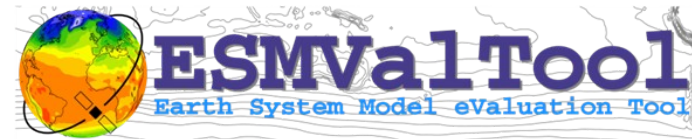


Supporting CMIP6 Simulations with the ESMValTool (AP6)

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Projekttreffen CMIP6-DICAD



13 März 2019

Knowledge for Tomorrow



ESMValTool modernisation

! Version 1.0 released in 2016 (Eyring et al., GMD, 2016)
Apache 2 Open Source License



Due to

- growing complexity of the code
- inefficient modularization
- demands by increasing data volumes
- performance issues
- not being very user friendly



a large refactoring of the code base and professionalization was initiated (v1.0 → v2.0)

Joint development across projects by international partners und the lead of DLR (Germany): NLESC (Netherlands), MetOffice (UK), URead (UK), BSC (Spain)


<https://github.com/ESMValGroup/ESMValTool>



(I) Development ESMValTool v2: Preprocessor

- ESMValTool **preprocessor** now fully based on **python** with Conda installation
- **Modern standards for storing configuration files** (YAML), **data** (NetCDF), and **provenance information** (W3C PROV)
- Revised **Backend** for a central preprocessing of input data (9 operations)
- New **interface** between workflow and diagnostics
- Huge gain in **execution time**: factor 10 to 20 (depending on recipe)
- **Professional software development tools**, e.g.
 - code review (through GitHub pull requests)
 - automated testing (using CircleCI)
 - software quality monitoring (static code analysis through Codacy and a consistent coding style enforced through unit tests)

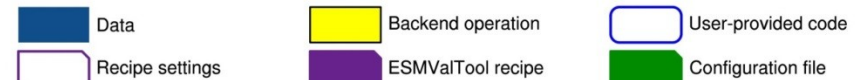
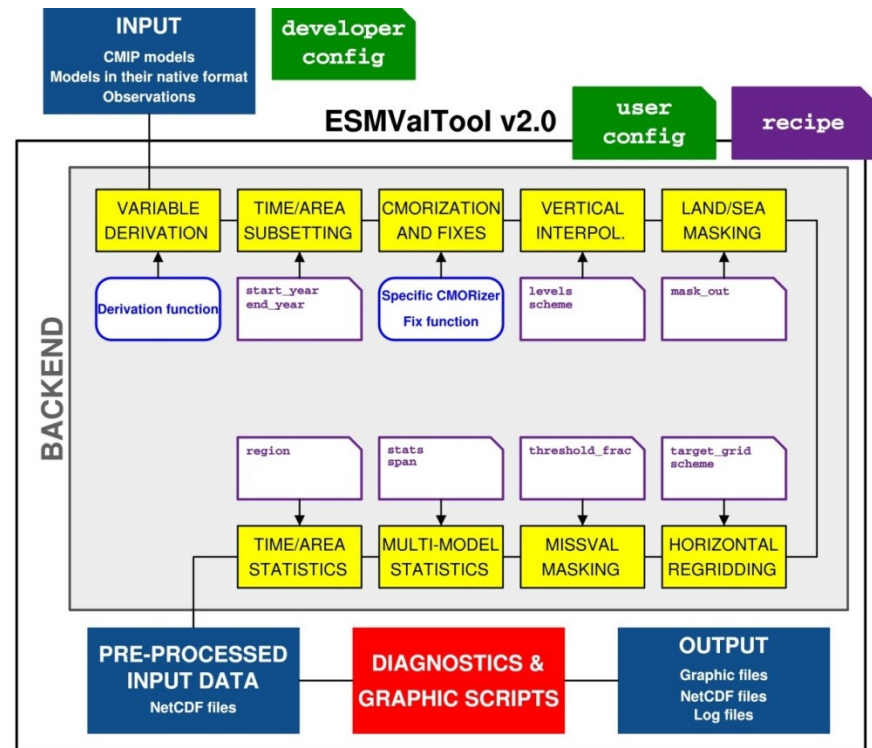
=> ensures that the ESMValTool is reliable, well documented and easy to maintain.



