and depletion of water bodies by humans.

WCRP Grand Challenges relates to the Water Cycle

Melting Ice and Global Consequences

Clouds, Circulation and Climate Sensitivity

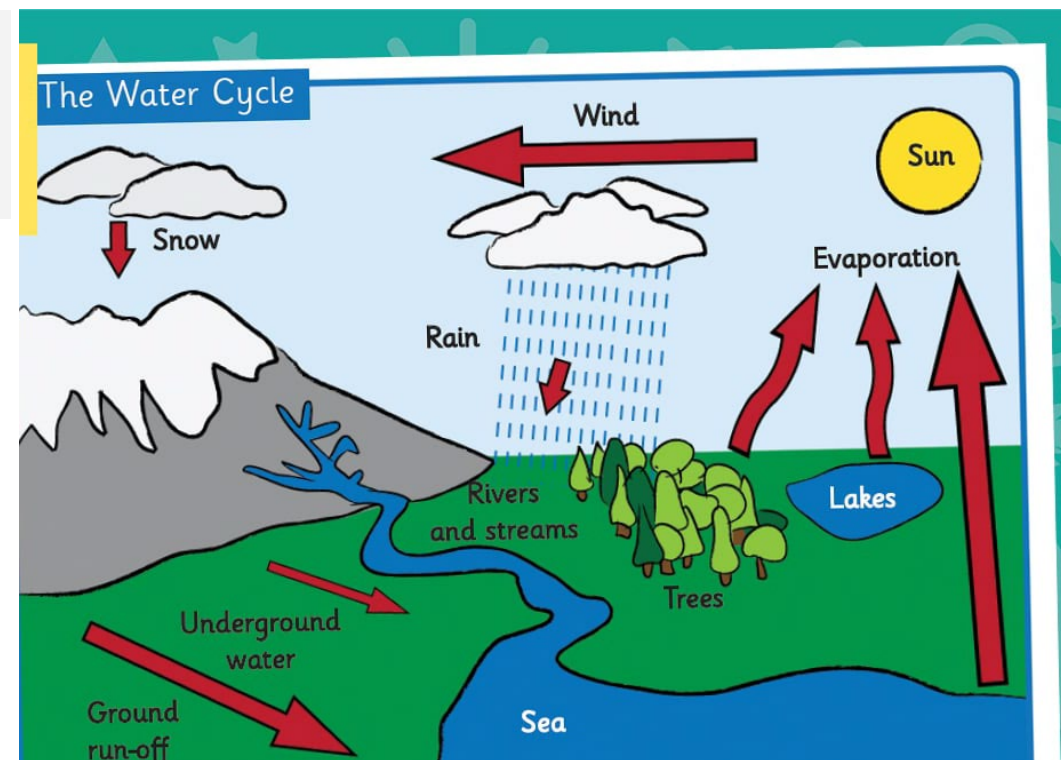
