Workflows @ DKRZ - Preparing for CMIP6

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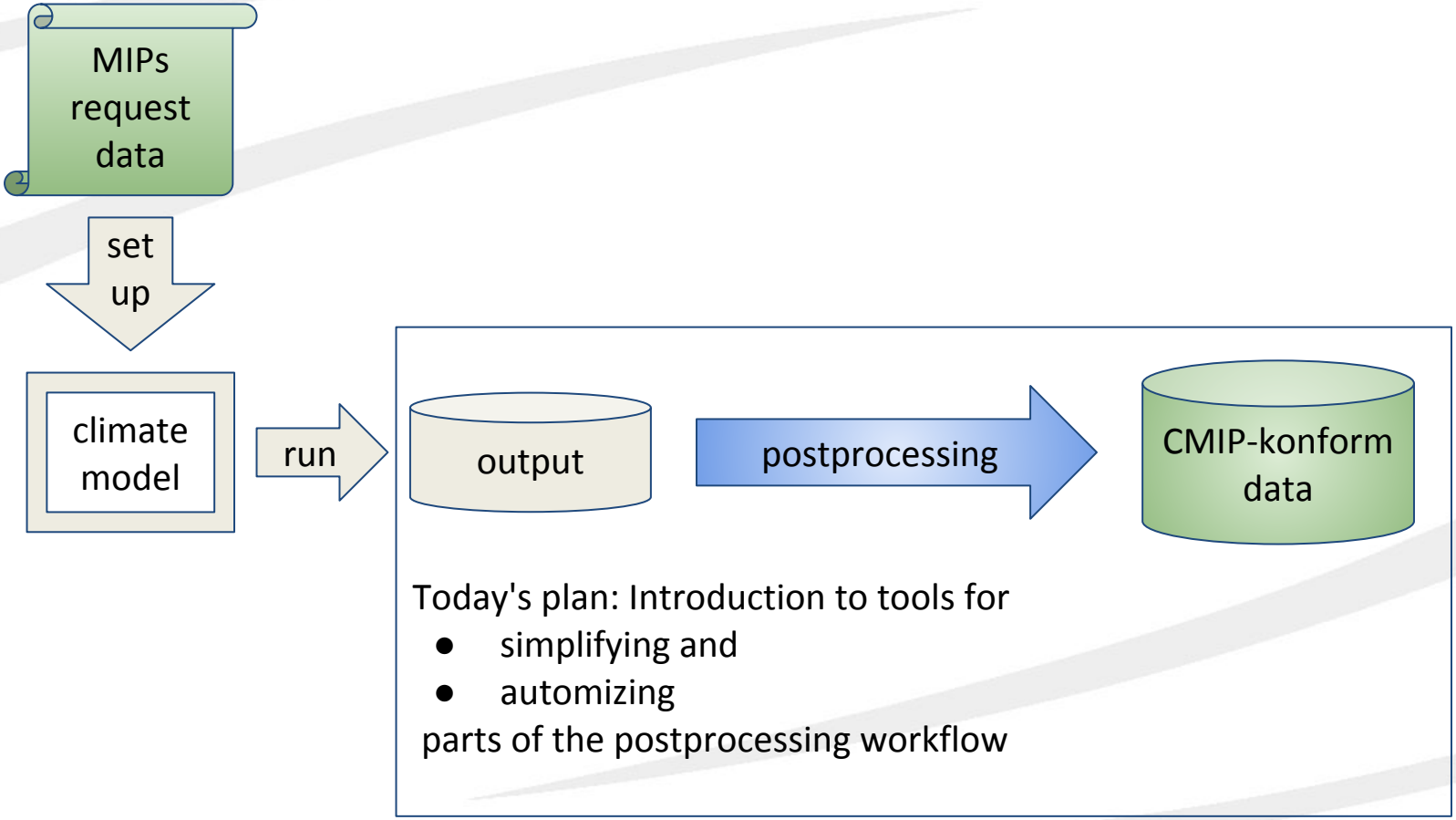
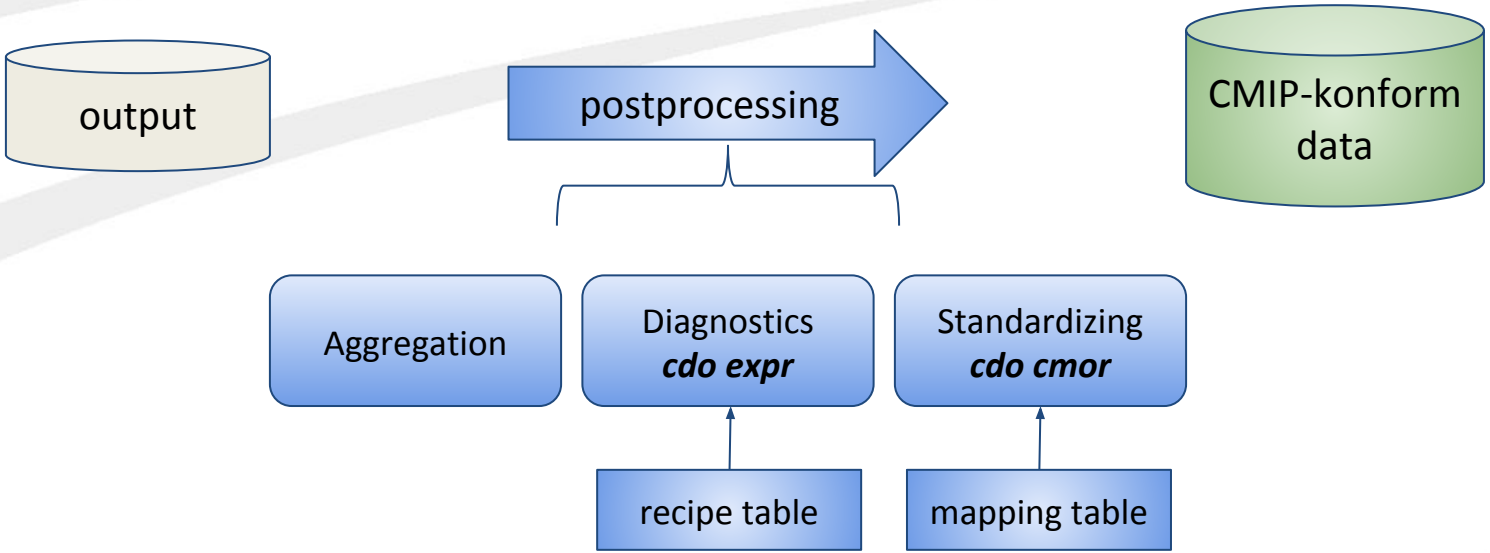
DKRZ

