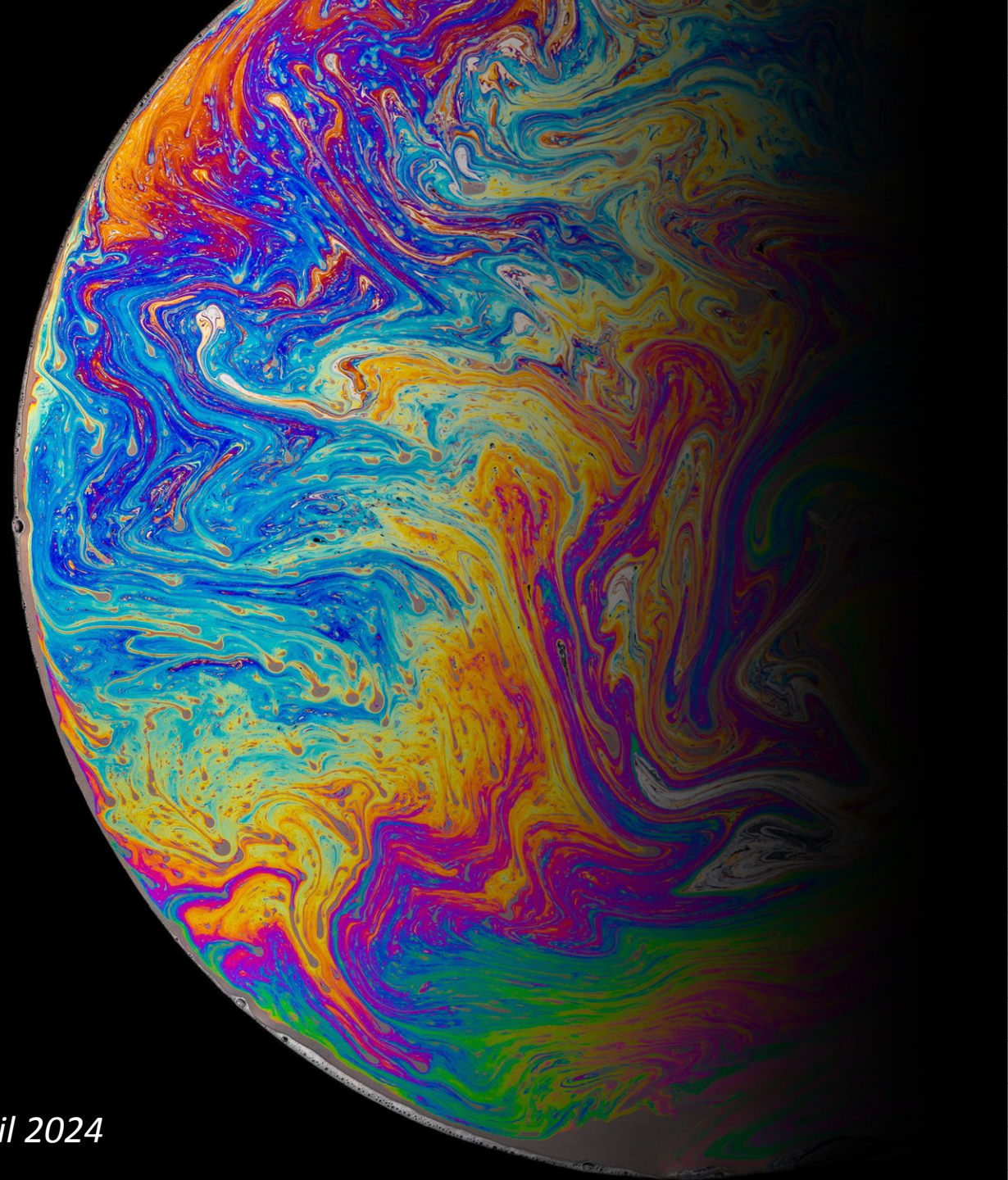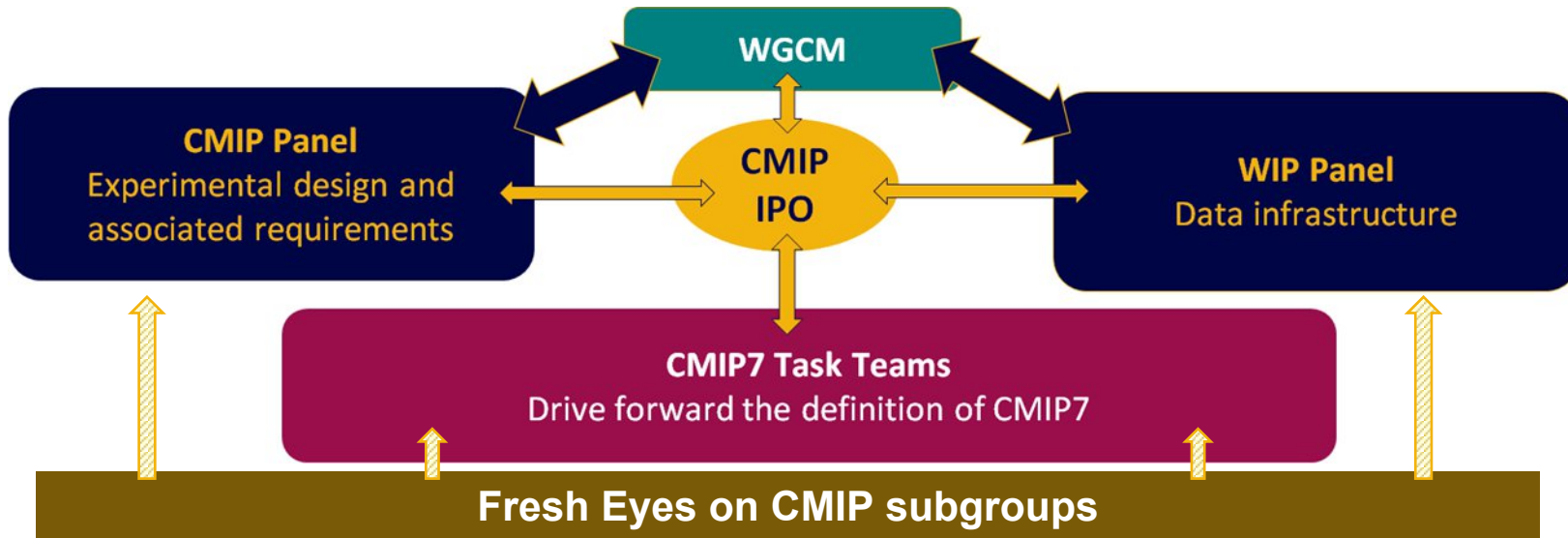# Climate Model Benchmarking for CMIP7