→ Data retrieval is performed automatically; data parameters are extracted from the namelist and handled via the dedicated data finder.

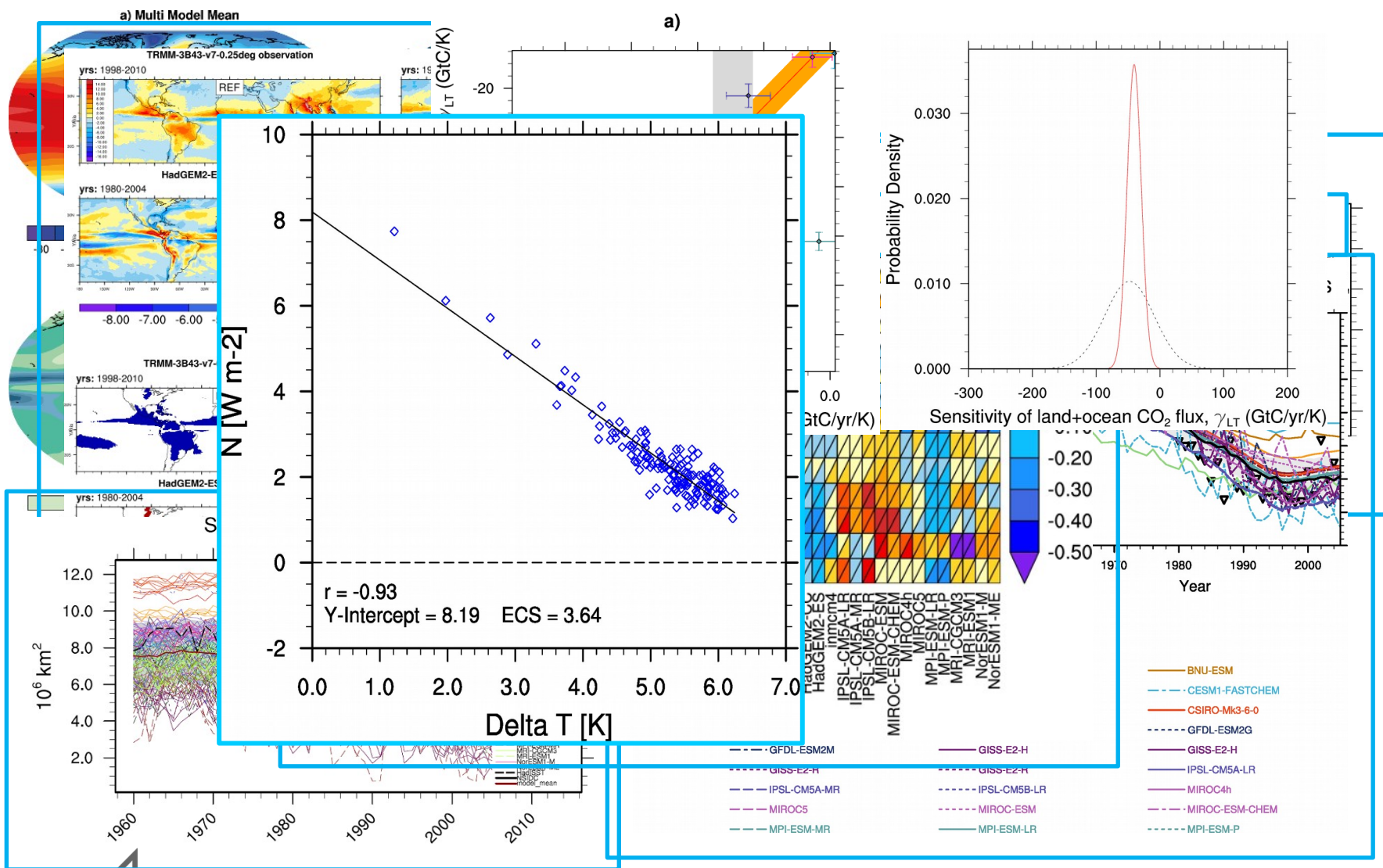
→ Supports user, local cluster, local ESGF node data storage types.