CMIP6 data production workflow



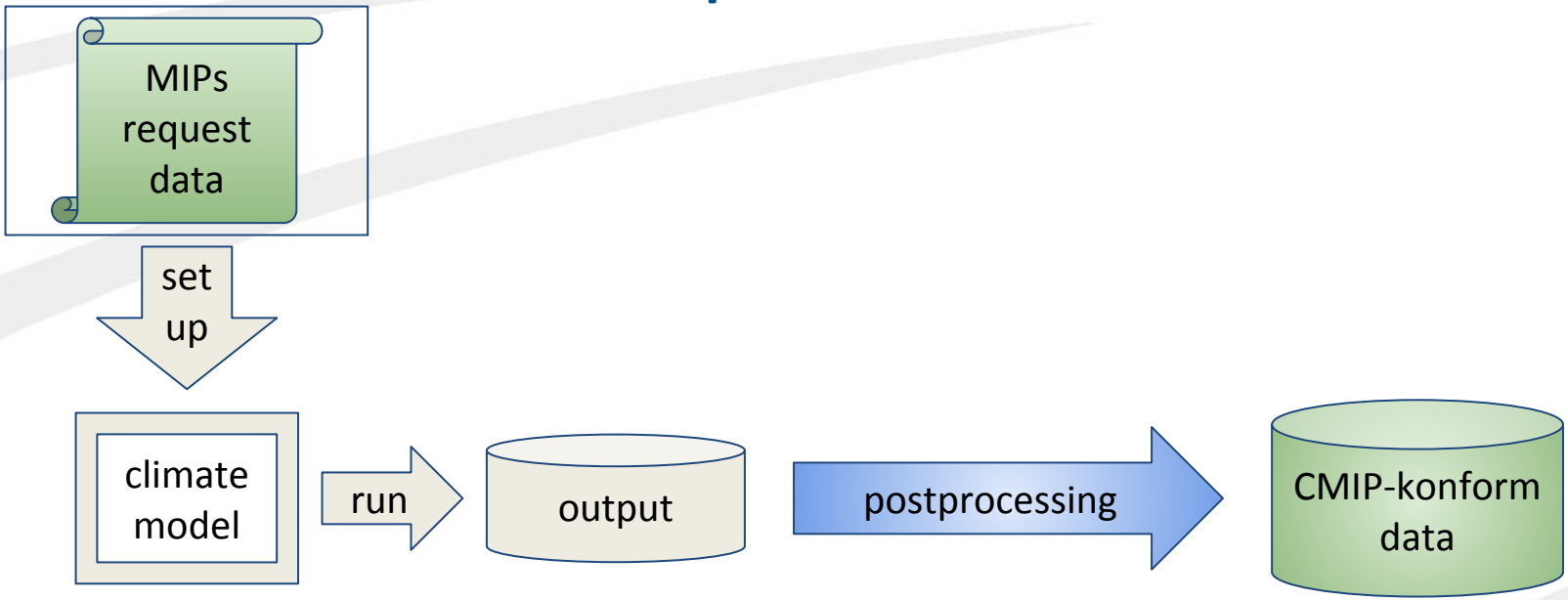
Tools



We are developing

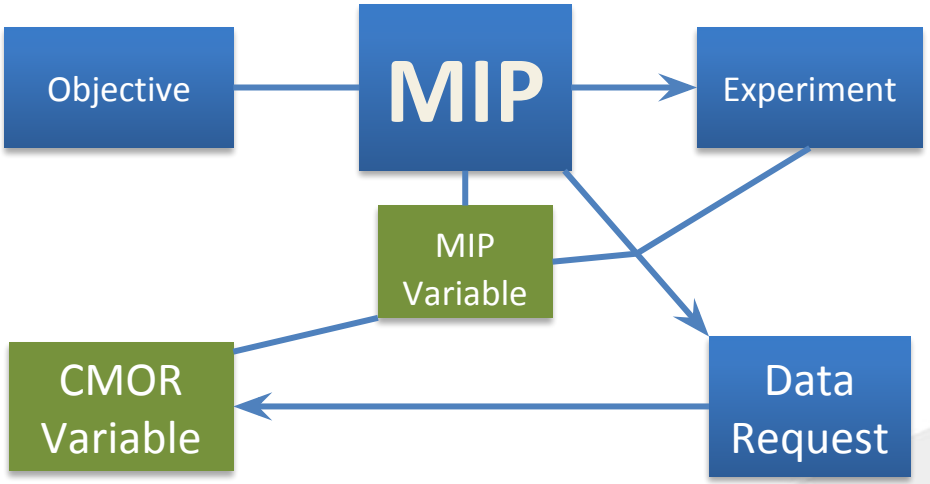
- the **cdo cmor** operator
- the **c6dreq-WebGUI** to
  - create a mapping table (map model output variables to CMOR variables)
  - generate Diagnostics and Standardizing script fragments

