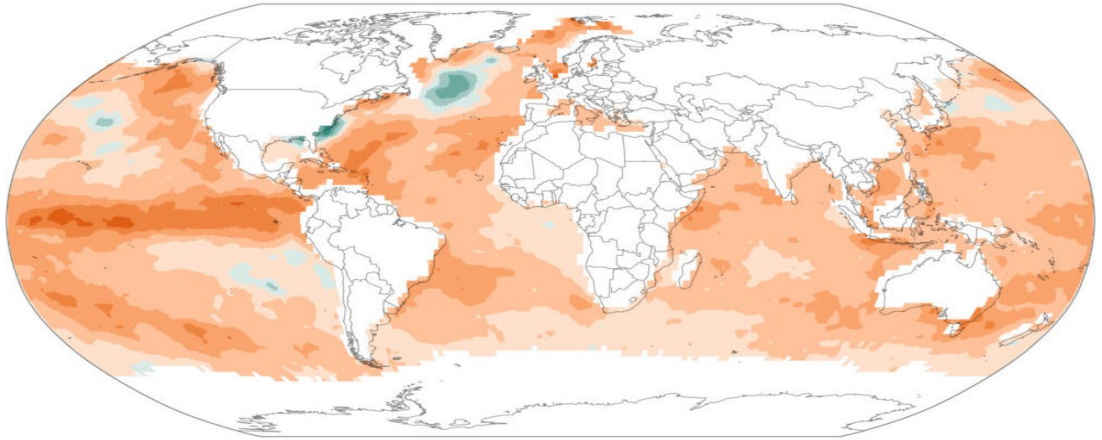
Agora Session: Earth System Science

High level Scientific Challenges and Opportunities: Ocean

Global warming - Climate change - Loss of Biodiversity - Acidification - Pollution - Microplastic - Overfishing

Extremes - Marine heat waves - Sea level rise - Sea ice area/volume decline



Number of heat wave days 1987-2016 versus 1925-1954. Orange-red indicate 18-36 more days.

Source: Nature Climate Change | By The New York Times.

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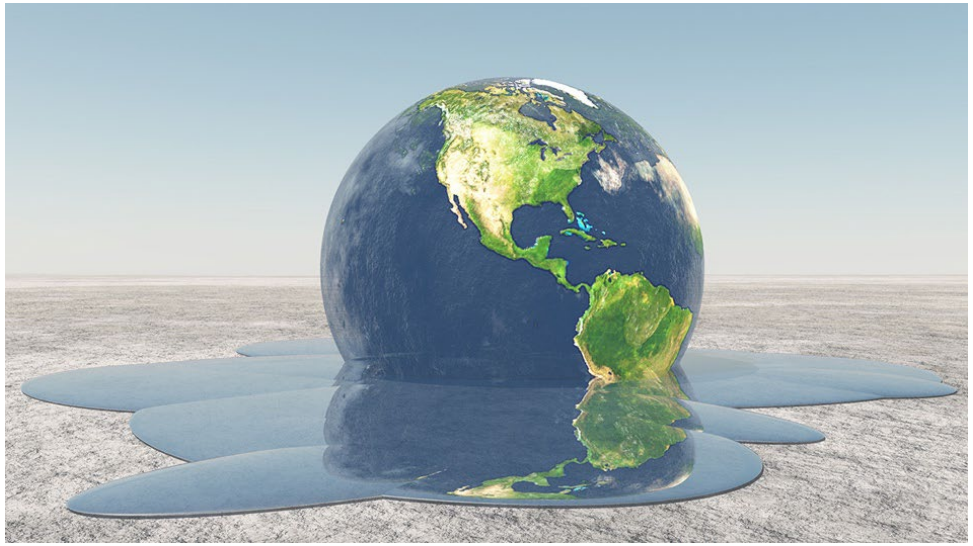
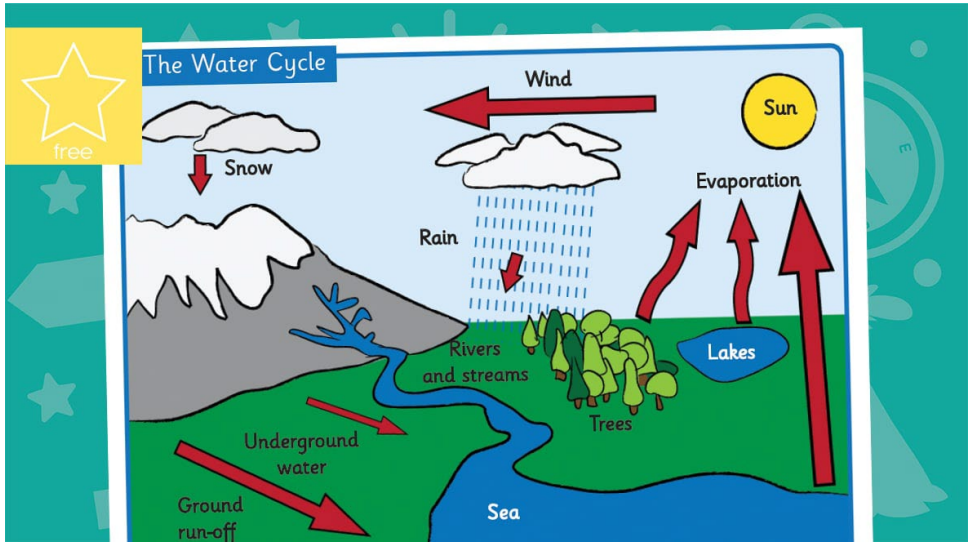
High level Scientific Challenges and Opportunities: Ocean

- Carbon Cycle
- Energy Cycle
- Water Cycle





Movement of water between:
- oceans, seas, lakes, rivers, artificial 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).

