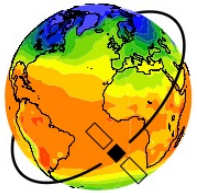

ESMValTool

Earth System Model Evaluation Tool

Terra FIRMA

# ESMValTool Tutorial
# 4th May 2023
# NCEO and TerraFIRMA


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[5]National Centre for Atmospheric Science
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UKRI Natural Environment Research Council

National Centre for Atmospheric Science NATURAL ENVIRONMENT RESEARCH COUNCIL | National Oceanography Centre | UK Centre for Ecology & Hydrology | National Centre for Earth Observation NATURAL ENVIRONMENT RESEARCH COUNCIL | PML Plymouth Marine Laboratory | British Antarctic Survey NATURAL ENVIRONMENT RESEARCH COUNCIL | cpom Centre for Polar Observation and Modelling Natural Environment Research Council | BGS British Geological Survey

# Today's Tutorial

1. Introduction – presentation
2. Demo
3. Q&A

Break

4. Hands on Exercises with the Software Carpentry online tutorial
5. Feedback

Recording on for 1 and 2.

# Desired Outcomes

- **Understanding** what ESMValTool is and what it can do for you.
- **Starting** with existing recipes and diagnostics.
- **Writing** your own recipes for preprocessing.
- **Parsing** error messages and getting help when stuck.
- **Contributing** to the community (as early as right after this session)!
- **Advanced** tutorial planning!

# ESMValTool

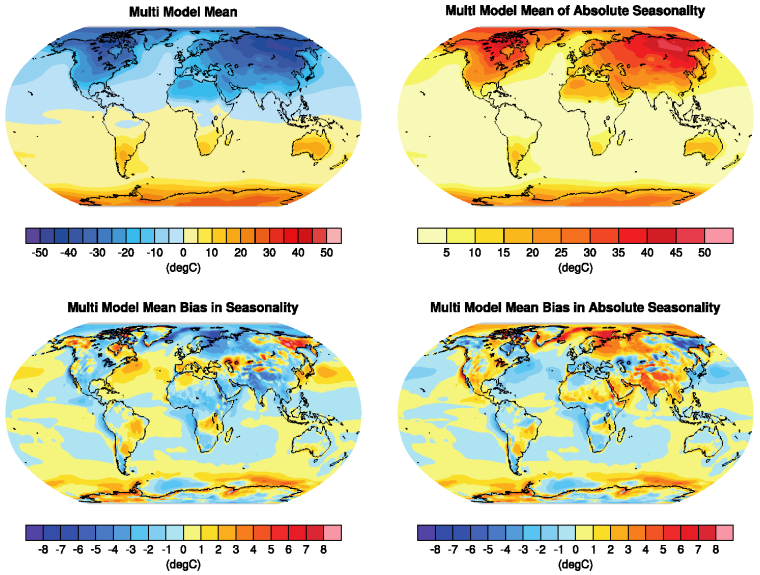
- **E**arth **S**ystem **M**odel E**val**uation **Tool** (ESMValTool)
- community diagnostics and performance metrics tool
- for the evaluation and analysis of Earth System Models
- routine comparison of single or multiple models
- against predecessor versions or observations

