is-enes
INFRASTRUCTURE FOR THE EUROPEAN NETWORK FOR EARTH SYSTEM MODELLING

2nd General Assembly

4-6 October 2021
Virtual

Overview of ESMValTool progress

Rémi Kazeroni (DLR) on behalf of the
ESMValTool & ESMValCore development teams

ESMValTool
Earth System Model eValuation Tool

IS-ENES3 has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824084

Introduction

➢ Diagnostics and performance metrics tool for the evaluation of Earth System Models

- Easy analysis of CMIP models
- Fast overview due to standard diagnostics, figures and variables
- Easy comparison of new model simulations with already existing runs and observations

➢ Improved quality standard for model evaluation

- Growing number of included diagnostics
- Traceability and reproducibility of results
- Production of a subset of figures for the IPCC WGI AR6 (August 2021)

➢ Easily expandable

- Synergy with other projects to expand the ESMValTool (e.g. NCAR CVDP)

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ESMValTool information

1. Github repositories

https://github.com/ESMValGroup/ESMValTool

2. Documentation

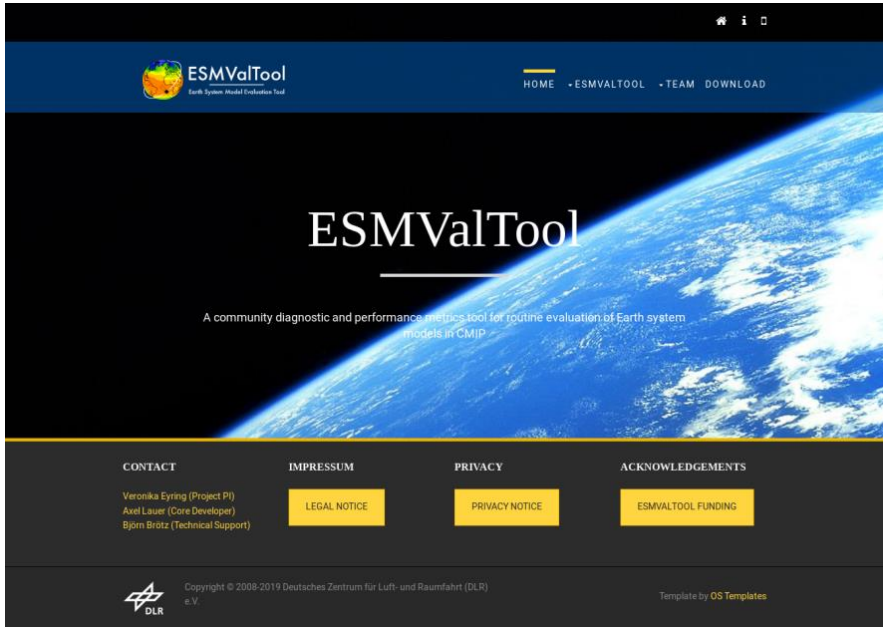
https://docs.esmvaltool.org/en/latest/

3. Tutorial

https://esmvalgroup.github.io/ESMValTool_Tutorial/

4. Webpage

https://www.esmvaltool.org/



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Community

➢ Teams and meetings

- Two principal investigators: Birgit Hassler (DLR) and Alistair Sellar (MetOffice)
- Technical and Scientific lead teams
- Large team of scientific contributors
- Team of technical contributors
- User engagement team
- Monthly meetings
- Several workshops per year (next one in Nov. 2021 – pool for the dates)

Contact

- ESMValTool mailing-list:
  esmvaltool@listserv.dfn.de

- Email to the user engagement team:
  esmvaltool_user_engagement_team@listserv.dfn.de

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ESMValTool v2.0

Release v2.0 August 2020

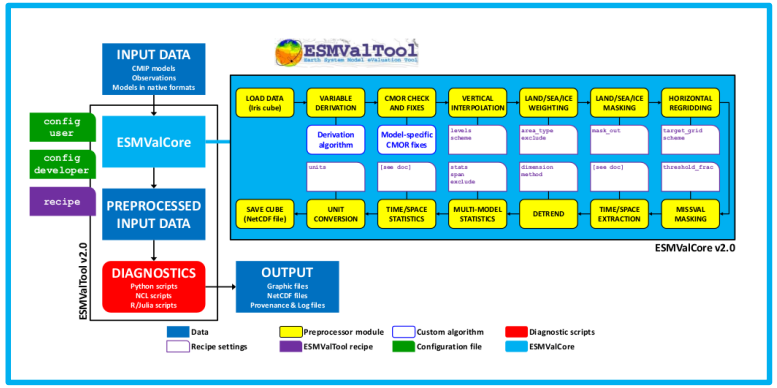
- 3.5 years of work
- 8 coding workshops
- 416 pages documentation
- 776 solved issues
- 1276 merged pull requests
- 1725 files
- 544,971 lines of code