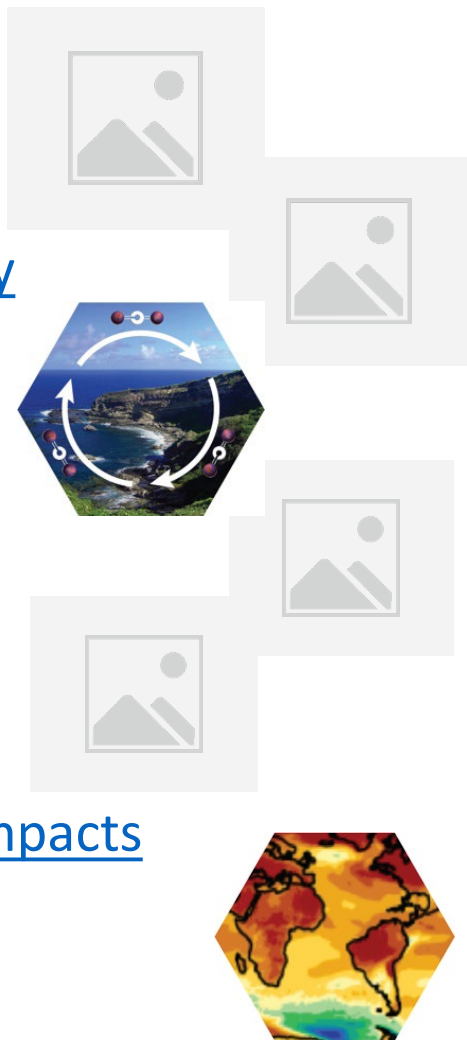
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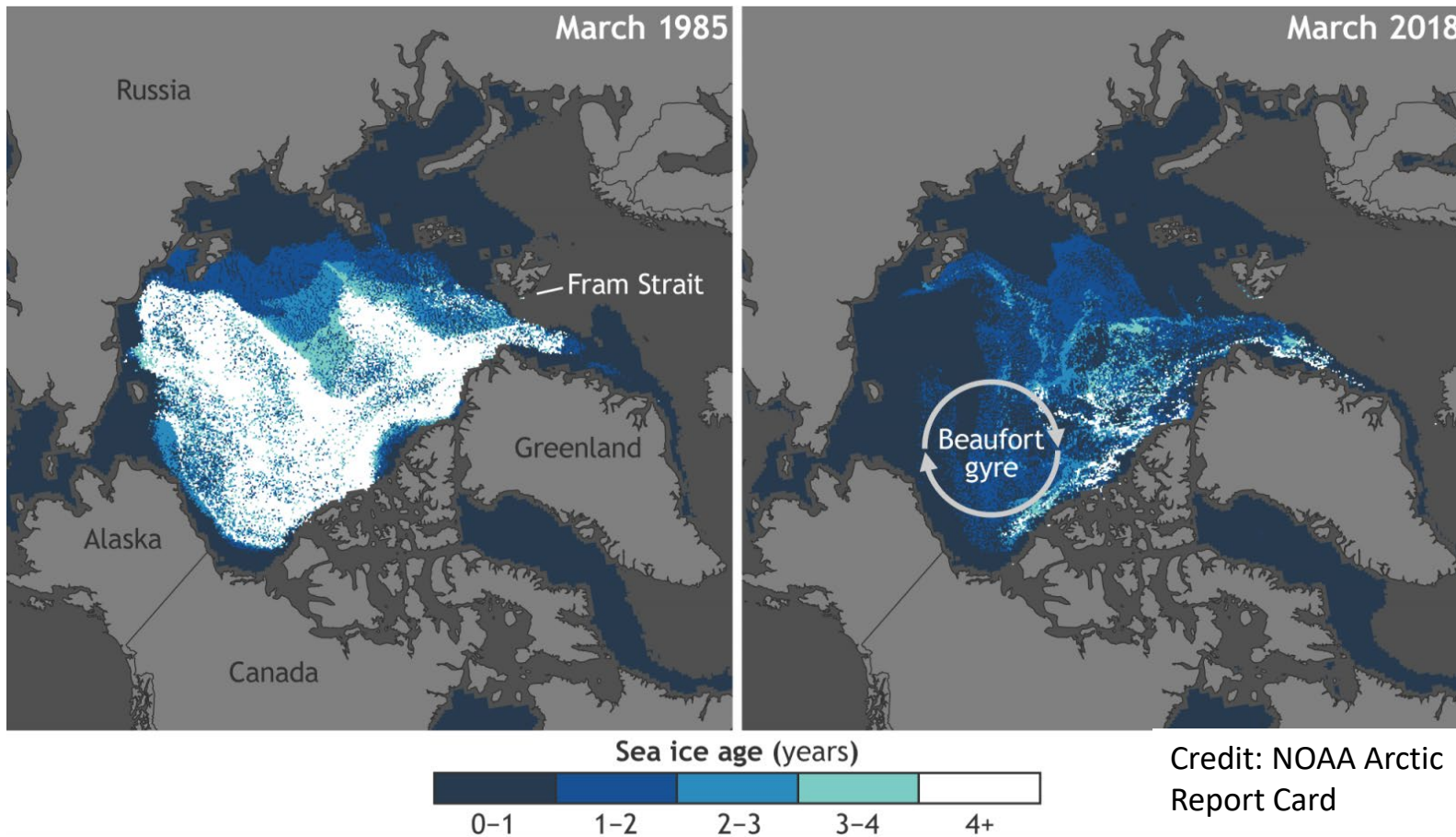
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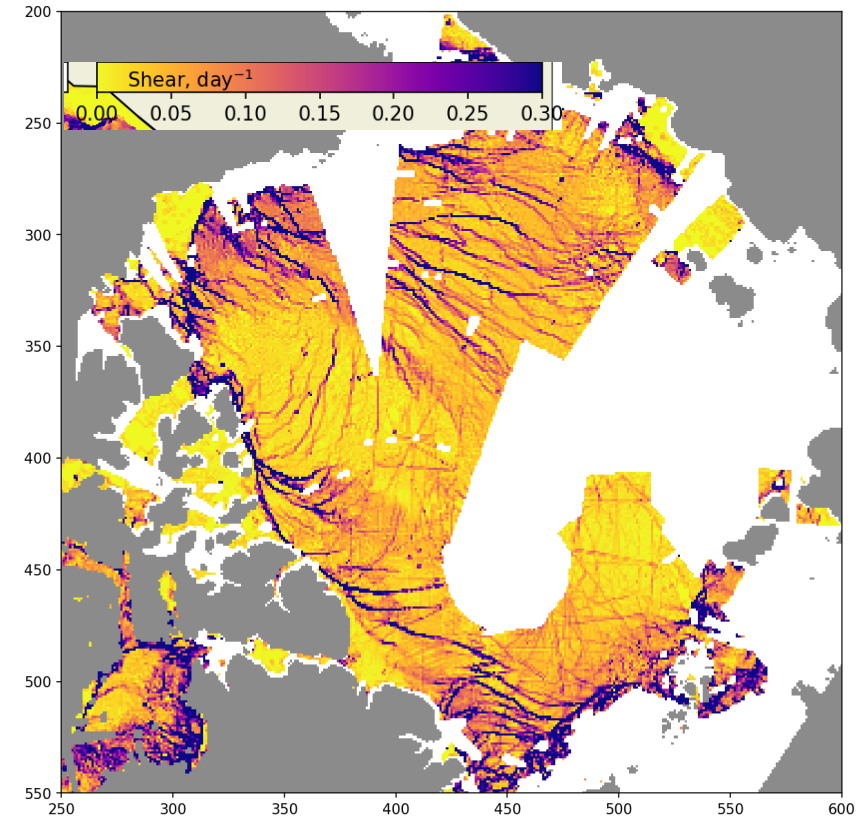