CMIP6 data production workflow



Data Request Python API (DreqPy) & CMIP6 Data Request Structure

- MIPs founded to achieve WCRP defined scientific objectives
- MIPs define Experiments, Variables and set up a data request
- CMOR-Variables are the different realisations (frequency, shape, …) of a MIP-Variable



Example:

MIP-Variable: Ozone volume mixing ratio

CMOR Variables:

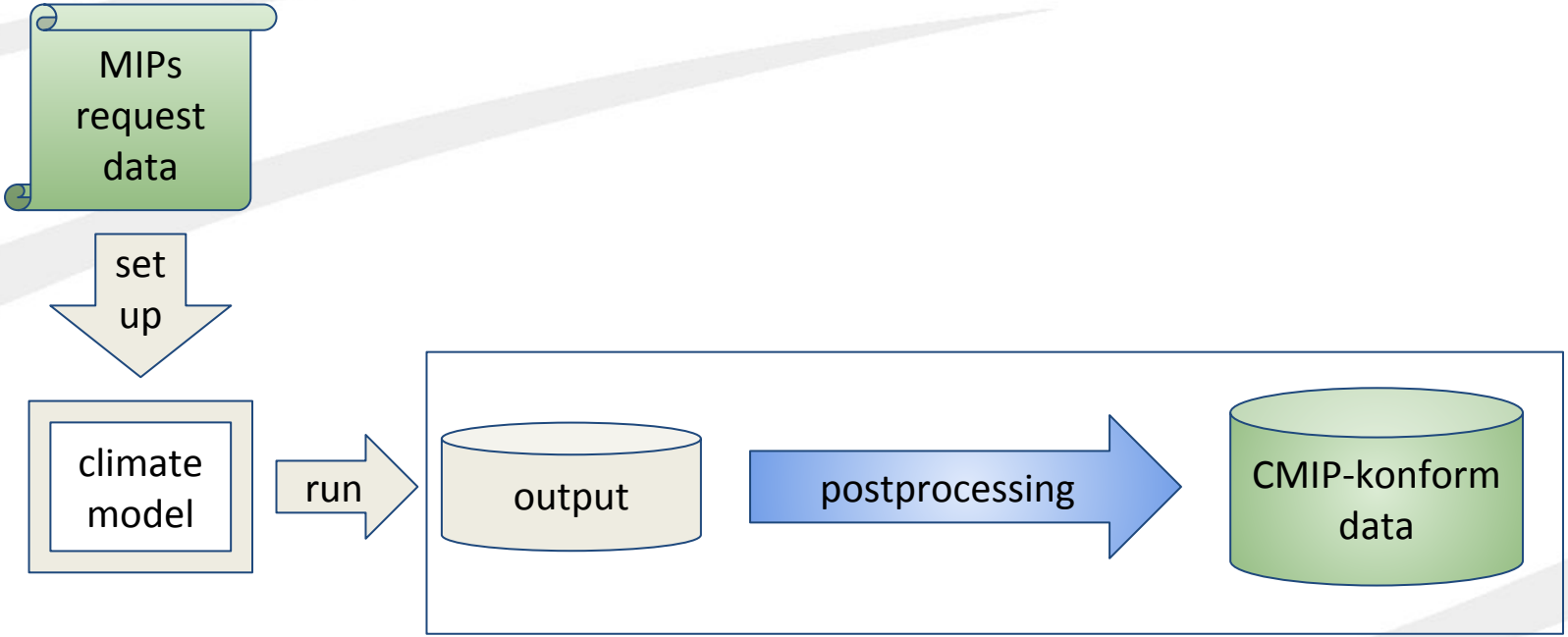
(1) Ozone vmr (zonal mean on 39 pressure levels, monthly mean)

(2) Ozone vmr (global field on model levels, monthly mean)