International ESMValTool development team

- 17 funded projects
- 63 institutions
- 203 developers

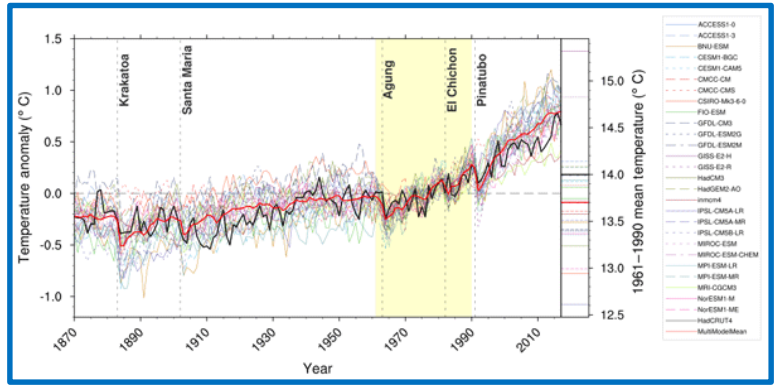
Righi et al., 2020

Technical overview



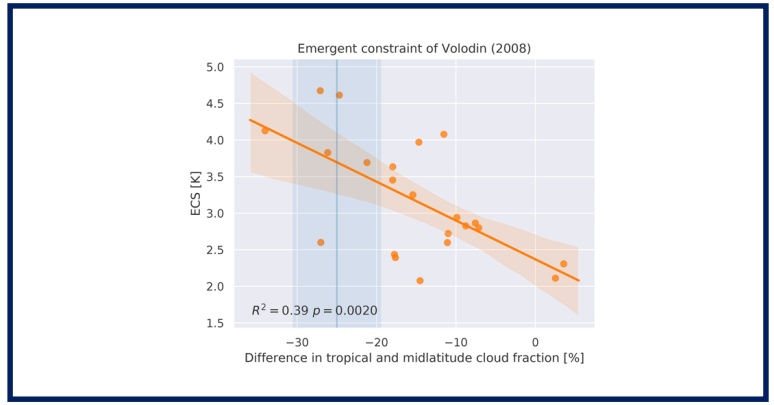
Eyring et al., 2020

Large-scale diagnostics



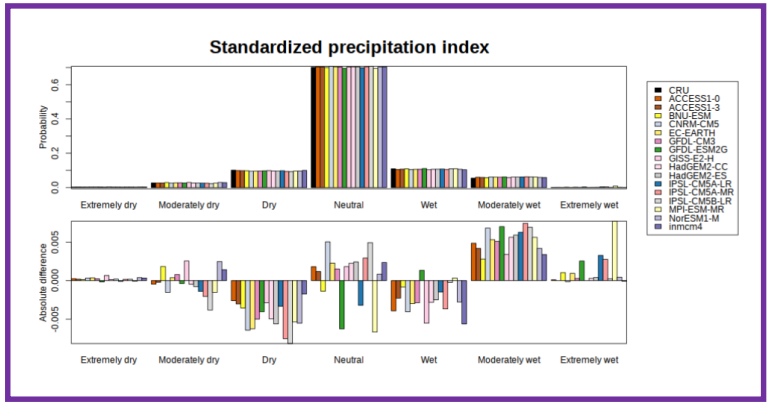
Lauer et al., 2020

Diagnostics for emergent constraints and future projections



Weigel et al., 2021

Diagnostics for extreme events, regional and impact evaluation



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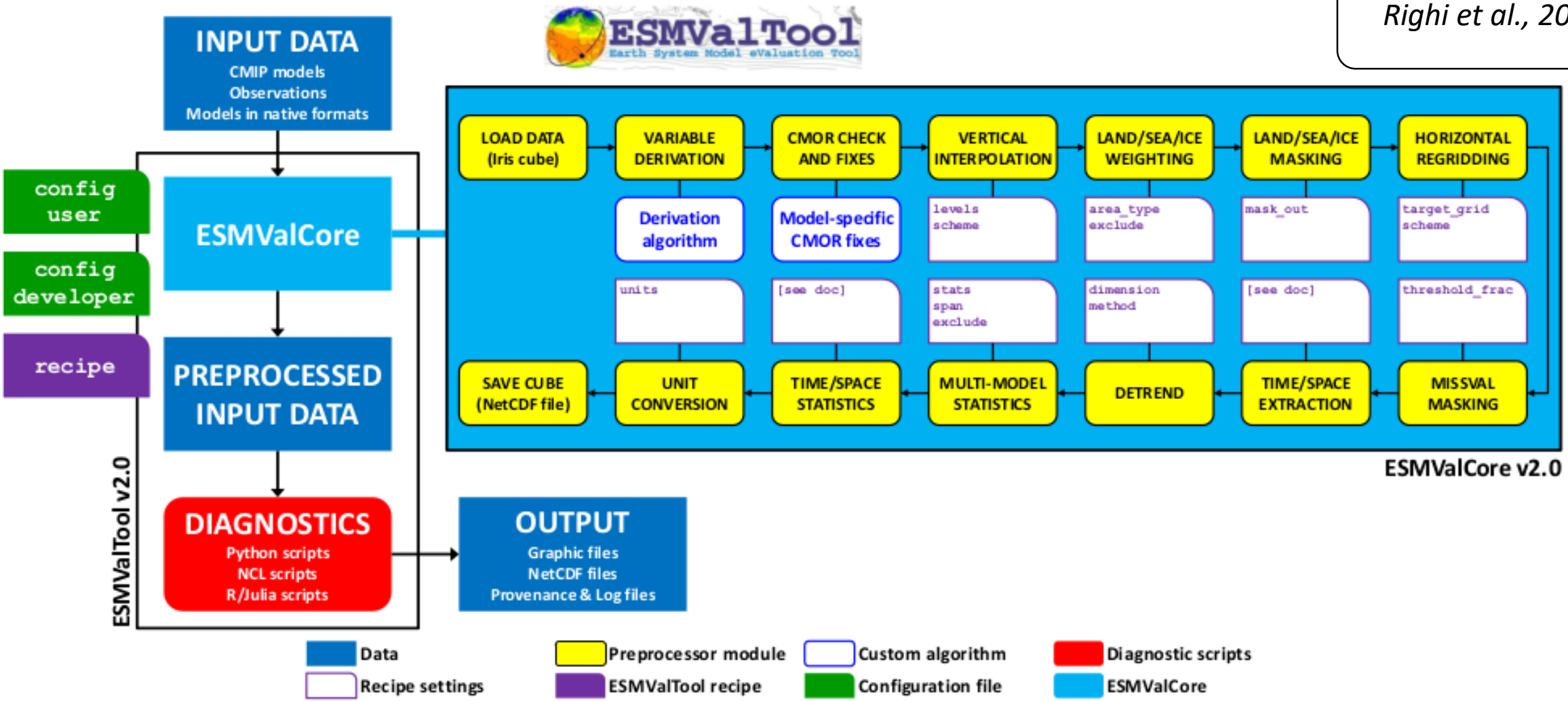
Righi et al., 2020