Loss of old sea ice



In March 1985, the sea ice that had survived at least four summers **comprised 33%** of the Arctic ice pack at the winter maximum.

In March 2019, such long-lasting sea ice **comprised just over 1%**.

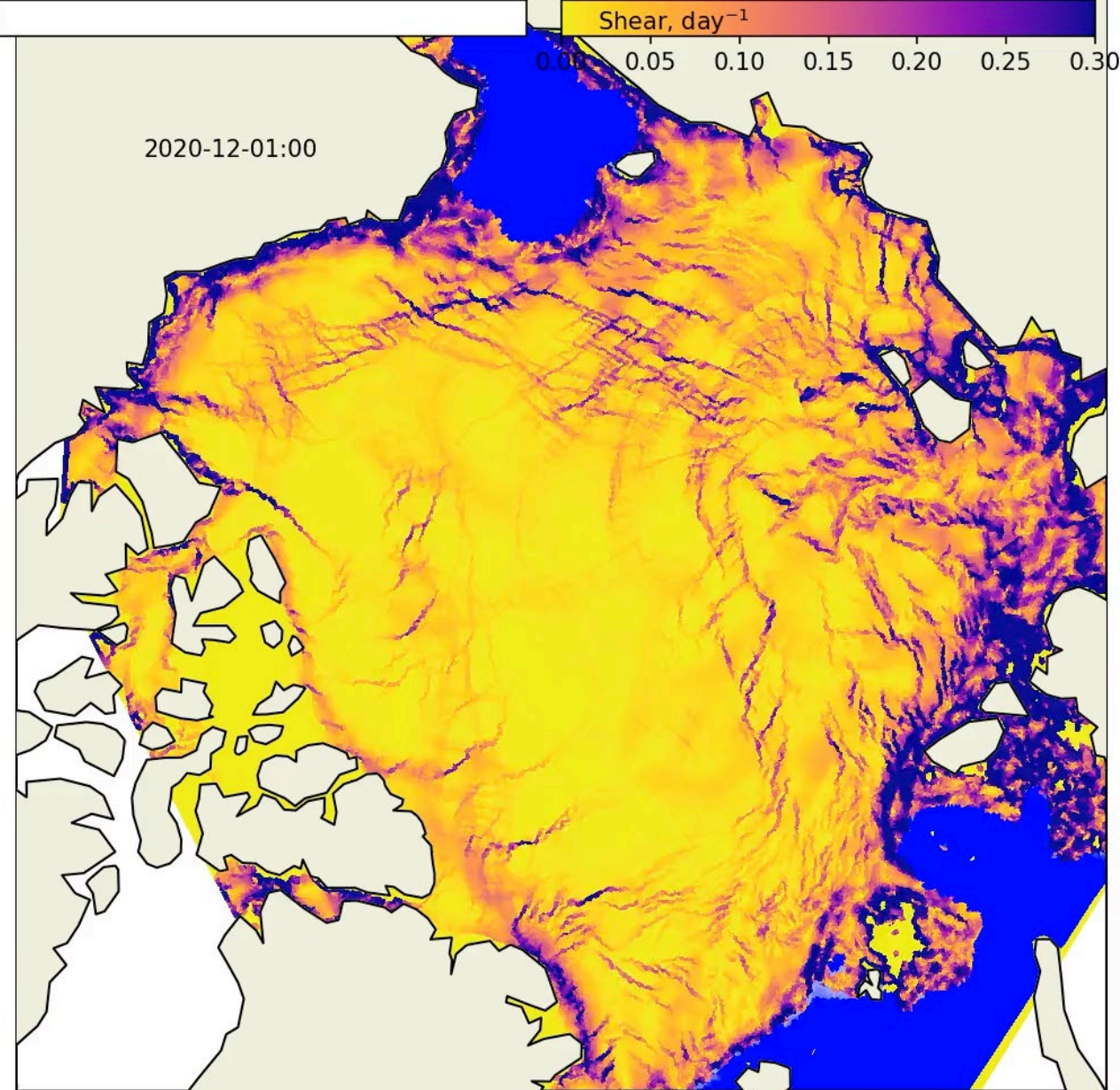


Sentinel-1 SAR based sea ice deformation presented as shear intensity on 14 January 2021

New understanding of sea ice mechanical behaviour and dynamics using the neXtSIM Sea Ice Model (courtesy: Einar Olason, NERSC)

Free Run Simulation 1 Dec. 2020 - 1 Feb. 2021

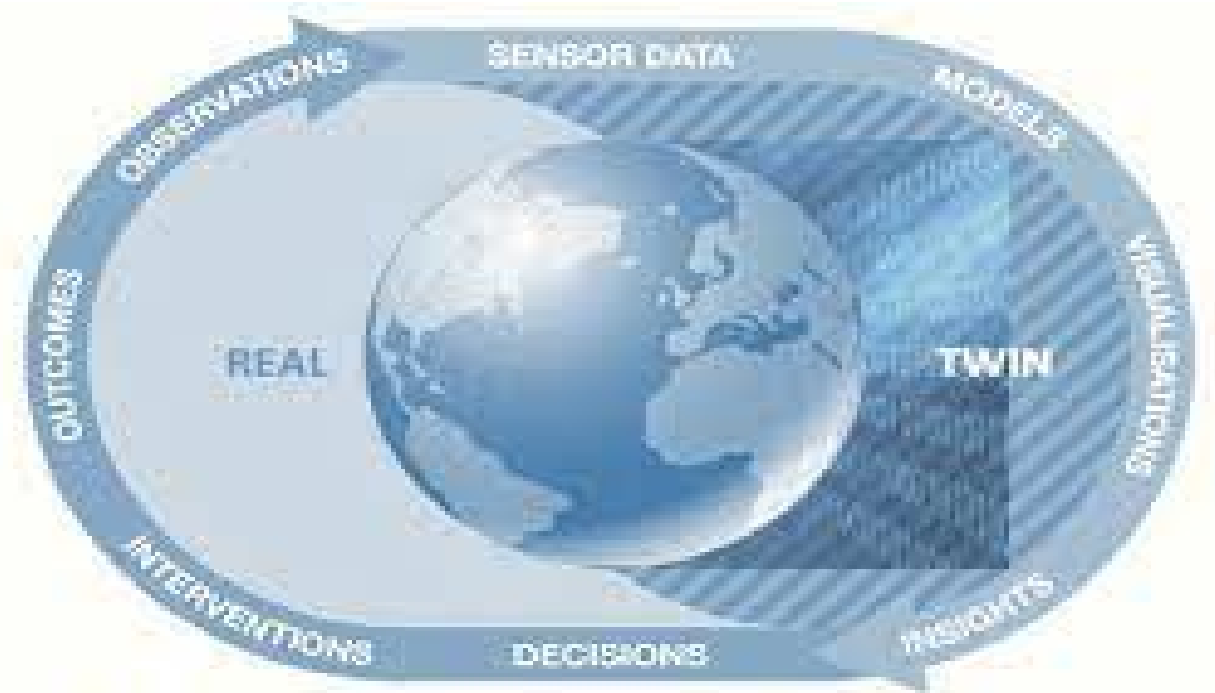
- Rheology: Brittle Bingham Maxwell
- Mesh: Triangular, Lagrangian
- Resolution: 10 km
- Timestep: 900 sec
- Ocean forcing: TOPAZ4
- Atmosphere forcing: ECMWF



High level Scientific Challenges and Opportunities

Strengthening opportunities through Destination Earth and Digital Twin development.

Advancing the Observing System and removing the knowledge gaps



- ESA and EU to Agree and Prioritize the Big Scientific Challenges;
- Co-design of programs and coordination of calls that strengthen satellite-based Earth System research and application in combination with improved in-situ observation capacities and advances in Digital Twins.