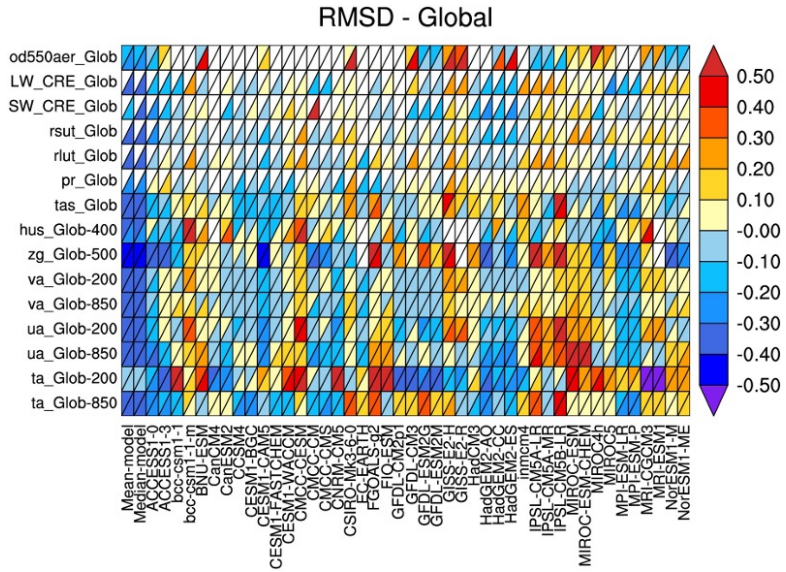
# Features

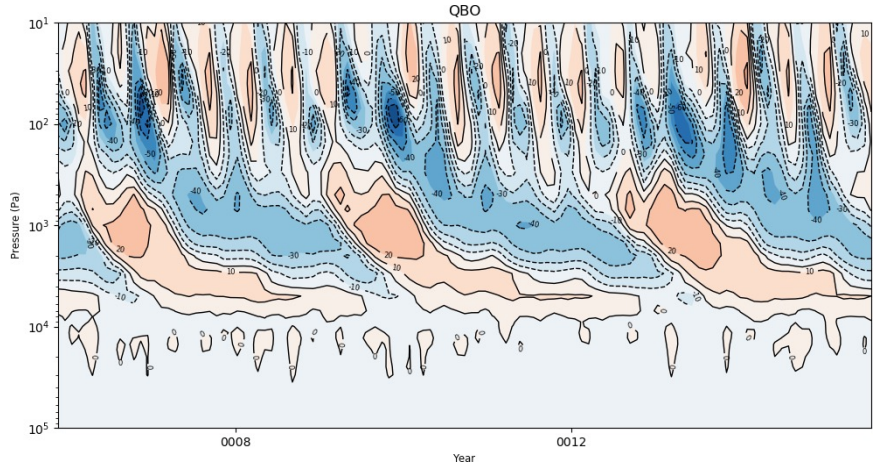
- **Community Effort:** open to users and developers (~63 participating institutions, > 70 CMIP models, 203 developers, 17 funded projects)
- **Wide scope:** diagnostics and performance metrics covering different aspects of the Earth System.
- **High flexibility:** new diagnostics and observational datasets can be easily added.
- **Multi-language support:** Python, NCL, R, Julia…other open source languages possible.
- **Reproducibility of results:** provenance.
- **Well documented:** source code and diagnostics.

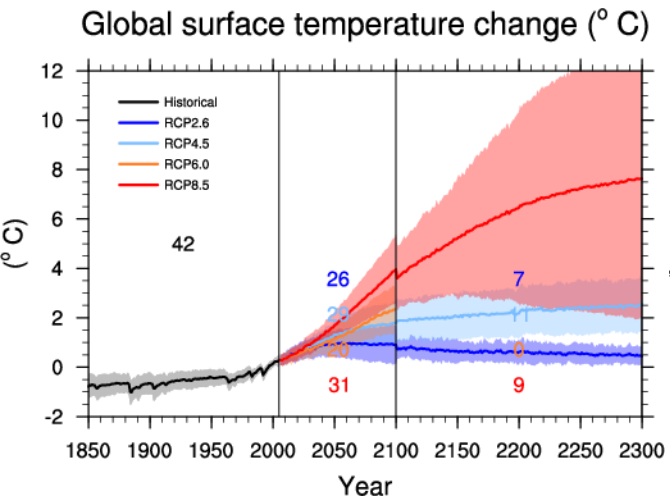
# ESMValTool Gallery

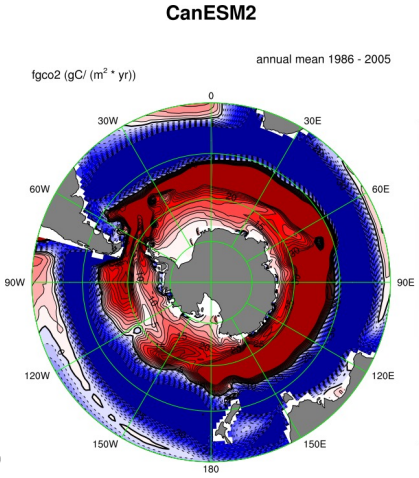
## (https://docs.esmvaltool.org/en/latest/gallery.html)