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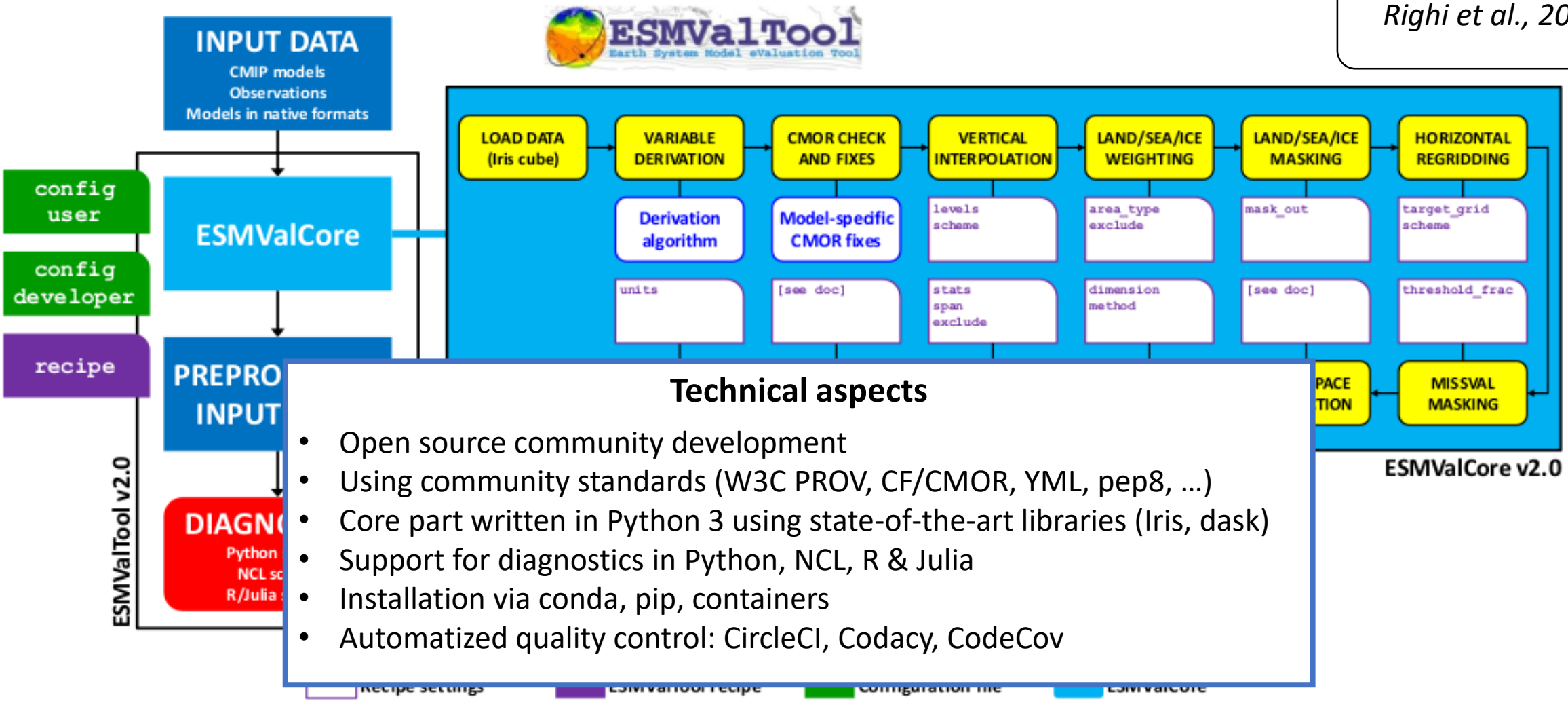
Technical overview

Righi et al., 2020



Technical aspects

- Open source community development
- Using community standards (W3C PROV, CF/CMOR, YML, pep8, …)
- Core part written in Python 3 using state-of-the-art libraries (Iris, dask)
- Support for diagnostics in Python, NCL, R & Julia
- Installation via conda, pip, containers
- Automatized quality control: CircleCI, Codacy, CodeCov

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Latest developments

General aspects

- Frequent releases (next: ESMValTool v2.4, end of Oct. 2021)