Forrest M. Hoffman and Birgit Hassler
CMIP Climate Model Benchmarking Task Team Co-Leads
European Geophysical Union (EGU) 2024, Vienna, Austria, 15 April 2024

CMIP Coupled Model Intercomparison Project
Model Benchmarking

CMIP and Preparations for CMIP7

- CMIP is part of the WCRP's Earth System Modelling and Observation (**ESMO**) realm, and the Working Group on Coupled Modelling (**WGCM**)

- CMIP activities are coordinated by the CMIP Panel, the WGCM Infrastructure Panel (**WIP**), the CMIP IPO and the CMIP7 Task Teams

- **Two new CMIP co-chairs** were appointed (2022/2023):
  - Helene Hewitt (Met Office, UK)
  - John Dunne (NOAA GFDL, USA)

- The **CMIP IPO**, newly established in March 2022 and hosted at the European Space Agency's (ESA's) ECSAT site in Harwell, UK, is staffed by five people and is tasked with helping coordinate and support CMIP activities and responsibilities

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#CMIP

CMIP Task Teams

- The CMIP Panel and WIP have established a number of **Task Teams** to support the **design**, **scope**, and **definition** of the next phase of CMIP and evolution of CMIP infrastructure and future operationalization

- Individual Task Teams aim to address **specific topics** (shown at right) and **interact with each other** to develop recommendations for the CMIP Panel and WIP