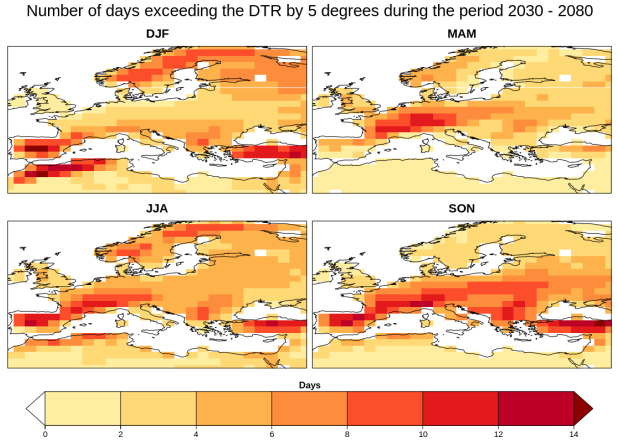


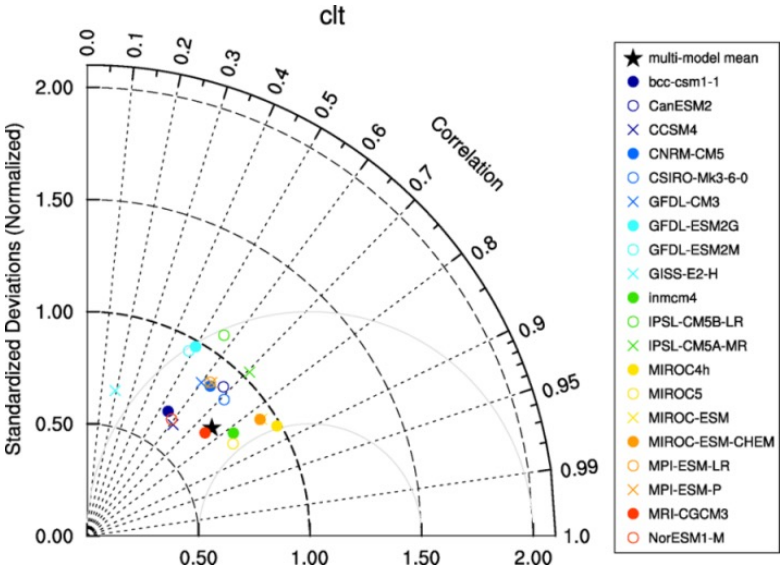



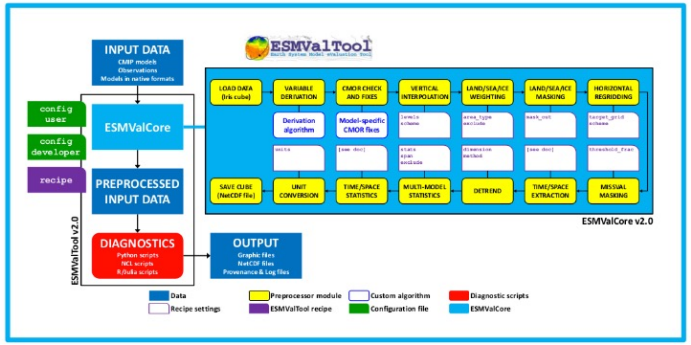



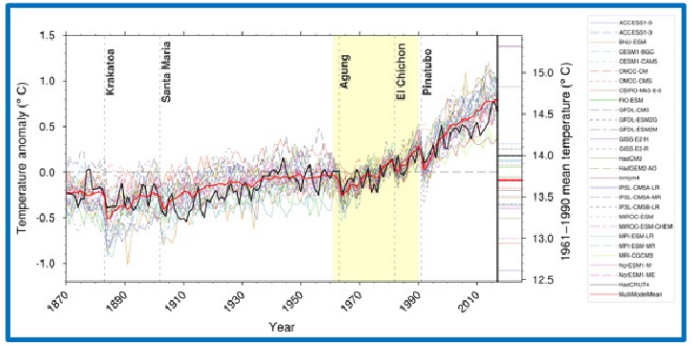
# ESMValTool Science

https://esmvaltool.org/publications/

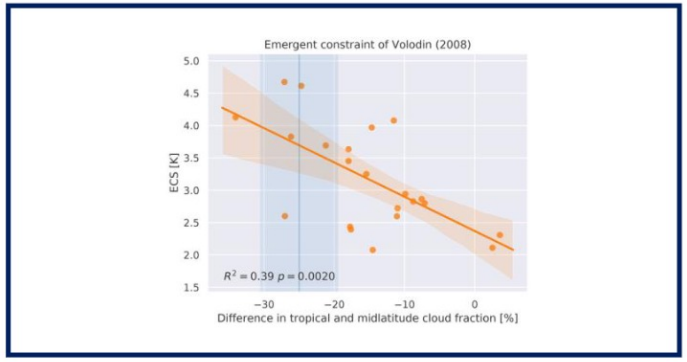
*Righi et al., 2020*
**Technical overview**



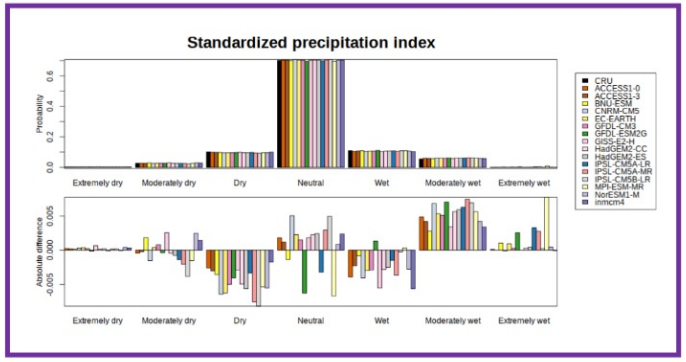

*Eyring et al., 2020*
**Large-scale diagnostics**




*Lauer et al., 2020*
**Diagnostics for emergent constraints and future projections**