- **Enhancement and improvement of automated testing**
- Several possibilities for installation and usage (conda, pip, containers, central modules at ESGF sites, Jupyter Kernel)

Models and data

- **Support for native model output and incorporation of ESMValTool into model development workflows**
- Coupling to the ESGF nodes including automatic download of missing datasets
- Enhanced scripts to download and “CMORize” observational data

Diagnostics

- **Diagnostic scripts and recipes continuously included**
- Improved the provenance information

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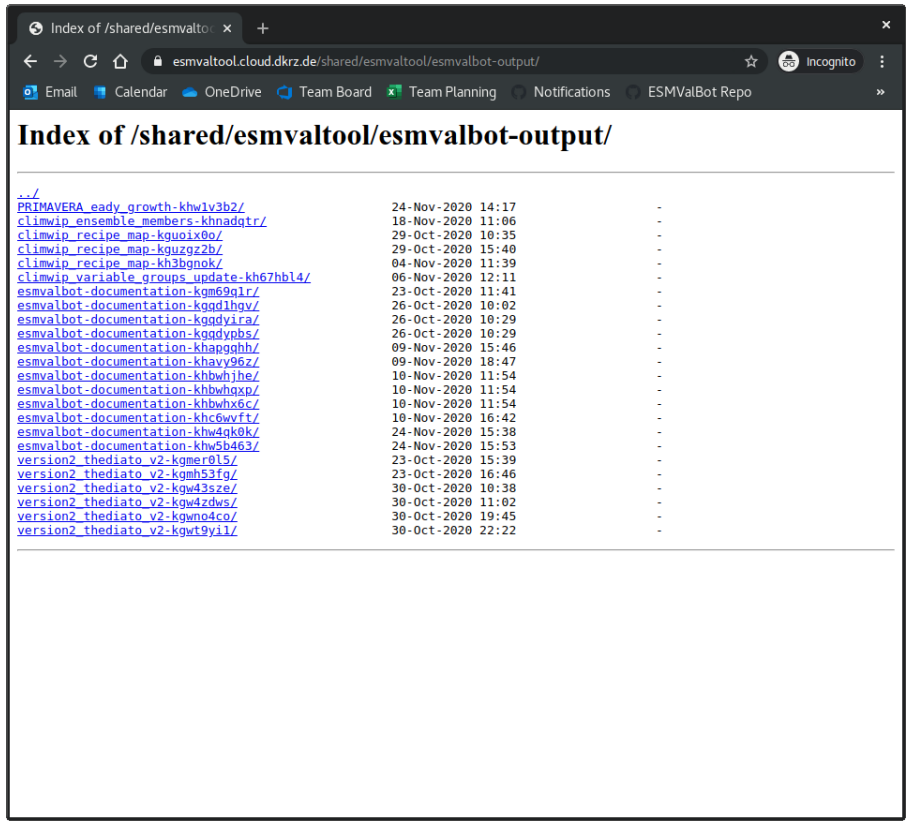
Latest developments – Automated testing