→ Data could alternatively be downloaded from remote ESGF nodes via *synda*.



(II) Development ESMValTool v2: Enhanced diagnostics

Growing number of recipes included



Enhancement of the ESMValTool

Improved provenance – traceability and reproducibility

Log-files

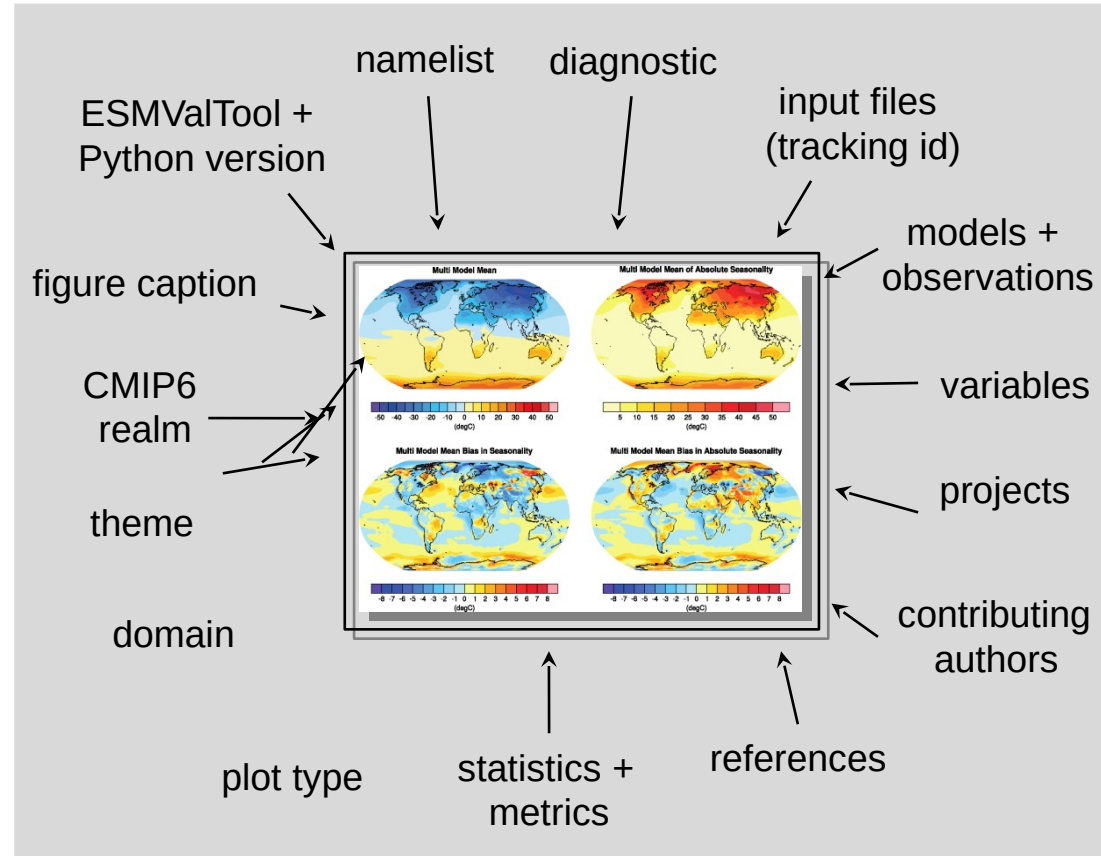
- Creation date
- Host and user
- Version number of the ESMValTool
- List of namelists / diagnostics run
- Variables and models processed
- List of all model files that have been used including + Tracking ID (read from metadata if available)
- Patches applied to model data (if any)
- List of all observations used including references
- Contributing authors and acknowledgement of projects