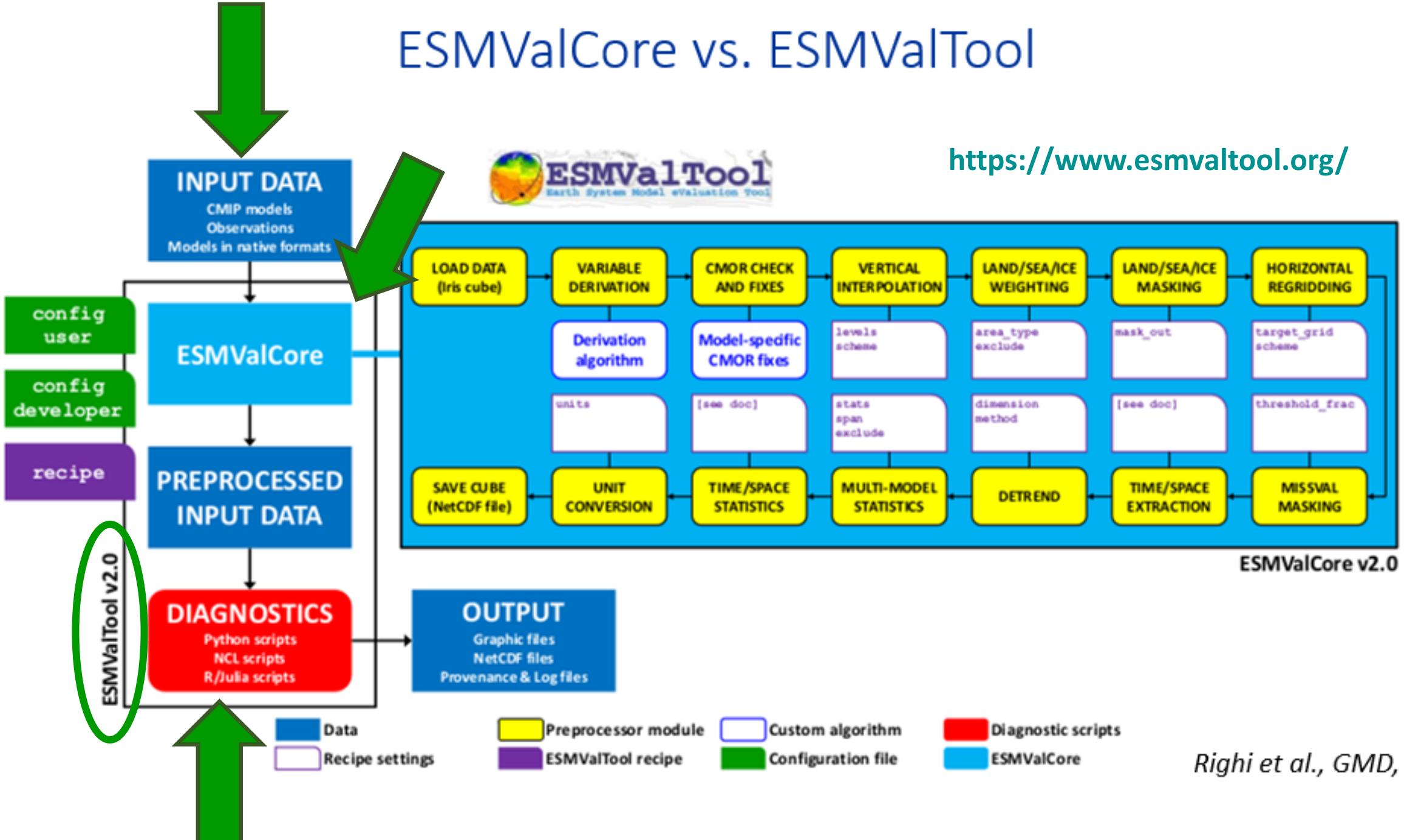



*Weigel et al., 2021*
**Diagnostics for extreme events, regional and impact evaluation**



