

ESA CCI Mid-term Review

Contribution to Panel “Key challenges in climate research and monitoring”

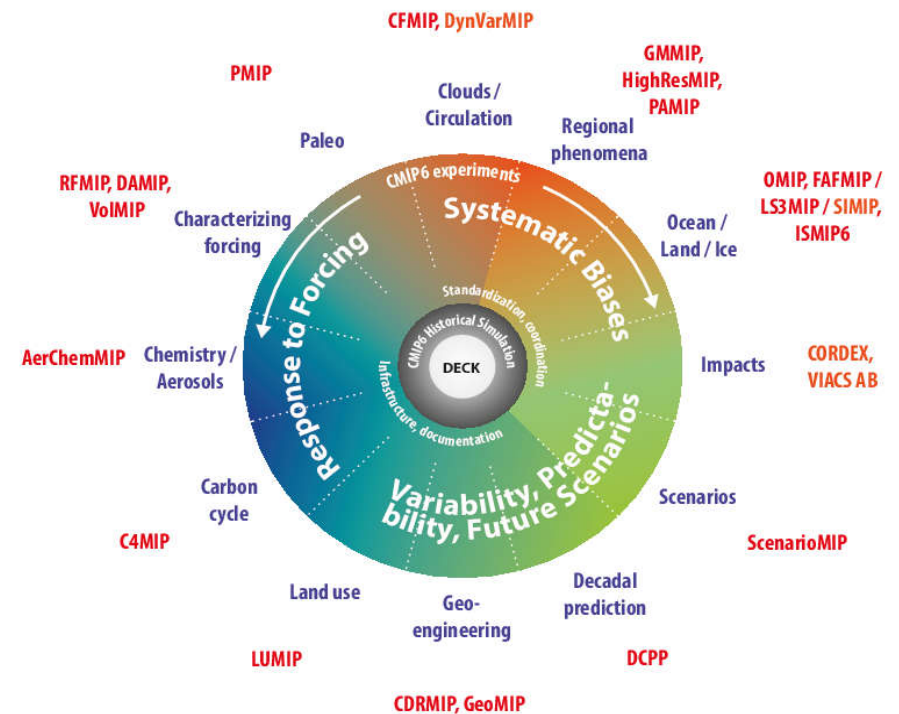
Veronika Eyring^{1,2}

¹ Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany

² University of Bremen, Institute of Environmental Physics (IUP), Germany

CMIP Perspective

Chair CMIP Panel
(2014-July 2020)



Evolution of the CCI+ Program to CMIP: Current Activities & Achievements

ESA CCI datasets are crucial for **Earth System Model (ESM) development & evaluation**. **CMIP needs:**

- Consistent and harmonized multi-instrument data
- (Near) global coverage, quality-controlled
- Uncertainty estimates & guidelines for error propagation
- Bring together ECVs from a climate perspective
- Multi-year long-term time series

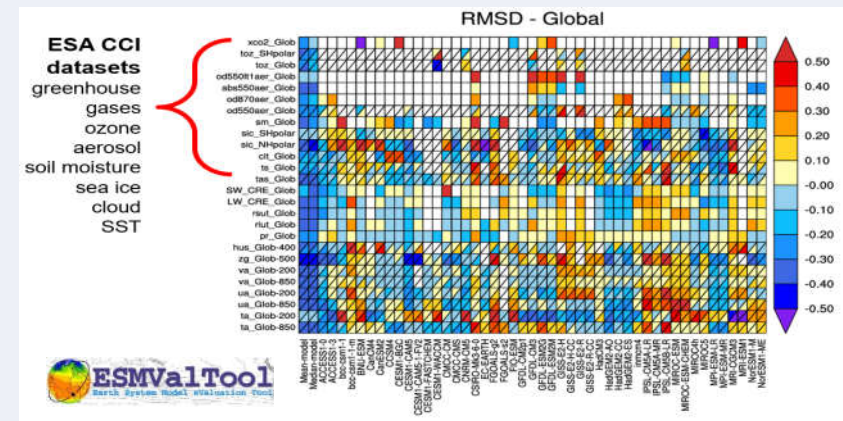
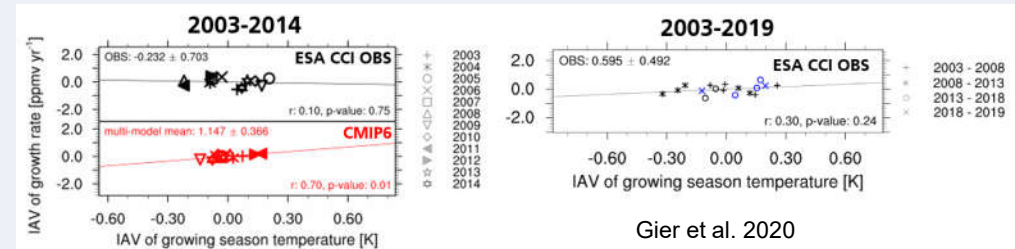
=> **Continuation essential** => further research e.g. on consistency of ECVs and refined uncertainty estimates

Easy access to ESA CCI data for the wider climate community and for policy information

- obs4MIPs (technical support from CMUG)
 - Consideration for Model-Observation Comparisons
- Inclusion of the ESA CCI+ datasets in the **Earth System Model Evaluation Tool (ESMValTool)** as part of CMUG
 - **Facilitates** routine model evaluation and **wide use** of CCI data
 - Now well-tested tool providing end-to-end provenance
 - Used in several IPCC WGI AR6 chapters

=> **Continuation essential** => further research e.g. process-oriented evaluation & new ECVs from all components

Interannual variability of XCO₂ growth rate in tropics



Lauer et al. 2017; Righi et al. 2020; Eyring et al. 2020; Lauer et al. 2020



ESA's Contribution to Climate Modelling Activities in a Wider Context

=> Targeted Observations to Constrain Climate Projections and Feedbacks

- Large uncertainties due to **clouds** and the **carbon cycle**
- **Policy relevant** information

=> New datasets to serve Earth System Model Developments

- **Higher resolution** (e.g. extreme events / precipitation)
- **Complex ESMs** (e.g. carbon, CH₄ & N cycles, ice sheets, permafrost)

=> New Forcing Datasets for Climate Model Simulations

- E.g. ozone, aerosols, sea ice, sea surface temperatures, land use, biomass
- Provide an avenue through Copernicus to make **operational**

=> Innovative Retrieval and Analysis Techniques

- **Community Diagnostics Tools** (e.g., ESMValTool)
 - Handling of Big Data
- **Machine Learning (AI4Climate)**
 - Improved retrievals (e.g. cloud masks), Gap filling
 - Uncertainty quantification and propagation
 - Earth system data (model & obs) analysis and evaluation
- **Foster link between observational and model community**
 - Joint research opportunities

