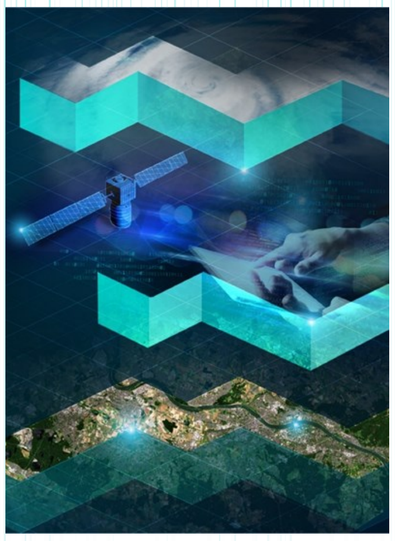
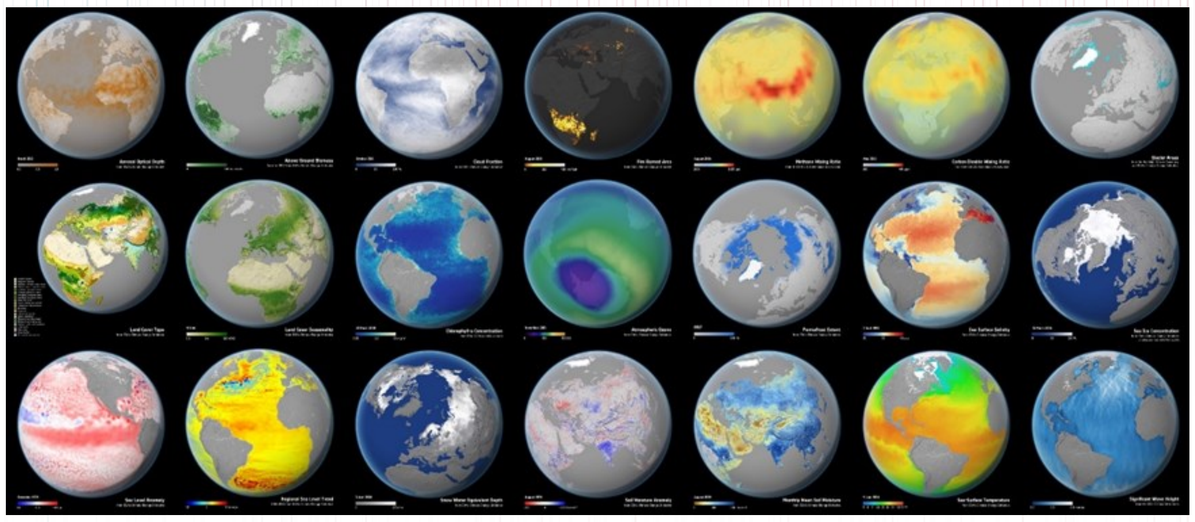
Strengthening the observation-modelling interface to support climate action



Our climate system is continuously changing, and to understand it we need to build computer simulations of its complex, interacting processes.

Climate models help us to better understand past, present and future climate changes. They are used to make predictions, which help guide actions to reduce carbon emissions and adapt to climate change.

Climate data from space is used in the evaluation and development of climate models.



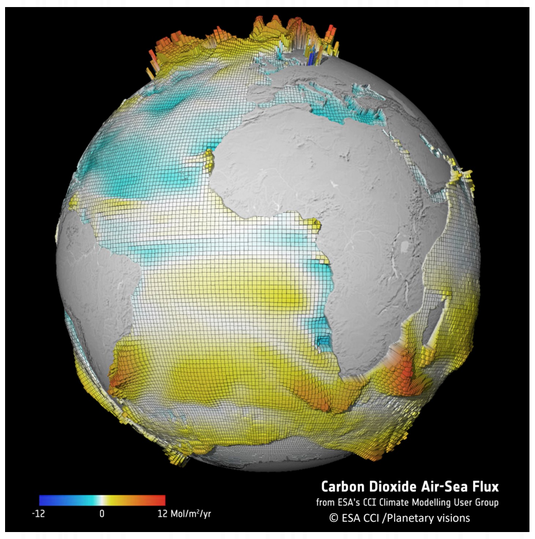
There are 54 Essential Climate Variables of which 21 generated using space observations by ESA 's Climate Change Initiative. The Global Climate Observing System (GCOS), was formally established in 1992 as an international, interagency interdisciplinary framework for meeting the full range of national and international needs for climate observations. An ECV is a physical, chemical or biological variable or a group of linked variables that critically contributes to the characterisation of Earth's climate.