# ESMValCore vs. ESMValTool

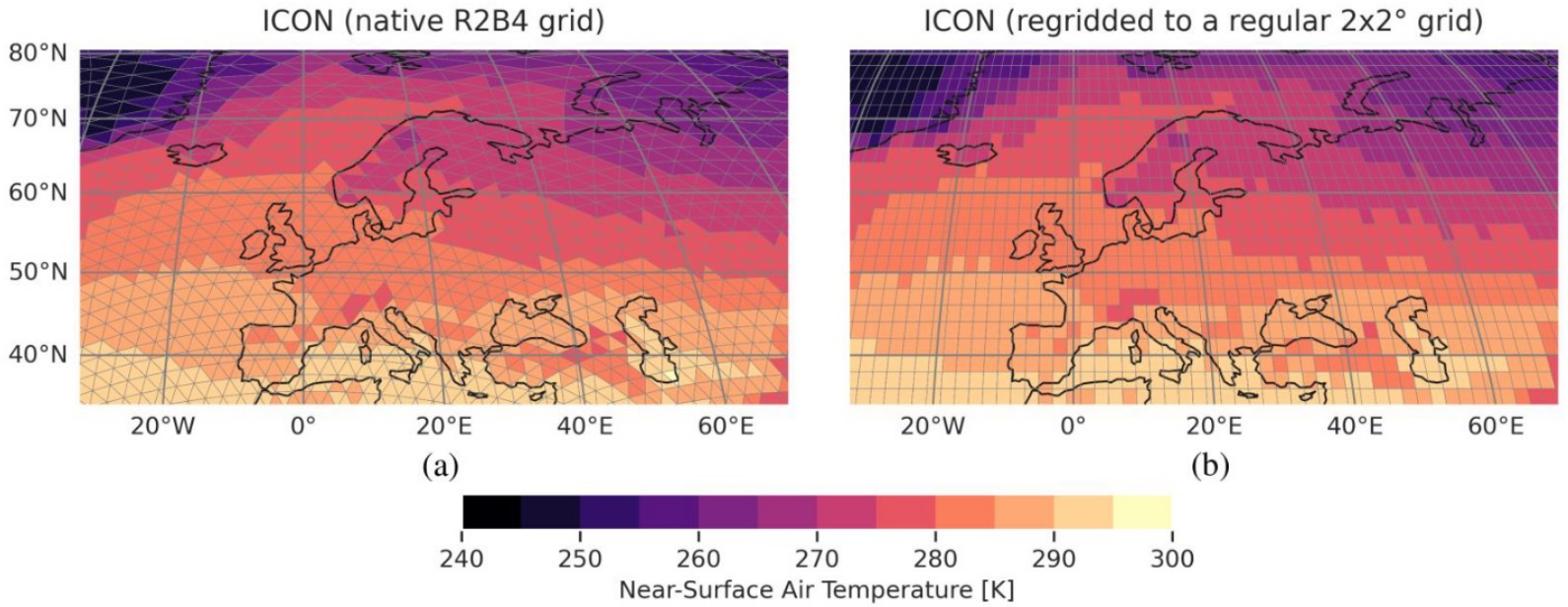
https://www.esmvaltool.org/




*Righi et al., GMD, 2020*

# Latest ESMValTool features

- Working with native model output: no CMOR-ization of model data necessary; four models currently supported.




- Automatic download from ESGF nodes including support for wildcard characters in recipes.
- Support for CORDEX datasets in a rotated pole coordinated system.
- Working with unstructured grids possible.
- Monitoring capabilities: model simulations can be checked while they are running.

# For users in the UK

- Access to CMIP data via CEDA (BADC)
- Access to CMOR-ized observational data sets (Tiers1/2/3 : **~827GB**)
  - ESA-CCI, ERA, obs4MIPS
- JASMIN specific instructions where possible in the tutorial (more on this later).
- Available as a module on JASMIN

# UK Met Office users

```
> module load scitools/community/esmvaltool/2.8.0
```

Further instructions are available at

https://metoffice.sharepoint.com/sites/MOESMValToolCommunityofPracticeExt/SitePages/ESMValTool-at-the-Met-Office.aspx#to-use-esmvaltool.

# ESMValTool Resources

## 1. Github repositories

https://github.com/ESMValGroup/ESMValTool

## 2. Documentation

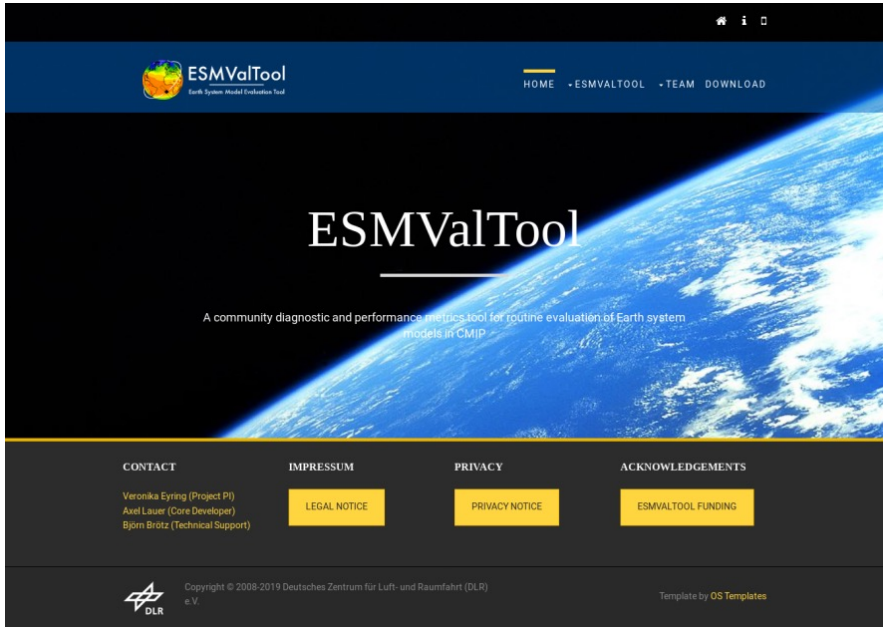
https://docs.esmvaltool.org/

## 3. Tutorial

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

## 4. Webpage

https://www.esmvaltool.org/



# ESMValTool Tutorial
# (https://esmvalgroup.github.io/ESMValTool_Tutorial/)

This lesson is being piloted (Beta version)

Home | Setup | Episodes | Extras | License | Improve this page | Search...