To learn more about CMIP activities while here at EGU24, see
- Lightning talks, **13:30 daily, ESA Booth (X202)**
- CMIP AR7 Fast Track Townhall, **Tue 18:30-20:00, Room L2**
- Information for Society Townhall, **Tue 19:00-20:00, Room G1**
Or simply see **https://bit.ly/CMIP-at-EGU24**

#CMIPatEGU24

- Data Access
  (Robert Pincus & Atef Ben-Nasser)

- Data Citation
  (Martina Stockhause & Sasha Ames)

- Data Request
  (Martin Juckes & Chloe Mackallah)

- Forcings
  (Paul Durack & Vaishali Naik)

- Model Benchmarking
  (Birgit Hassler & Forrest Hoffman)

- Model Documentation
  (David Hassell & Guillaume Levavasseur)

- Strategic Ensemble Design
  (Ben Sanderson & Isla Simpson)

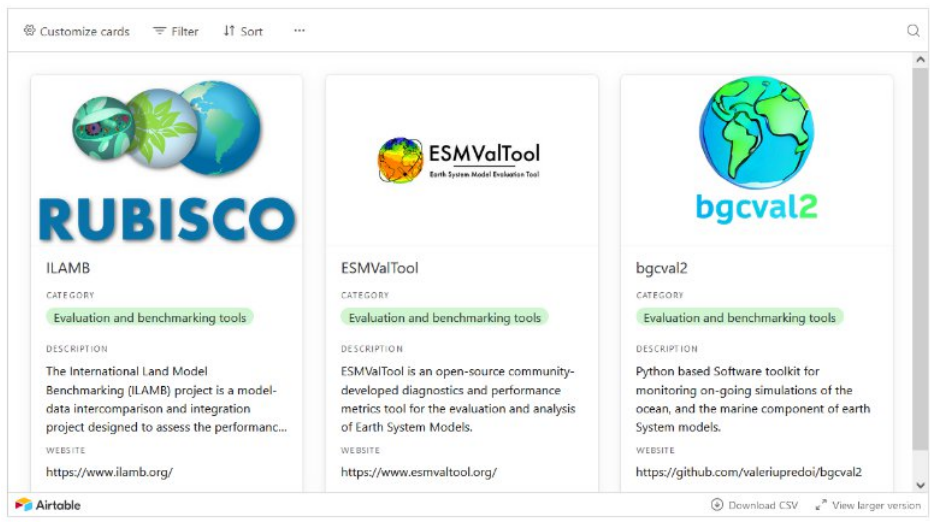**#CMIP**

The Model Benchmarking TT

- Rebecca Beadling, *USA*
- Ed Blockley, *UK*
- Jiwoo Lee, *USA*
- Valerio Lembo, *Italy*
- Jared Lewis, *Australia*
- Jianhua Lu, *China*
- Luke Madaus, *USA*

- Elizaveta Malinina, *Canada*
- Brian Medeiros, *USA*
- Wilfried Pokam Mba, *Cameroon*
- Enrico Scoccimarro, *Italy*
- Ranjini Swaminathan, *UK*

- **Diversity** in expertise (realms and methods), user group representation, gender, location, career stage

- **Overarching goals**:
  - ➢ Systematic and rapid performance assessment of the expected models participating in CMIP7 (including the model output and documentation)
  - ➢ Enhancing existing community evaluation tools that facilitate performance assessment of models
  - ➢ Integration of evaluation tools into CMIP publication workflows and fostering publication of their diagnostic outputs alongside the model output on the ESGF

- Collaboration with two **Fresh Eyes on CMIP** Subgroups
  - Model Evaluation
  - Data Analysis

#CMIP

Model Benchmarking Tools – Info "Cards" & Videos

- **Main characteristics** of (open source) benchmarking and evaluation tools available for analyses of CMIP-style data summarized in an overview "card" or an information video

- Collected information **presented centrally** on the CMIP website for easy access

