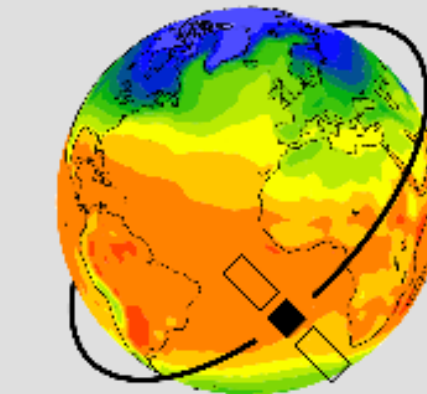


Evaluation of Native Earth System Model Output with ESMValTool

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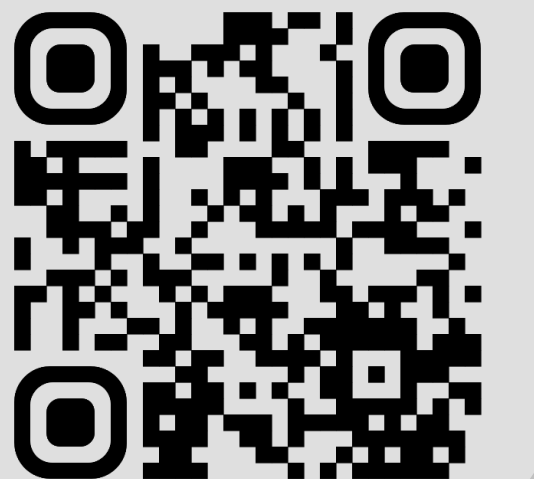
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ESMValTool
Earth System Model Evaluation Tool



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Abstract

The Earth System Model Evaluation Tool (ESMValTool) is a community diagnostics and performance metrics tool for routine evaluation of Earth system models. Originally, ESMValTool has been designed to process reformatted output provided by large model intercomparison projects like the Coupled Model Intercomparison Project (CMIP). Here, we describe a new extension of ESMValTool that allows reading and processing native climate model output, i.e., operational output produced by running the climate model through the standard workflow of the corresponding modeling institute.

About ESMValTool

- Fast and easy routine evaluation of ESMs including provenance records for all results (traceability and reproducibility).
- Well-established analysis based on peer-reviewed literature.
- Multitude of generalized preprocessor functions (e.g., regridding, statistics, multi-model analysis, etc.).
- Extensive documentation (user guide, peer-reviewed papers, tutorial).