## ESMValTool Tutorial

This tutorial helps you to use ESMValTool.

The Earth System Model Evaluation Tool (ESMValTool) is a community developed software toolkit that aims to facilitate the diagnosis and evaluation of the causes and effects of model biases and inter-model spread within the CMIP model ensemble.

This tutorial is structured such that the main body of the tutorial, up to the episode 7, can be done in one sitting. From episode 8, each episode is a mini-tutorial covering an advanced aspect of working with ESMValTool. These mini-tutorials can be appended to the main tutorial or worked through independently.

### What will you learn in this course

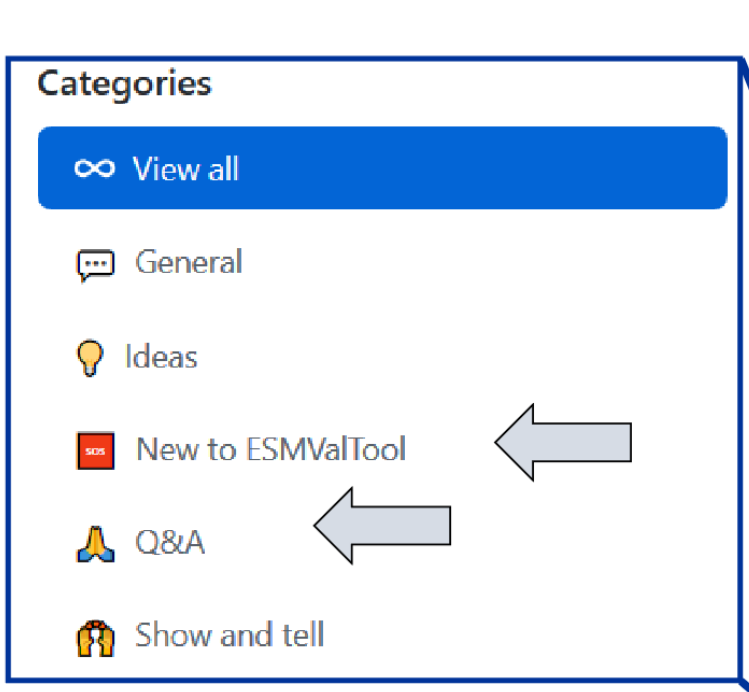
- What is ESMValTool
- How to install ESMValTool
- How to configure ESMValTool for your local system
- How to run ESMValTool
- How to work with ESMValTool's suite of preprocessors
- How to debug your recipes
- How to access and deploy recipes from the ESMValTools gallery (Advanced)
- How to develop your own diagnostics and recipes (Advanced)
- How to contribute your recipes and diagnostics back into ESMValTool (Advanced)
- How to include new observational datasets (Advanced)