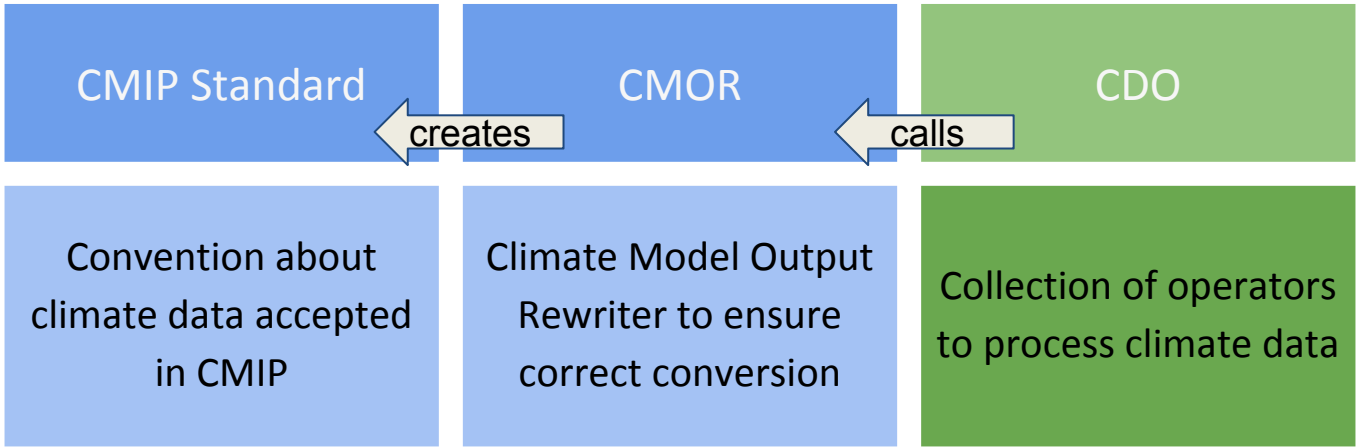
(3) Ozone vmr (global field on 23 pressure levels, monthly mean)


DKRZ
CMIP6
Data Request
WebGUI
Requested Variables
Volume Estimate
Variable Mapping
Infotables
Documentation & Links
Feedback
Admin Panel
Create Custom CMIP6 Data Request
This WebGUI facilitates the use of Martin Juckes'
Data Request Python (DreqPy) API
to generate a customized requested variable list for CMIP6.
A Data Request depends on the MIPs to be supported,
the Experiments to be conducted as well as the
Experiment Tier and the Priority of the requested variables.
In the following a customized data request can be generated
either in .csv or .xlsx format. Alternatively an Excel sheet
containing the data request for all MIPs and Experiments can
be downloaded:
Download official CMIP6 Excel Sheet
Web GUI to use the basic functions of the
Data Request Python API:
- Data request as csv list
- Data request as excel document
- Volume estimate
Select MIP(s)
All BUT selection
AerChemMIP
C4MIP
CFMIP
CMIP
CORDEX
DAMIP
Select Experiment(s)
All BUT selection
All defined by selected MIPs
All defined by selected MIPs above AND selection
All defined by selected MIPs above BUT selection
1pctCO2
abrupt-4xCO2
amip
historical
piControl
1pctCO2-4xext
Select maximum priority and tier
Variable Priority (max)

CMIP6 data production workflow



Definitions and motivations



"Systematic analysis across models only easy to do if model output is written in

- a common format
- with files structured similary
- and with sufficient metadata uniformly stored“

CMIP Standard

General requirements on CMIP6 compliant data

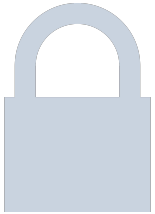
- netCDF4 Format
- conform to CF 1.7
- Each file must contain only a single output field from a single simulation including coordinates and additional meta data

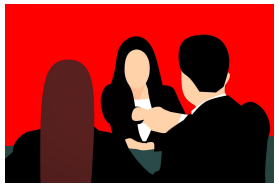
Detailled requirements for coordinates, output variables and metadata can be found in the document
CMIP6_output_metadata_requirements_5Jan2018 from Taylor et. al (2018).

More information about global attributes, controlled vocabulary and filenames can be found in the document
CMIP6_global_attributes_filenames_CVs from Taylor et. al (2017)

CMOR

- **Why use CMOR to create CMIP standard?**
- Why integrate CDO with CMOR?





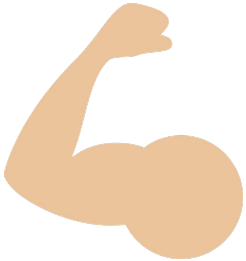
- CMOR ensures that output is CMIP compliant.
- Different CMIP standards can be produced
- Use synergies, avoid to repeat work

No user side preparation of CMIP format description

CDO

- Why use CMOR to create CMIP standard?
- **Why integrate CDO with CMOR?**

Use the power of CDOs...



- CDO is a well known tool with an active support
- The CDO's interface allows
  - netCDF as well as GRIB input
  - enables access to all infile information

cdo cmor

- Why use CMOR to create CMIP standard?
- **Why integrate CDO with CMOR?**

… to simplify the CMOR usage:

```
cmor_setup();
cmor_dataset_json();
cmor_load_table();
cmor_set_table();
cmor_axis();
cmor_grid();
cmor_set_grid_mapping();
cmor_time_varying_grid_coordinate();
cmor_zfactor();
cmor_variable();
cmor_set_deflate();
cmor_set_variable_attribute();
cmor_create_output_path();
cmor_write();
cmor_close();
```

are included by one **cdo cmor** operator

cdo cmor

CMIP6_Amon.json

contains parts of the data request in a CMOR-readable format

grid_info.nc

contains a grid description including coordinates and bounds

```
variables:
    double lat(lat);
    double
lat_bnds(lat,bnds);
```

```
cdo cmor,CMIP6_Amon.json \
    gi=grid_info.nc, \
     i=config.txt, \
    mt=mapping_table.txt\
                          infile
```