Status

- Technical testing done automatically
- Verification of recipes done manually at each release
- Recipe testing via a bot running on a virtual machine at DKRZ
- Website created with an overview of ESMValTool recipe runs



Next steps

- Developer discussion on the testing strategy (14.10.21)
- Implementing scientific regression testing of recipes to determine if results have changed at all between releases
- Schedule and run regular testing of recipes

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Latest developments – Support for native model output

Status

- New framework implemented to ease the import of native model output
- Recent incorporation of ESMValTool into model development workflows

Next steps

- User engagement to enhance the use of ESMValTool in model development workflows
- Increase the number of supported models (ICON, EMAC, …)

ICON grid

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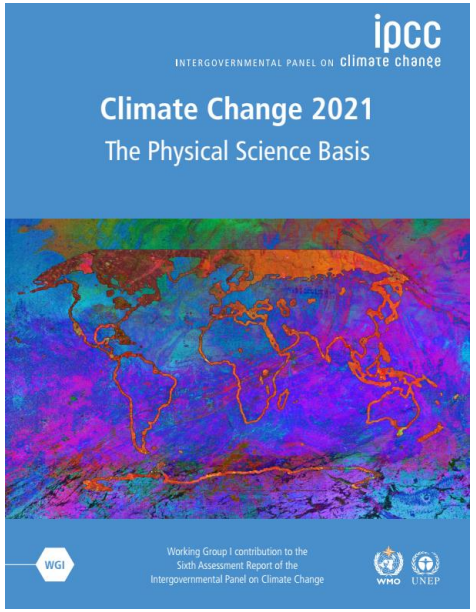
Latest developments – Inclusion of recipes and diagnostics

Status

- More than 100 recipes available
- Traceability and reproducibility of results
- ESMValTool used to produce about 50 figures in the AR6 WGI IPCC report



Next steps

- Implementation of diagnostics used in published papers
- Integration of AR6 recipes into the public version of ESMValTool

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Resources

Links

- Code on GitHub:
  - https://github.com/ESMValGroup/ESMValTool
  - https://github.com/ESMValGroup/ESMValCore
- Documentation:
  - https://docs.esmvaltool.org
- Installation with conda:
  - https://anaconda.org/conda-forge/esmvaltool
  - https://anaconda.org/conda-forge/esmvalcore
- Issues available at:
  - https://github.com/ESMValGroup/ESMValTool/issues
- F.A.Q.:
  - https://github.com/ESMValGroup/ESMValTool/discussions
- Tutorial:
  - https://esmvalgroup.github.io/ESMValTool_Tutorial/
- Website:
  - https://www.esmvaltool.org/
- User mailing-list:
  - esmvaltool@listserv.dfn.de
- User Engagement Team mailing-list:
  - esmvaltool_user_engagement_team@listserv.dfn.de

Papers

- *Righi et al., Geosci. Model Dev., 13, 1179-1199*, 2020. https://doi.org/10.5194/gmd-13-1179-2020
- *Eyring et al., Geosci. Model Dev., 13, 3383-3438*, 2020. *https://doi.org/10.5194/gmd-13-3383-2020*
- *Lauer et al., Geosci. Model. Dev.,* 13, 4205-4228, 2020. *https://doi.org/10.5194/gmd-13-4205-2020*
- *Weigel et al., Geosci. Model Dev.,* 14, 3159-3184, 2021. *https://doi.org/10.5194/gmd-14-3159-2021*

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THE CONSORTIUM

Coordinated by **CNRS-IPSL**, the IS-ENES3 project gathers **22 partners** in **11 countries**

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