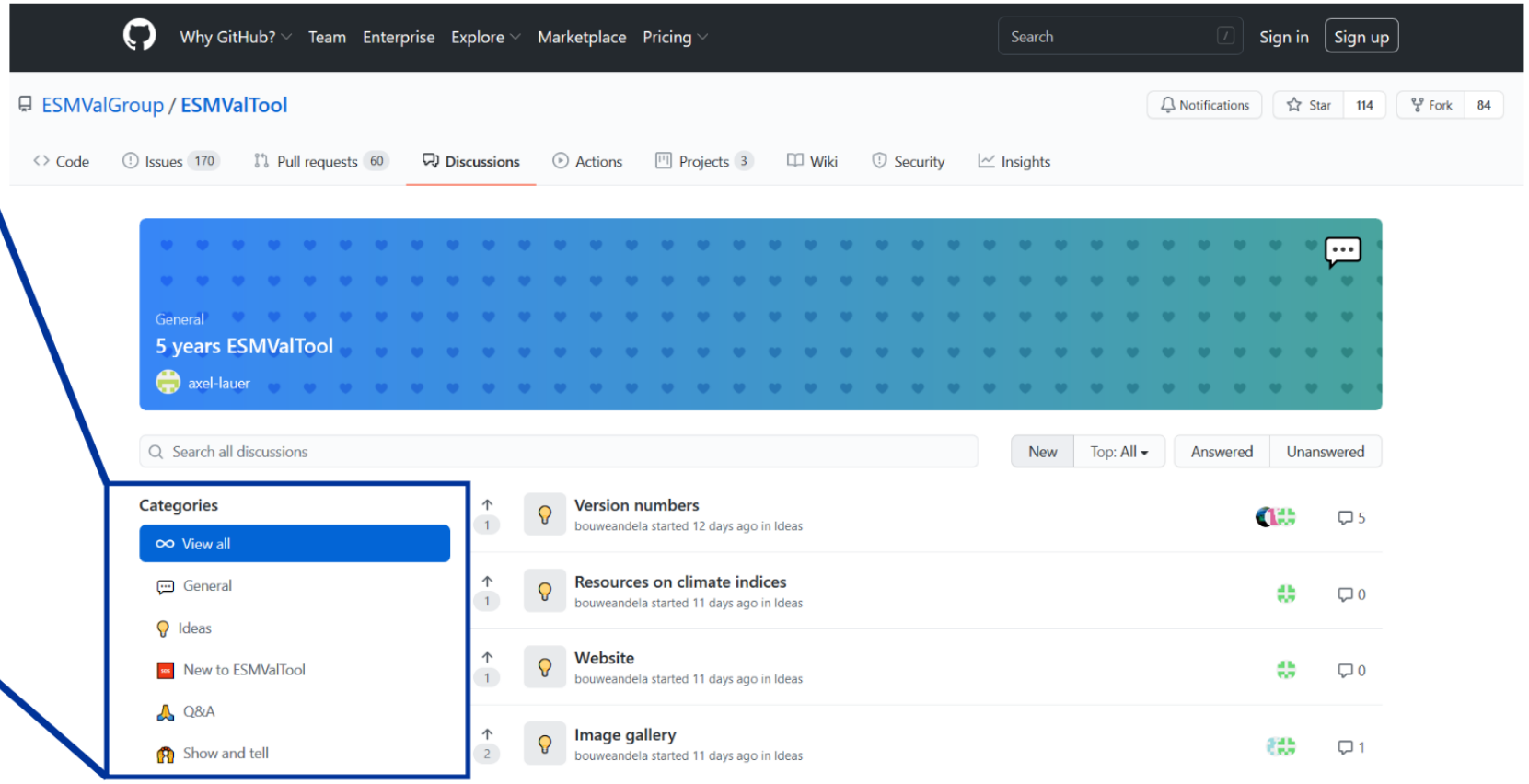
### Prerequisites

The prerequisites for the tutorial are listed on the tutorial setup page.

# GitHub Discussions
## (https://github.com/ESMValGroup/ESMValTool/discussions)

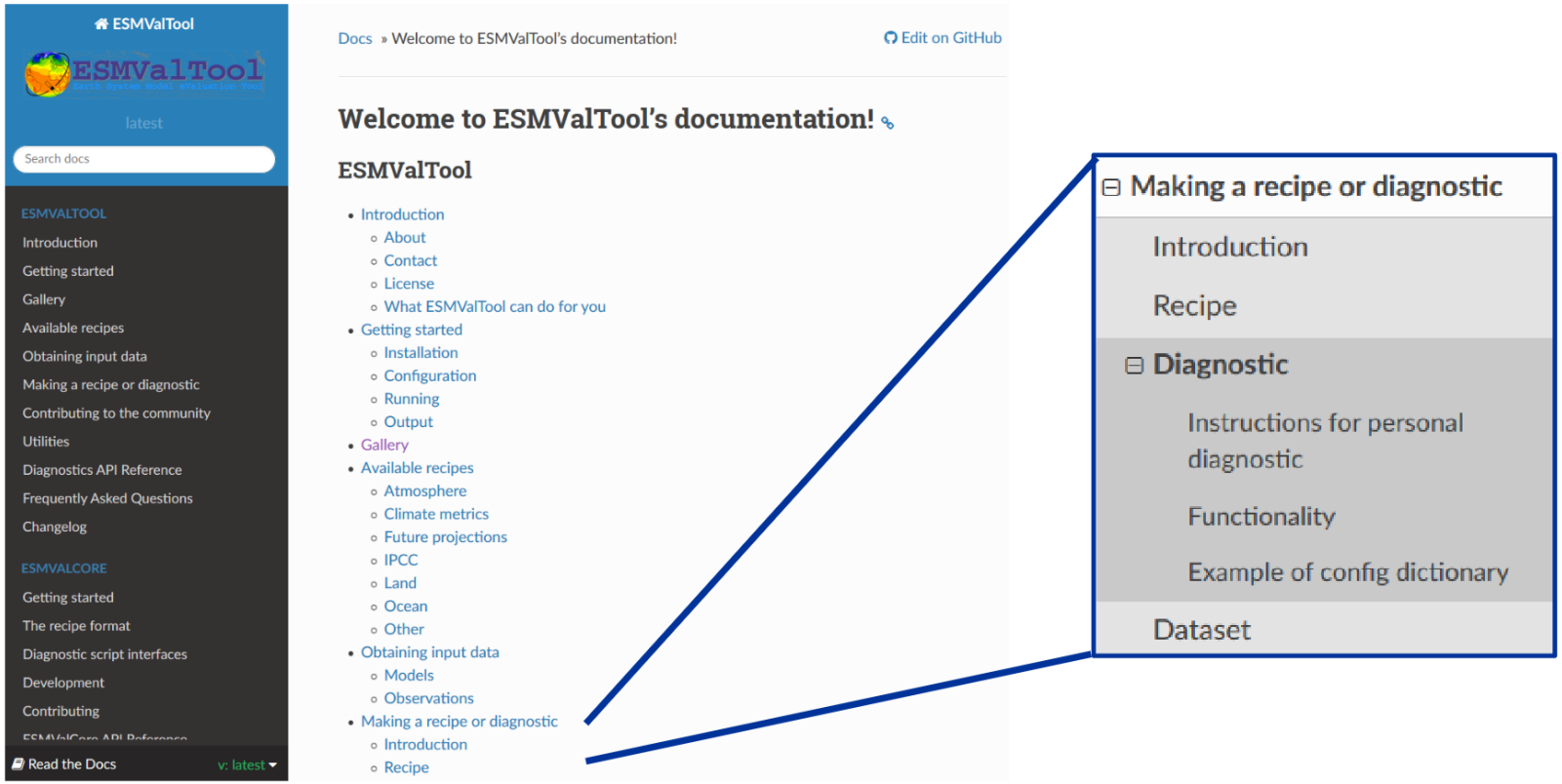
- Ideally suited for new users.
- Easy way to get in contact with developers.