- Cards can be filled out for **all available open source benchmarking and evaluation tools** if they can be used for CMIP data analysis; pre-defined questionnaire available on the CMIP website

https://wcrp-cmip.org/tools/model-benchmarking-and-evaluation-tools/

Status: first cards available
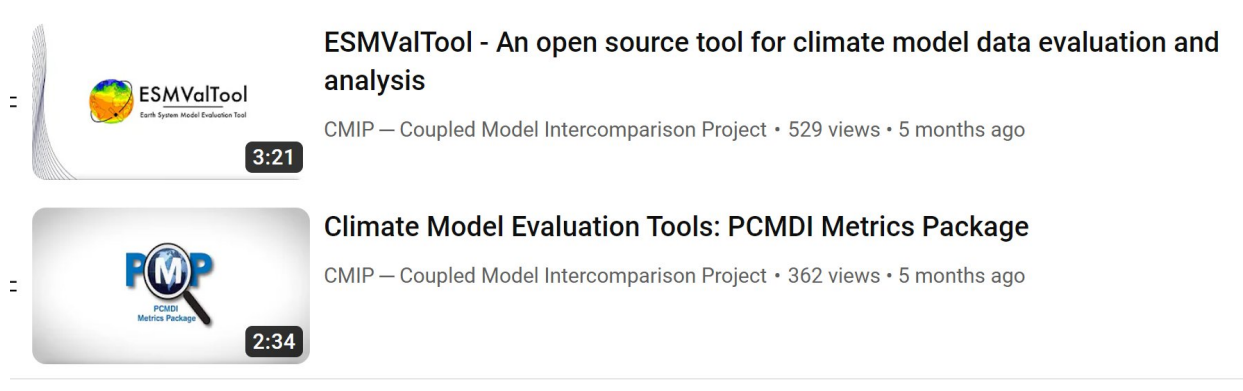
Started: October 2023

Birgit Hassler's lightning talk on **Benchmarking and Analysis Tools** was held today at 13:30 at the ESA Booth (X202)

#CMIP

Model Benchmarking Tools – Information Videos

- **Videos** with descriptions of different benchmarking and evaluation tools

- Contain also the **main characteristics** of the different tools, just presented in a different way than the "cards"

- Videos can also be of **different style**

- All videos are presented in **one central location** linked to CMIP

ESMValTool - An open source tool for climate model data evaluation and analysis

CMIP — Coupled Model Intercomparison Project • 529 views • 5 months ago

3:21

Climate Model Evaluation Tools: PCMDI Metrics Package

CMIP — Coupled Model Intercomparison Project • 362 views • 5 months ago

2:34

➢ **More videos of tools welcome!**

➢ **More info cards about evaluation/benchmarking tools welcome!**

https://wcrp-cmip.org/tools/model-benchmarking-and-evaluation-tools/

#CMIP

Retrospective paper

- **Definitions** of "evaluation", "validation", and "benchmarking"

- Retrospective look at **evolution of evaluation & benchmarking metrics**

- What tools were **available** for CMIP6 (methods, philosophies, tools)?

- What approaches were **used** for CMIP6?

- Which of them **worked well** for CMIP6 and what **did not work** for CMIP6?

- **Extensive information** about different benchmarking and evaluation tools

Status: Currently being finalized

Planned submission: May 2024

#CMIP

What is the way forward?

- Based on the findings of the extensive information collected about different tools, and the retrospective paper – What do we think should be the **benchmarking/evaluation focus for CMIP7**?

- What **framework** would ideally be available for instantaneous benchmarking and evaluation at the time of data submission? Is such a framework even possible?

- How to **avoid the bottlenecks** encountered in CMIP6 benchmarking/ evaluation?

- Comprehensive community evaluation in **near-real time** possible?

Status: Under development

Planned submission: Summer 2024

#CMIP

Other Planned TT Activities

- CMIP Model Benchmarking TT **face-to-face meeting in May** at the German Aerospace Center (DLR) to finish off the retrospective paper and establish vision for the perspectives paper

- In collaboration with **Fresh Eyes on CMIP** groups
  - Develop scope for better quality assurance / quality control (QA/QC) for CMIP model output
  - Develop a white paper on data needs for model benchmarking, including uncertainties
  - Develop a final report from the Model Benchmarking TT that proposes an architecture for automated benchmarking capabilities at the time of CMIP data publication

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