config.txt

contains the user configuration

```
activity_id="CMIP"
```

can be created with https://c6dreq.dkrz.de/cdocmorinfo/index.html

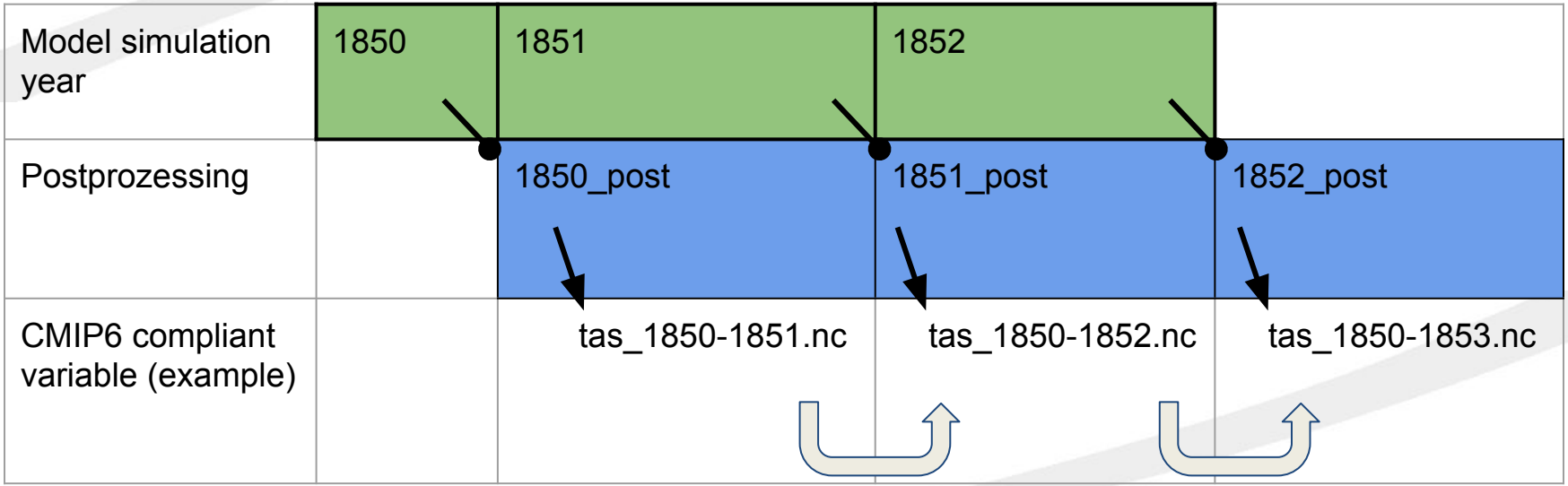
mapping_table.txt

links model output variables with CMOR variables

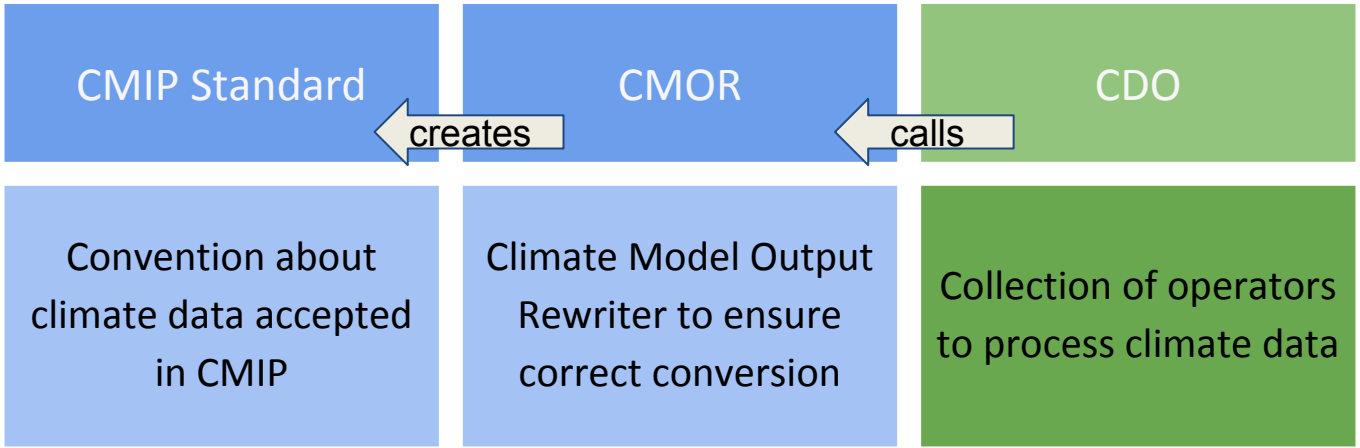
```
&parameter pmt=Amon cmor_name=tasmax  code=201
/
```

cdo cmor

- Append data to a chunk



Defintions and motivations



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cdo cmor workflow

The CMIP6 infrastructure components depend on each other (Taylor and Balaji, 2017). Therefore, it is important to make sure to use compatible versions of components.

If the dreq is updated, new MIP-tables are created. The MIP-table processing in CMOR is adapted to the most recent MIP-tables. Subsequently, CDO is adapted to CMOR

There are incompatabilities:

- CMOR versions < 3.2.5 cannot process MIP-Tables based on DReq versions newer than 01.00.06
- Recent CMOR >3.2.8 can only be linked to most recent CDO versions >=1.9.2

cdo cmor installation

Instruction\Target format:	**CMIP5/CORDEX**	**CMIP6/CORDEX2**
Use DKRZ HPC mistral or install CDO..	locally via script	locally via script or use conda
Install CDO with...	CMOR2	CMOR3
MIP-table format is..	special	json

```
#update conda
conda update conda
#name the environment for cdo with cmor
cdoenv=cdocmor
#install develop-cdo which contains CMOR "conda-forge/label/dev::cdo"
#use conda-forge channel with "-c conda-forge"
#set $cdoenv as environment with --name
conda create --name ${cdoenv} conda-forge/label/dev::cdo -c conda-forge
#then activate it
source activate ${cdoenv}
```

cdo cmor users and use cases

The operator is used

- and developed within the CMIP6 project DICAD for data
  - of AWI-CM at AWI
  - of EMAC at DLR
  - of MPI-ESM at MPI-M, DWD and DKRZ
- for the large ensemble of MPI-ESM
- for CORDEX data of REMO at GERICS
- Different users world wide
  - Karlsruhe, GER (KIT)
  - Oxford, UK OX
  - Rio, Brazil (Institution: INPE)

Since CMOR is developed parallel to PrePARE, users can do a quality control for files by running them with the operator using a configuration including `"keep_all_attributes=y"`

cdo cmor

CMIP6_Amon.json

contains parts of the data request in a CMOR-readable format

grid_info.nc

contains a grid description including coordinates and bounds

```
variables:
    double lat(lat);
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config.txt

contains the user configuration

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activity_id="CMIP"
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can be created with https://c6dreq.dkrz.de/cdocmorinfo/index.html

mapping_table.txt

links model output variables with CMOR variables

```
&parameter pmt=Amon cmor_name=tasmax  code=201
/
```

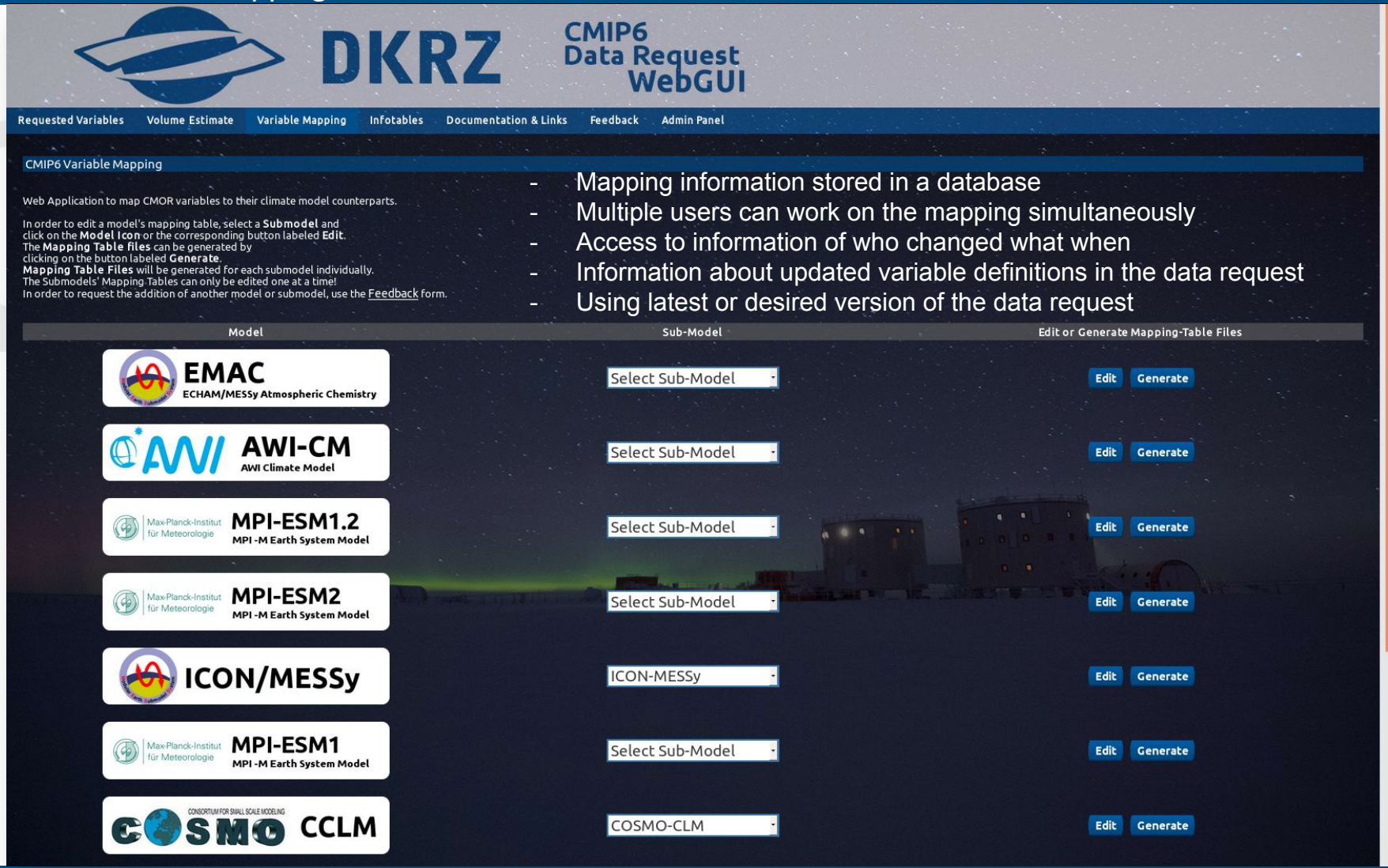
Variable Mapping Table

Map Model Variable to CMOR Variable

CMOR variable name & MIP table | Model variable name / code | Units & positive flux direction | Requested cell methods