Key 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.

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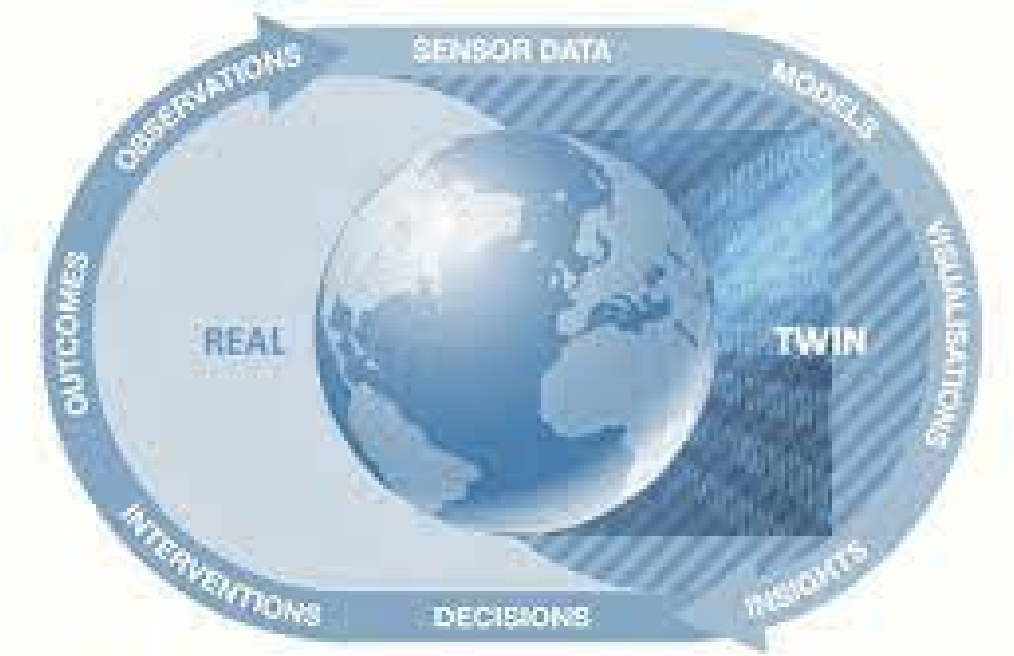
Strengthening opportunities through Destination Earth and Digital Twin Ocean development.

Advancing the Observing System and remove the knowledge gaps



Collaboration between ESA (FutureEO) and the EC (Horizon Europe) is a key driver

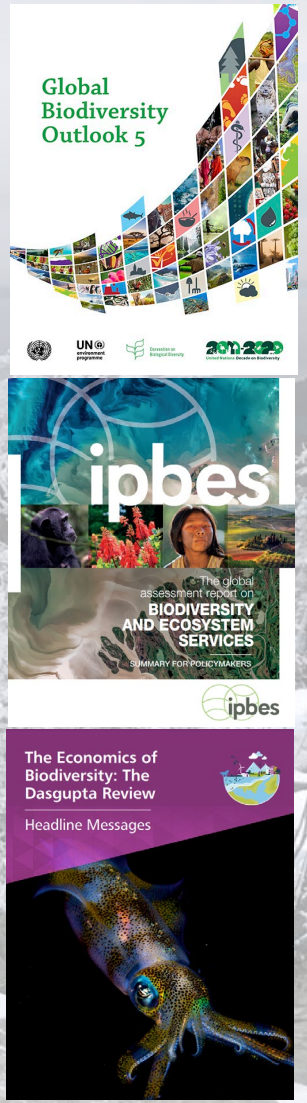
- Agree and Prioritize the Big Scientific Challenges;
- Co-design of programs and coordination of calls that strengthen satellite-based Earth System research and application in combination with advances in DTO.

Grey skies of biodiversity – what's the problem?

- Biodiversity loss is an **existential risk** for human civilizations.
- We are approaching the 6th mass extinction of the Earth.

Challenges and opportunities:

- **Lack of information of biodiversity – state and trends**
  - (EO-enabled) EBVs operationalised
  - Diversity of data required
- **Integration of traditional and novel methods**
  - Comparability of results & multidisciplinarity of expertises needed (BD, EO, ICT)
- **Restoration & resilience of vulnerable ecosystems** – measuring the impacts to secure ecosystem services
  - Ecosystem extent and condition
  - Earth system models and scenarios



SYKE

Blue skies of biodiversity – solutions we need for the future

- **Integration of *in situ* observations with remote sensing – with help of AI**
  - Field sensors (eDNA, acoustic, camera), species & habitat surveys, LiDAR, UAVs
  - Operational and interoperable data products to monitor change (cf. Copernicus land)
- **Advances in satellite remote sensing can strongly boost biodiversity science and conservation**
  - Long-term security of multi- and hyperspectral data, and derived biodiversity products
  - Harmonisation of methods and approaches
- **Coordination of BD monitoring schemes and consensus for governance of BD data and information**
  - Enhancing collaboration of research infrastructures
  - Increasing societal impact and linkages to policies

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biodiversa+
European Biodiversity Partnership

EUROPABON

GEO BON
Group on Earth Observations
Biodiversity Observation Network

Knowledge Centre for Biodiversity

EEA

European Commission