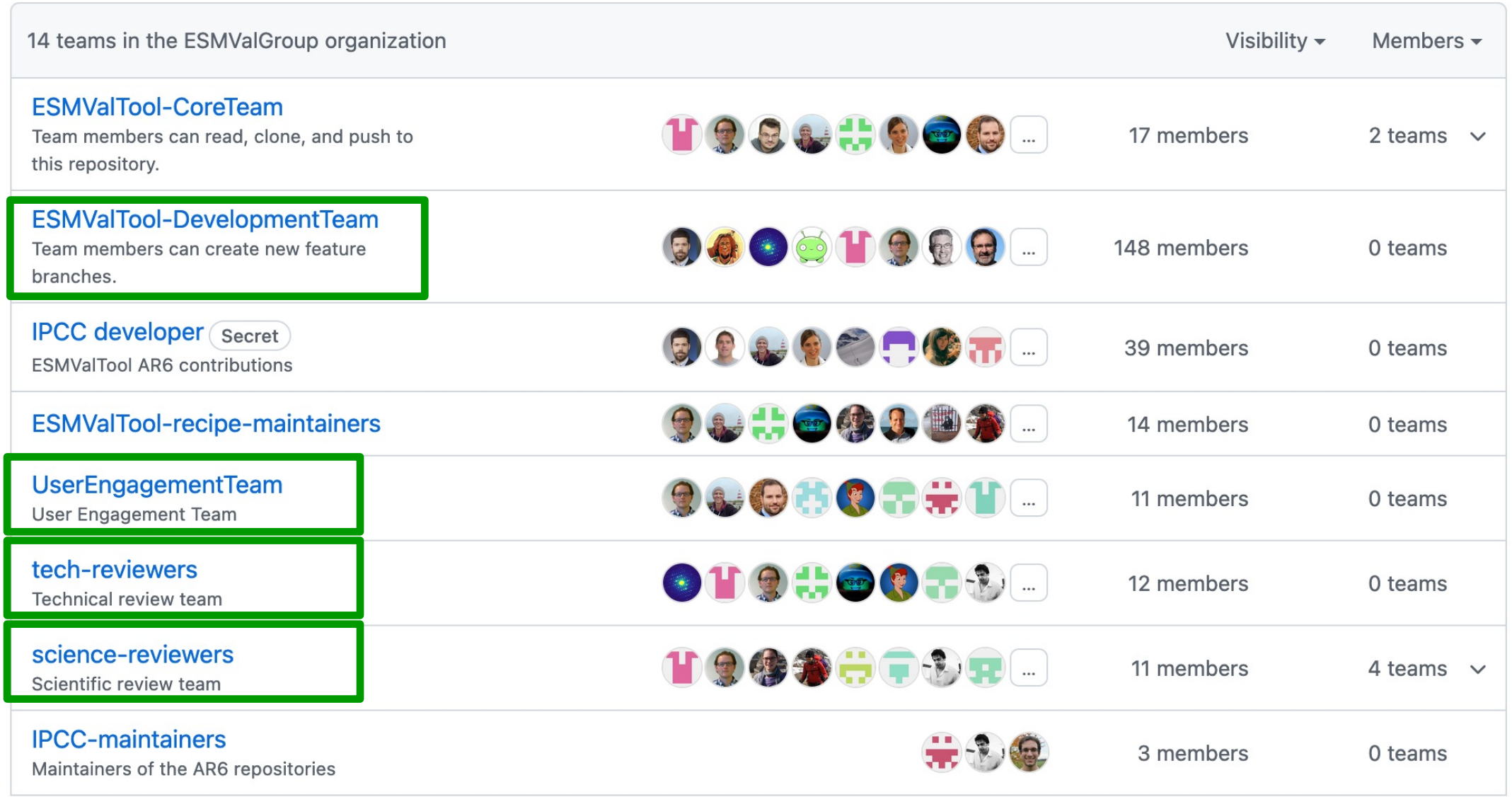



# ESMValTool Documentation

- Very detailed information about ESMValTool and ESMValCore functionality.



# Organization and Community Participation



# Questions?

**Contact the User Engagement Team at**
**esmvaltool_user_engagement_team@listserv.dfn.de**