```
&parameter pmt=Amon   cmor_name=tasmax   c=201   units="K"   cell_methods="m" /
&parameter pmt=day    cmor_name=tasmax   c=201   units="K"   cell_methods="m" /
&parameter pmt=day    cmor_name=tasmin   c=202   units="K"   cell_methods="m" /
&parameter pmt=Amon   cmor_name=tasmin   c=202   units="K"   cell_methods="m" /
```

optional: Variable comment attribute



- Mapping information stored in a database
- Multiple users can work on the mapping simultaneously
- Access to information of who changed what when
- Information about updated variable definitions in the data request
- Using latest or desired version of the data request

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DKRZ CMIP6 Data Request WebGUI

Logout ms

Admin

Unlock all Variables | Lock all Variables | Set N/A

User Options

Unlock Variables

Mapping Table for ECHAM6 (MPI-ESM-1-2) in Project CMIP6

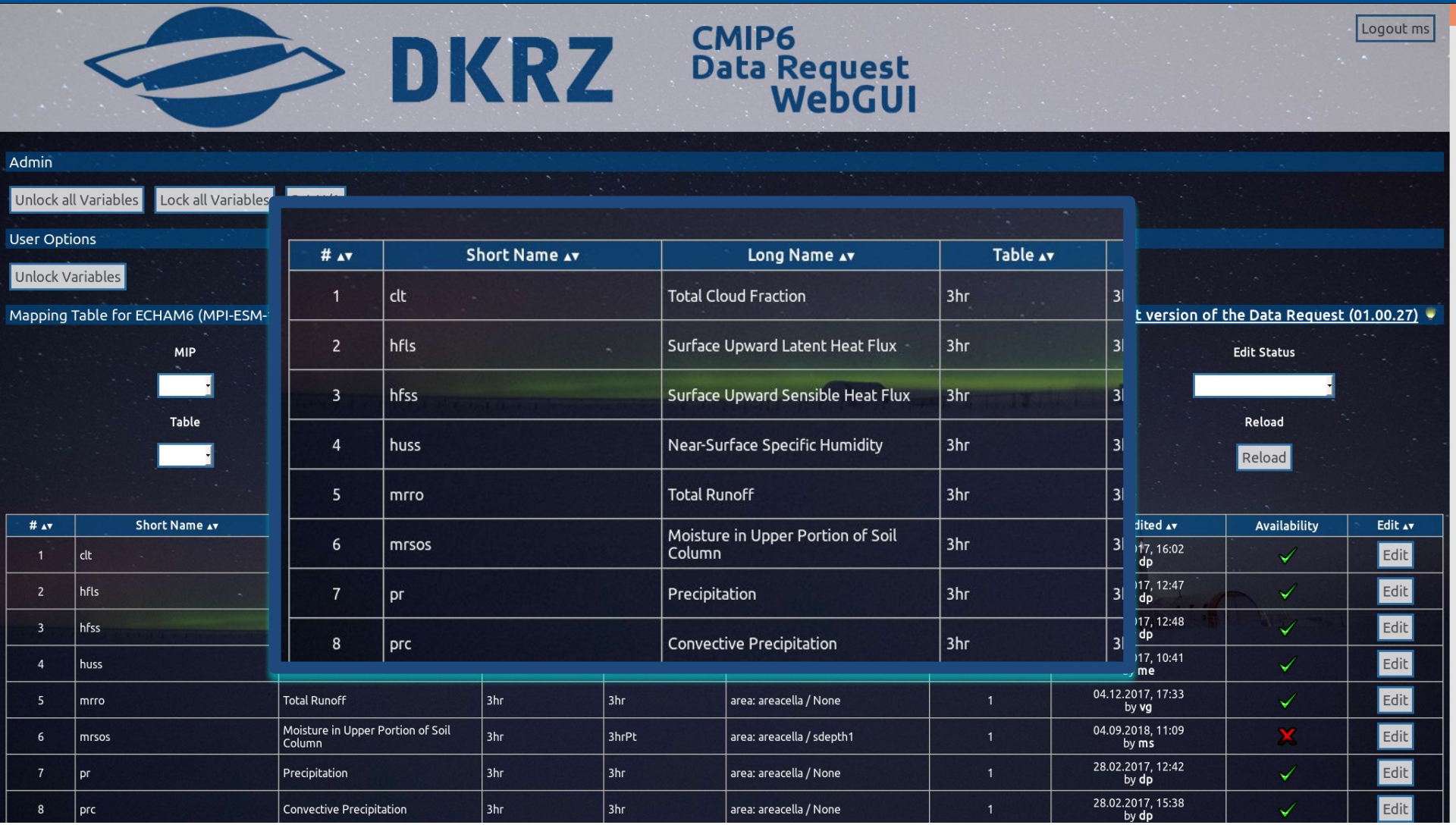
Using latest version of the Data Request (01.00.27)

MIP | Variable | Grid/Z-axis | Edit Status

Table | Mapping-Info | Priority | Reload

Reload

#	Short Name	Long Name	Table	Frequency	Grid / Z-axis	Priority	Last Edited	Availability	Edit
1	clt	Total Cloud Fraction	3hr	3hr	area: areacella / None	1	28.02.2017, 16:02 by dp	✓	Edit
2	hfls	Surface Upward Latent Heat Flux	3hr	3hr	area: areacella / None	1	28.02.2017, 12:47 by dp	✓	Edit
3	hfss	Surface Upward Sensible Heat Flux	3hr	3hr	area: areacella / None	1	28.02.2017, 12:48 by dp	✓	Edit
4	huss	Near-Surface Specific Humidity	3hr	3hrPt	area: areacella / height2m	1	09.03.2017, 10:41 by me	✓	Edit
5	mrro	Total Runoff	3hr	3hr	area: areacella / None	1	04.12.2017, 17:33 by vg	✓	Edit
6	mrsos	Moisture in Upper Portion of Soil Column	3hr	3hrPt	area: areacella / sdepth1	1	04.09.2018, 11:09 by ms	✗	Edit
7	pr	Precipitation	3hr	3hr	area: areacella / None	1	28.02.2017, 12:42 by dp	✓	Edit
8	prc	Convective Precipitation	3hr	3hr	area: areacella / None	1	28.02.2017, 15:38 by dp	✓	Edit



#	Short Name	Long Name	Table	
1	clt	Total Cloud Fraction	3hr	3
2	hfls	Surface Upward Latent Heat Flux	3hr	3
3	hfss	Surface Upward Sensible Heat Flux	3hr	3
4	huss	Near-Surface Specific Humidity	3hr	3
5	mrro	Total Runoff	3hr	3
6	mrsos	Moisture in Upper Portion of Soil Column	3hr	3
7	pr	Precipitation	3hr	3
8	prc	Convective Precipitation	3hr	3

#	Short Name	Long Name	Table				Edited	Availability	Edit
1	clt						17, 16:02 dp	✓	Edit
2	hfls						17, 12:47 dp	✓	Edit
3	hfss						17, 12:48 dp	✓	Edit
4	huss						17, 10:41 me	✓	Edit
5	mrro	Total Runoff	3hr	3hr	area: areacella / None	1	04.12.2017, 17:33 by vg	✓	Edit
