

Contribution to „Observations & modelling: shedding light on climate futures”

Work experience

2015 – present Research scientist, Institute of Atmospheric Physics (DLR), Oberpfaffenhofen, Germany

2012 – 2015 Team leader, Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany

2007 – 2012 Assistant researcher, International Pacific Research Center (IPRC), University of Hawaii at Manoa, Honolulu, Hawaii, USA

2004 – 2007 Postdoc, Institute of Atmospheric Physics, German Aerospace Center (DLR), Oberpfaffenhofen, Germany

Education

2005 PhD in meteorology, Free University of Berlin, Germany

2001 Diploma in meteorology, University of Munich (LMU), Germany

Research fields

Climate modeling, model evaluation and analysis

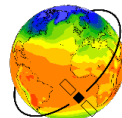
Research topics

Clouds, cloud-climate feedbacks, climate change

Core developer of the ESMValTool
(evaluation and analysis of climate model results)



Axel Lauer (DLR)



ESMValTool
Earth System Model Evaluation Tool



Climate models

Earth System Models (ESMs) are important tools for

- improving our understanding of the climate system
- projecting future climate change

The **evaluation** of Earth System Models with observations is crucial for

- model improvements,
- a better process understanding of the climate system and
- more trustworthy climate projections to be used for policy guidance.

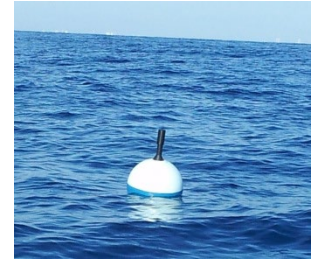


Image: NASA (Apollo 17), December 7, 1972



ESM evaluation

Comparison with observations (in-situ and remote sensing)



Images:

DLR, DWD, ESA, Portal Deutsche Forschungsschiffe, Wetterdienst.de, Wikipedia



Community evaluation tools

Open source software to

- enhance our ability to identify model errors,
- investigate their causes,
- quantify and potentially reduce projection uncertainties.

Main aims

- easier and faster evaluation of complex Earth System Models
- improved quality standard for model evaluation
- easily expandable, synergies among software projects



Earth System Model Evaluation Tool (ESMValTool)

International ESMValTool development team

- 17 funded projects
- 63 institutions
- > 200 developers

Righi et al., 2020

Technical overview

Eyring et al., 2020

Large-scale diagnostics

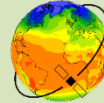
Lauer et al., 2020

Diagnostics for emergent constraints and future projections

Weigel et al., 2021

Diagnostics for extreme events, regional and impact evaluation

scientific documentation



ESMValTool

Earth System Model Evaluation Tool

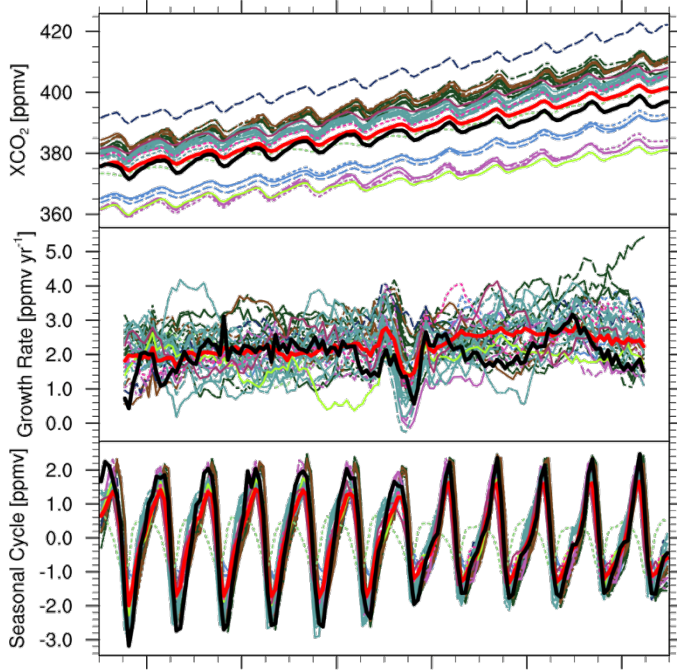
- Tool for fast and easy routine **evaluation and analysis** of Earth system models including provenance records for all results (**traceability and reproducibility**)
- Well-established analysis based on **peer-reviewed literature**
- Many diagnostics and performance metrics covering **different aspects of the Earth System** (dynamics, radiation, clouds, carbon cycle, chemistry, aerosol, sea-ice, etc.) and their interactions
- Extensive **documentation** (user guide, peer-reviewed papers, tutorial)
- Supported production of a subset of figures of the **IPCC WGI AR6**

<https://www.esmvaltool.org/>



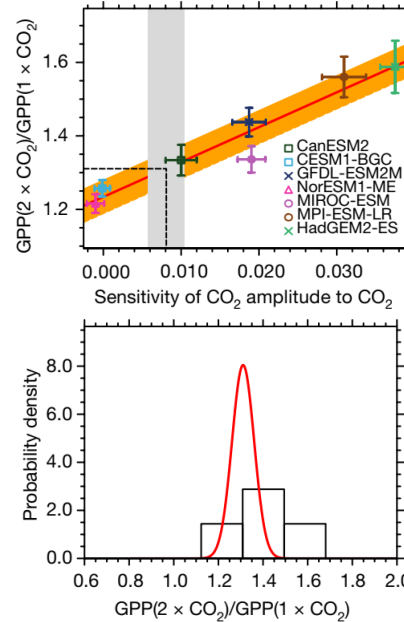
Examples model evaluation and analysis (ESMValTool)

Column-averaged CO₂



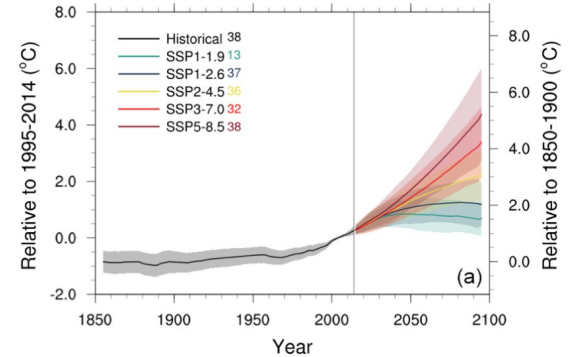
From: Gier et al. (2020)

Emergent constraint for GPP

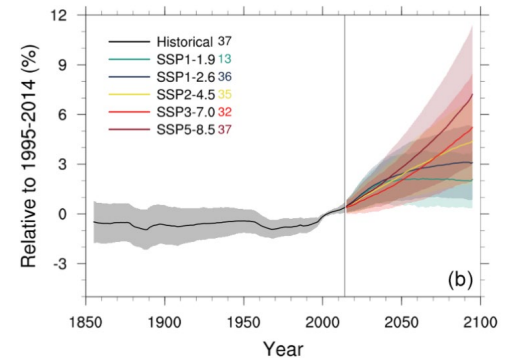


From: Wenzel et al. (2016)

2m temperature



Precipitation



From: Tebaldi et al. (2021)