Provenance

- W3c prov standard

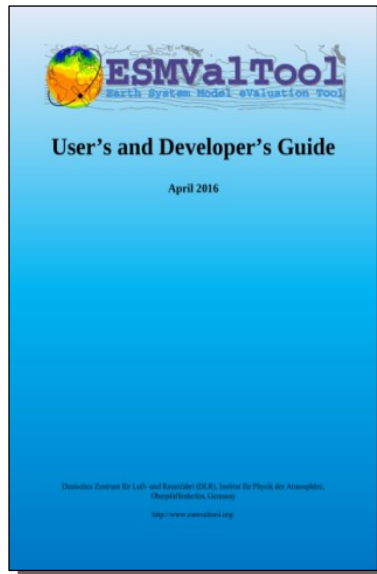


Tagging: meta data attached to image files



Enhancement of the ESMValTool

Automatization of creating User's and Developer's Guide: Sphinx based documentation system



Sphinx-based documentation

- Conversion to *reStructuredText* Format (.rst)
- Possibility of **in-code documentation**
- All source code files available in GitHub repository and can be edited directly on the GitHub website
- Automatic generation of html and pdf via **Read the Docs**
- Documentation available online at <http://esmvaltool.readthedocs.io/en/latest/>



Enhancement of the ESMValTool

The screenshot displays the ESMValTool documentation website. The top navigation bar includes the ESMValTool logo and a search bar. The left sidebar contains a table of contents with links to various sections. The main content area shows the 'Preface' page, which includes a list of sections: Preface, Known Issues, and User's Guide. The 'User's Guide' section is expanded, showing a detailed list of sub-sections. An orange dashed arrow points from the 'v. latest' link in the sidebar to the 'v. latest' link in the main content area.

ESMValTool

latest

Search docs

1. Preface

1. ESMValTool known issues

1. Introduction

2. Software installation

3. ESMValTool namelists

4. Directory structure of the ESMValTool

5. Configuration files

6. Running the ESMValTool

1. Writing a diagnostic script or a metrics set

2. Scientific documentation of a diagnostic script or metrics set

3. Tasks and responsibilities

4. Guidelines for data processing

5. References

1. More tables

2. Workflow of reformat routines

1. Git repository

1. Introduction

Read the Docs v. latest

Docs » Preface Edit on GitHub

Preface

- 1. Preface

Known Issues

- 1. ESMValTool known issues

User's Guide

- 1. Introduction
 - 1.1. Objectives and approach
 - 1.2. Architecture
- 2. Software installation
 - 2.1. Prerequisites
 - 2.2. Obtaining the source code
 - 2.3. Software installation
 - 2.4. Verification of the installation
- 3. ESMValTool namelists
 - 3.1. More on the <GLOBAL>-tag
 - 3.2. More on the <MODELS>-tag
 - 3.3. More on the <DIAGNOSTICS>-tag
 - 3.4. Namelist configuration file
 - 3.5. Standard header for the namelist
 - 3.6. Example namelist
- 4. Directory structure of the ESMValTool