Righi et al. (2020): **Technical overview**

Eyring et al. (2020): **Large-scale diagnostics**

Lauer et al. (2020): **Emergent constraints and future projections**

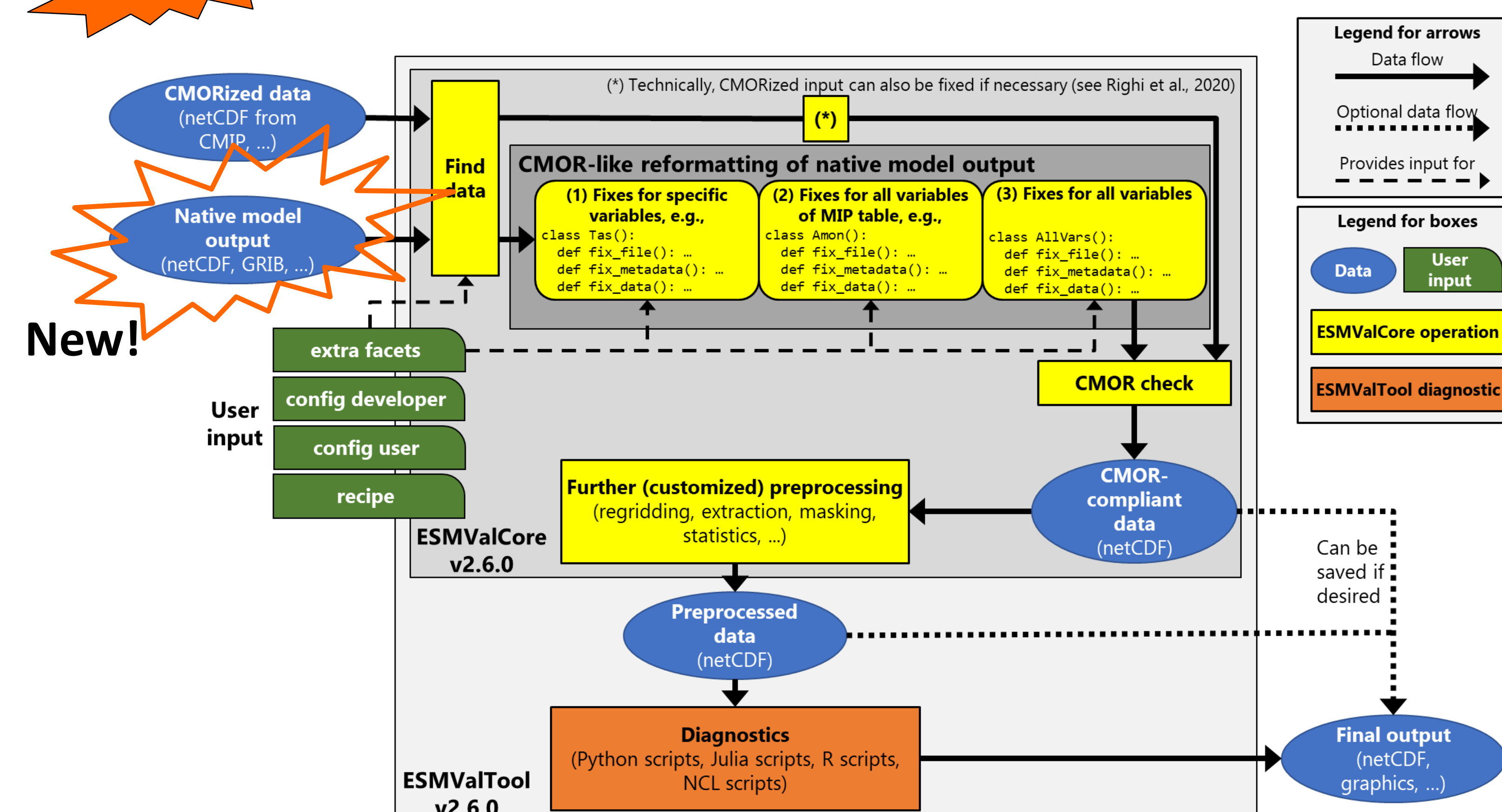
Weigel et al. (2021): **Extreme events, regional and impact evaluation**

Scientific Documentation

New Features Available Since v2.6.0

1

Reading and Processing Native Model Output



Then:

Originally, all input data for ESMValTool needed to be **CMORized** (CMOR = Climate Model Output Rewriter), i.e., follow the CMOR standards and conventions. CMORization is an expensive postprocessing step that is usually only performed for model output provided for large model intercomparison projects (e.g., CMIP – Coupled Model Intercomparison Project). This **hindered application of ESMValTool to native model output** which usually does not follow the CMOR conventions out-of-the-box.

Now:

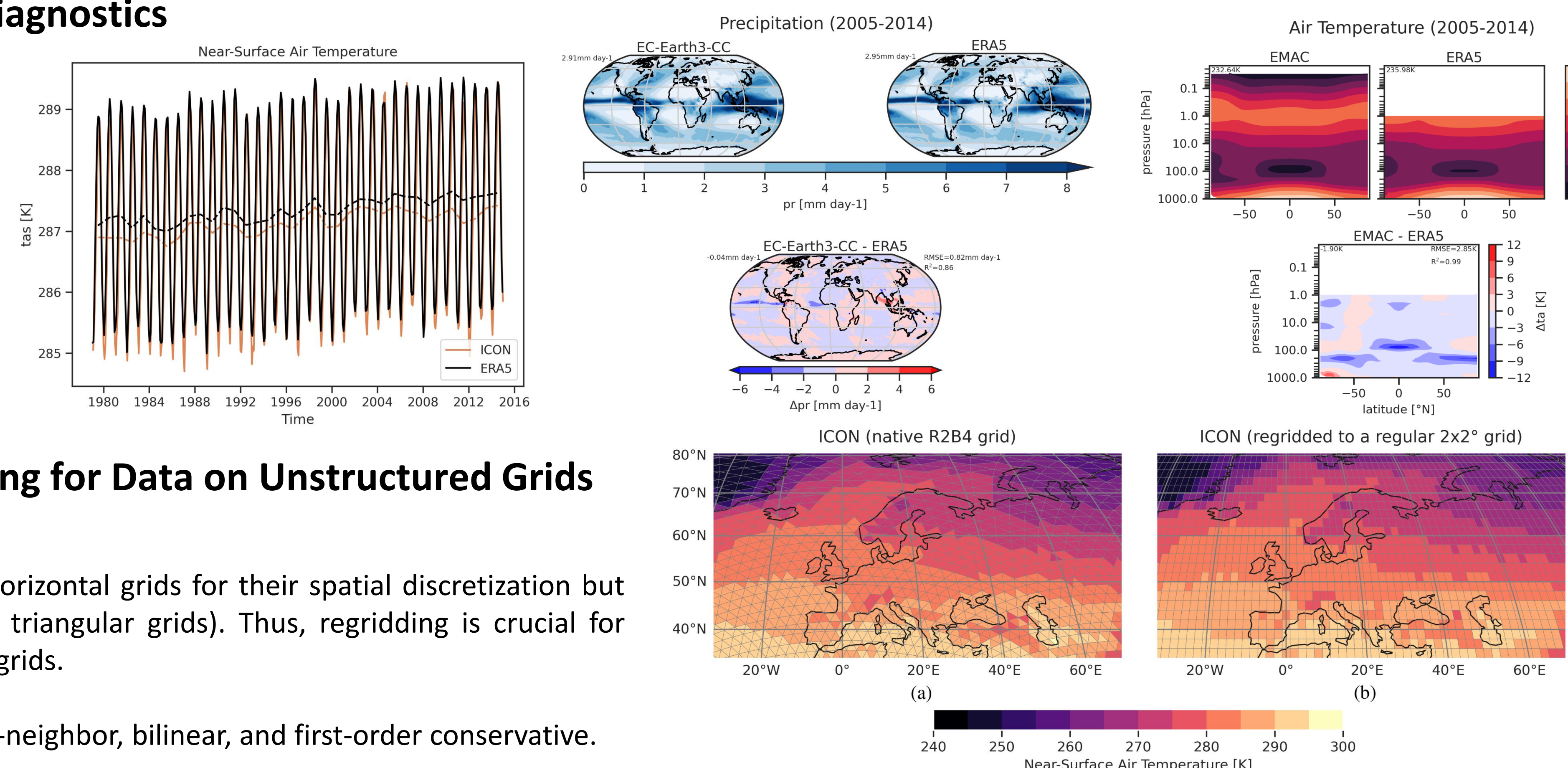
New additions to ESMValTool now allow a **CMOR-like reformatting** of native model output during runtime. This enables the application of the rich collection of diagnostics provided by ESMValTool to the supported models. Currently supported are: **CESM2, EC-Earth3, EMAC, ICON, and IPSL-CM6**.

2

General-Purpose Diagnostics

A set of **general-purpose diagnostics** have been added to ESMValTool that are able to plot a wide range of plot types. **Example applications:**

- Quick overview of new simulation results.
- Comparison of models against predecessor versions.
- Assessment of performance of different simulations against observations.



3

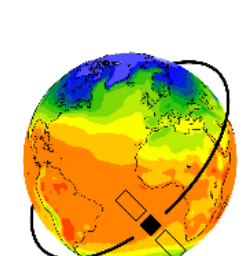
Advanced Regridding for Data on Unstructured Grids

Many state-of-the-art ESMs do not use regular horizontal grids for their spatial discretization but **unstructured grids** instead (example: ICON with triangular grids). Thus, regridding is crucial for comparison of these models with data on regular grids.

Currently supported regridding schemes: nearest-neighbor, bilinear, and first-order conservative.

Further Resources

Schlund, M., Hassler, B., Lauer, A., Andela, B., Jöckel, P., Kazeroni, R., Loosveldt Tomas, S., Medeiros, B., Predoi, V., Sénési, S., Servonnat, J., Stacke, T., Vegas-Regidor, J., Zimmermann, K., and Eyring, V.: *Evaluation of Native Earth System Model Output with ESMValTool v2.6.0*, Geosci. Model Dev. Discuss. [preprint], <https://doi.org/10.5194/gmd-2022-205>, in review, 2022.



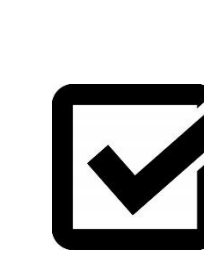
ESMValTool Website
esmvaltool.org



ESMValTool Documentation
docs.esmvaltool.org/en/latest



ESMValTool on GitHub
github.com/ESMValGroup/ESMValTool



ESMValTool Tutorial
esmvalgroup.github.io/ESMValTool_Tutorial