ESA's activities

climate modelling user group cci

ESA established the Climate Modelling User Group (CMUG) to place a climate system perspective at the centre of its Climate Change Initiative (CCI) programme.

CMUG provides a dedicated forum through which the Earth observation data community and the climate modelling and reanalysis community can work closely together.



CMIP Coupled Model Intercomparison Project

ESA hosts the World Climate Research Programme (WCRP) Coupled Model Intercomparison Project (CMIP) International Project Office, which was established in March 2022.

Dedicated to supporting CMIP, the office is collocated with the ESA Climate Office in the UK. The objective of CMIP is to better understand past, present and future climate changes arising from natural, unforced variability or in response to changes in radiative forcing in a multi-model context.

Hosting the CMIP Project Office at ESA strengthens the link between climate observation and modelling prediction communities, and supports a key recommendation from the most recent WCRP review.
https://www.wcrp-climate.org/wgcm-cmip

WCRP World Climate Research Programme

obs4MIPs Observations for Model Intercomparisons Project

ESA co-chairs and supports obs4MIPs through the activities of CMUG. obs4MIPs is a collection of satellite datasets that are formatted and organized according to the model output raequirements of WCRP CMIP. These datasets are made available on the Earth System Grid Federation (ESGF) together with the archive of CMIP model output data.

Each obs4MIPs observational dataset corresponds to a biogeophysical field that is output by a climate model in one or more of the CMIP experiments. This technical alignment of observational products with climate model output facilitates model-data comparisons.

ESA's CMUG project provides specialist support to CCI teams in contributing their data to obs4MIPs and are identifying emerging needs. Find out more:

https://esgf-node.llnl.gov/projects/obs4mips/

WCRP World Climate Research Programme

ESMValTool Earth System Model Evaluation Tool

The ESMValTool is a community-developed evaluation and analysis tool for climate models and Earth System Models.

ESMValTool facilitates analysis of many different ESM components, provides well-documented source code and scientific background of implemented diagnostics and metrics and allows for traceability and reproducibility of results.

CMUG aims to enhance the ESMValTool with additional diagnostics and performance metrics enabling tailored analysis for the evaluation of models with ESA CCI and CCI+ data.

https://www.esmvaltool.org/

Collective action required

At the 2nd Climate Observation Conference of the Global Climate Observing System, held on 17-19 October 2022 in Darmstadt, Germany, members of the modelling and observation communities were invited to share and develop ideas to strengthen the climate observations-modelling interface. Recommendations include:

Building and sustaining climate data records.

Action is required to sustain maintenance and evolution of, established, harmonised in-situ, earth observation and reanalysis datasets with open access to ensure maximum impact and global equity. New Essential Climate Variables are required for urban and ocean modelling which will help support and inform decision making on adaptation to climate change in urban and coastal environments.

Action across the climate data supply chain to transform climate data into information relevant for decision making.

The modelling and observation communities need to establish information and format requirements from climate data users and implement standardisation of data formatting, vocabulary, uncertainty and data processing traceability throughout the data chain; from raw to product, using consistent and standardised recording methods within the metadata.

Urgent action at international and national scale to ensure open access climate data for all.

There are crucial gaps in access, important for both observation and modelling, are not only causing known biases, errors and assumptions but is also holding back scientific capability from progressing and innovating at the frontiers of climate science in specific regions of the world, particularly in Asia and Africa.

Developing climate observation networks.

The modelling and observation communities need to identify priority in-situ reference observation gaps needed for modelling evaluation, earth observation validation and improved physical process understanding. For example, where appropriate, citizen science should be embraced with new technologies developed to safeguard reliability and quality.

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