online
version

pdf
version
available

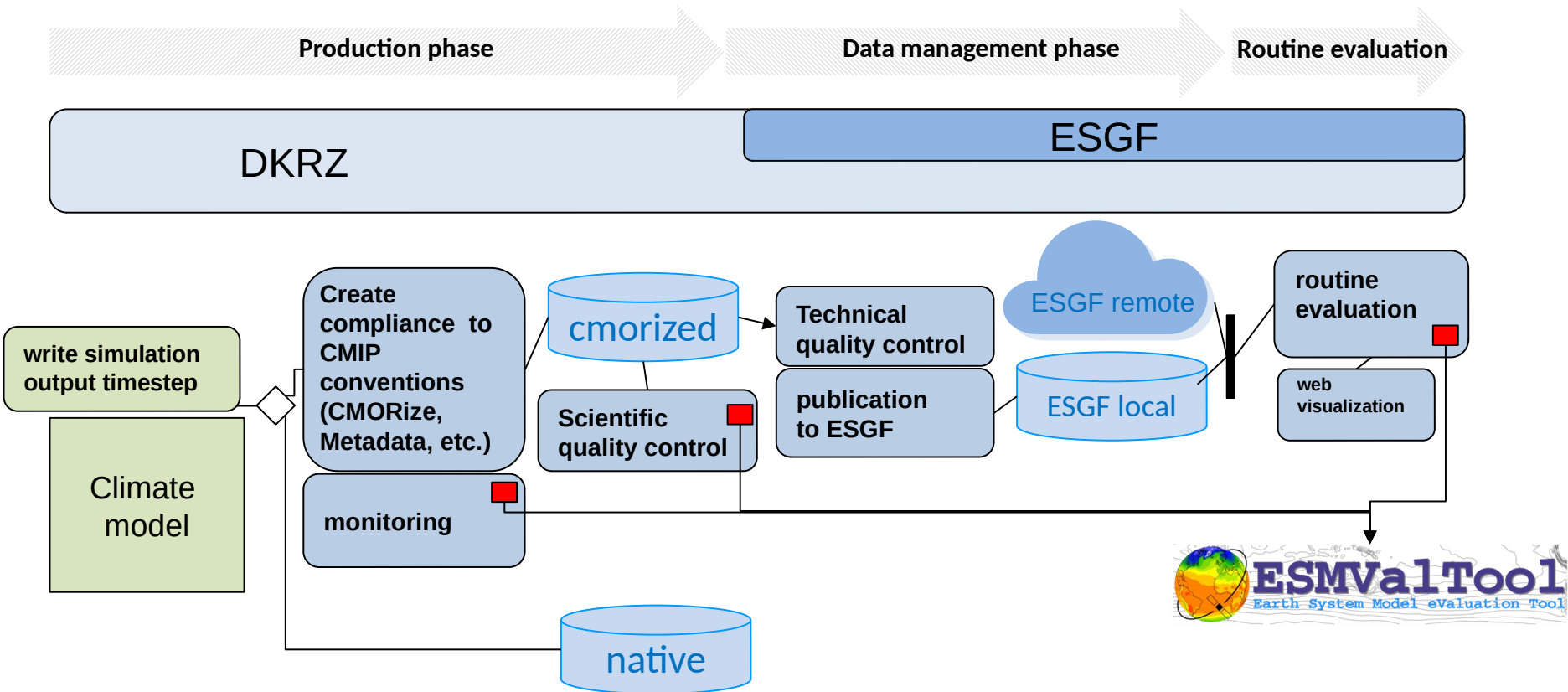


... kurz gesagt

- Starke Weiterentwicklung in den letzten drei Jahren
- Provenance
- Leicht zu installieren
- Anwendung auf neue Modelldaten (wenn Daten dem cmor-Standard folgen leicht möglich)
- Leichte Anpassungen notwendig bei "custom variables"



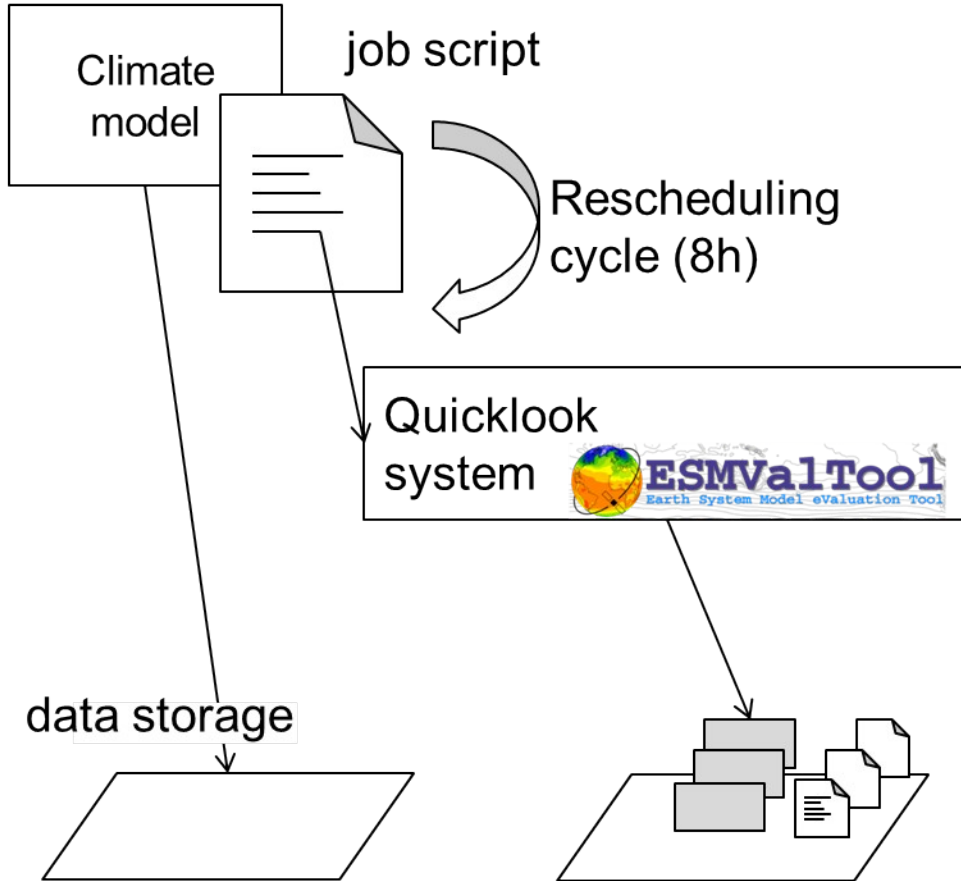
Integration of the ESMValTool into the CMIP6 Workflow at the DKRZ



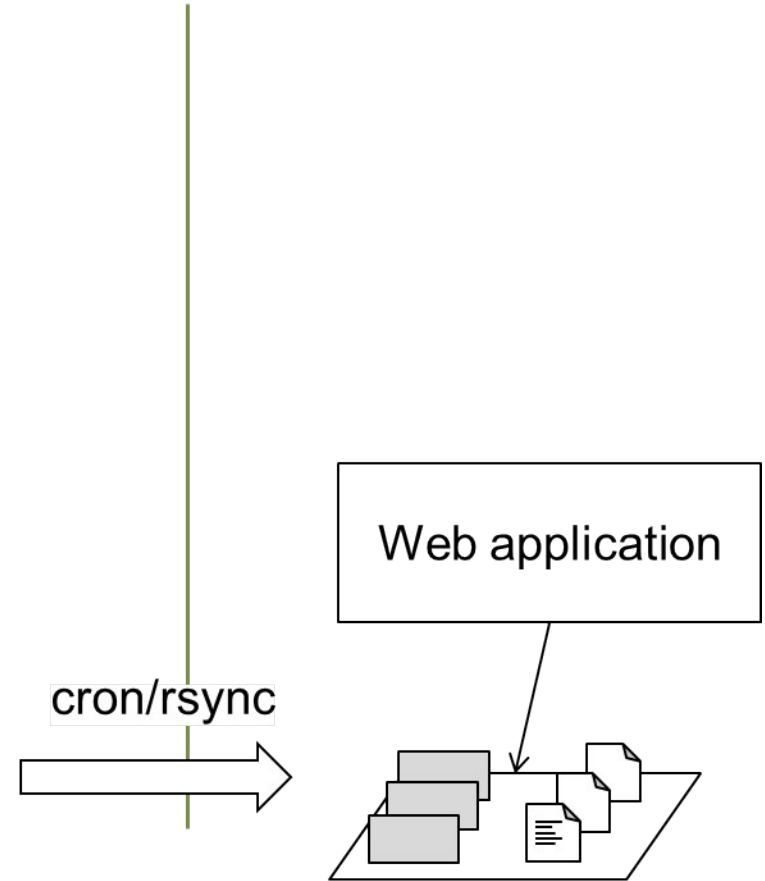
Quicklooks

ESMValTool Quicklook System @ DKRZ

Mistral




Modvis webserver



Frontend

ESMValTool Runtime Monitoring Service for CMIP6 Simulations



Home Overview Dashboard Science Technical Feedback About us

Select run

Select topic

Select variable/Season

R_023

Show 10 entries Search:

Name	Experiment	Status
R_023	historical	pending
R_024	historical	running
R_999	piControl	pending

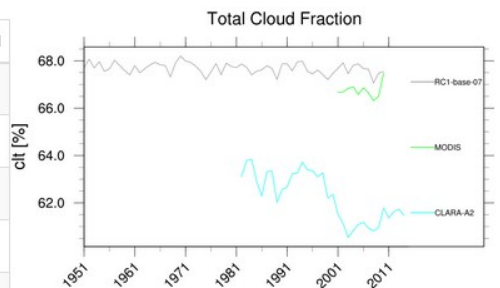
Showing 1 to 3 of 3 entries 1 row selected

Previous 1 Next

Atmospheric Physics Modes of Variability Atmospheric Chemistry and Aerosols Forcings

Global mean Timeseries

	Category	DJF	MAM	JJA	SON	Annual
evspsbl-mmday	Clouds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
clt	Clouds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
pr-mmday	Clouds	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
rsnt	Radiation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
LW_CRE	Radiation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Quicklooks

```
module use -a /pf/b/b309070/tools/sw/Modules/modulefiles/  
module load esmvaltool
```

```
$ quicklooks --help  
Usage: quicklooks [OPTIONS]  
  
quicklooks -- Command line interface for the ESMValTool Quicklook System  
  
Options:  
--model [EMAC|MPI]  Name of Model  
--rid TEXT          String that identifies a single simulation run  
--project TEXT      DKRZ project on which the quicklook jobs shall be  
                    charged  
--inpath TEXT       Path to input files (output files of the simulation run)  
--help              Show this message and exit.
```

Status:

- System implemented and installed at dkrz (modvis.dkrz.de)
- Application currently active for EMAC
- Currently only in “passive mode” active



Routine Evaluation

- CMIP6-Daten werden vom DKRZ repliziert
- Lokales CMIP6-Replika wird automatisch über das Freva-system idiziert
- Regelmäßige Erzeugung von "Steuerfiles" entsprechend der Datenverfügbarkeit (Abfrage an Freva) und dem Bedarf der Diagnostiken des ESMValTool
- Entstandene Plots tragen Metadaten/Provenance-Information mit sich
- Darstellung über das Portal (Nächster Vortrag)
- Gegenwärtig kommt hier v1 und v2 zum Einsatz



ESMValTool Related Milestones in CMIP6-DICAD

- Standardisierte Diagnostiken und Modellevaluation (AP6) -

- M1: Entwurf mit ausführlicher Spezifikation zum Portal [Monat 6, FUB]
- M2: Prototype ESMValTool Version läuft in der ESGF DKRZ Infrastruktur [Monat 9, DKRZ]
- M3: ESMValTool steht zur operationellen Laufüberwachung in der DKRZ Infrastruktur zur Verfügung [Monat 12, DLR]
- M4: Lauffähiger und getesteter Prototype für das Portal [Monat 15, FUB]
- M5: ESMValTool mit erweiterten Diagnostiken auf CMIP5 Modelldaten angewandt [Monat 18, DLR]
- M6: ESMValTool mit CMIP6 Modelldaten und Beobachtungsdaten vollständig integriert in der ESGF DKRZ Infrastruktur [neu: Monat 36, DKRZ]
- M7: MPI-ESM1/2 und EMAC2 mit erweiterter ESMValTool Version evaluiert und mit anderen CMIP6 Modellen verglichen [neu: Monat 42, DLR]
- M8: Produktionssystem des Portals ist installiert [Monat 36, FUB]



⇒ Work on time

Vielen Dank !

<https://github.com/ESMValGroup/ESMValTool>

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

<https://esmvaltool.readthedocs.io>