6	mrsos	Moisture in Upper Portion of Soil Column	3hr	3hrPt	area: areacella / sdepth1	1	04.09.2018, 11:09 by ms	✗	Edit
7	pr	Precipitation	3hr	3hr	area: areacella / None	1	28.02.2017, 12:42 by dp	✓	Edit
8	prc	Convective Precipitation	3hr	3hr	area: areacella / None	1	28.02.2017, 15:38 by dp	✓	Edit

DKRZ

CMIP6 Data Request WebGUI

Logout ms

Admin

Unlock all Variables | Lock all Variables | Set N/A

User Options

Unlock Variables

Mapping Table for ECHAM6 (MPI-ESM-1-2) in Project CM

Using latest version of the Data Request (01.00.27)

MIP

Table

Edit Status

Reload

Reload

Last Edited ▲▼	Availability	Edit ▲▼
28.02.2017, 16:02 by dp	✓	Edit
28.02.2017, 12:47 by dp	✓	Edit
28.02.2017, 12:48 by dp	✓	Edit
09.03.2017, 10:41 by me	✓	Edit
04.12.2017, 17:33 by vg	✓	Edit
04.09.2018, 11:09 by ms	✗	Edit
28.02.2017, 12:42 by dp	✓	Edit
28.02.2017, 15:38 by dp	✓	Edit

# ▲▼	Short Name ▲▼	Long N					Last Edited ▲▼	Availability	Edit ▲▼
1	clt	Total Cloud Fraction					28.02.2017, 16:02 by dp	✓	Edit
2	hfls	Surface Upward Lat					28.02.2017, 12:47 by dp	✓	Edit
3	hfss	Surface Upward Sen					28.02.2017, 12:48 by dp	✓	Edit
4	huss	Near-Surface Specif					09.03.2017, 10:41 by me	✓	Edit
5	mrro	Total Runoff	3hr	3hr	area: areacella / None	1	04.12.2017, 17:33 by vg	✓	Edit
6	mrsos	Moisture in Upper Portion of Soil Column	3hr	3hrPt	area: areacella / sdepth1	1	04.09.2018, 11:09 by ms	✗	Edit
7	pr	Precipitation	3hr	3hr	area: areacella / None	1	28.02.2017, 12:42 by dp	✓	Edit
8	prc	Convective Precipitation	3hr	3hr	area: areacella / None	1	28.02.2017, 15:38 by dp	✓	Edit

DKRZ

CMIP6 Data Request WebGUI

Admin

Lock Variable

Variable Information (Data Request v01.00.27) (UID: bab3c904-e5dd-11e5-8482-ac72891c3257)

This Variable has been locked for you. By clicking on "Submit" or "Back" it will be unlocked again!

(Scroll to Mapping Information)

Short Name	pr
Long Name	Precipitation
Standard Name	precipitation_flux
Variable Description	includes both liquid and solid phases | at surface; includes both liquid and solid phases. This is the 3-hour mean precipitation flux.
Units	kg m-2 s-1
Realm	atmos
Cell Methods & Cell Measures	area: time: mean (Area and Time Mean) | area: areacella
Frequency	3hr
Dimensions	**time longitude|latitude** time/time (double, for time-mean fields) [days since ?] longitude/longitude (double) [degrees_east] latitude/latitude (double) [degrees_north]
Requested on Grid(s)	1deg, native
Positive Flux Direction	Not applicable
Provenance MIP	CCMI
MIP Table	3hr
Requested by MIPs	VIACSAB DAMIP LS3MIP CMIP GeoMIP HighResMIP
Requested for Experiments	highresSST-future G6SST2-sulfur highresSST-LAI futureSST-4xCO2-solar abrupt-4xCO2 highresSST-p4K G7SST1-cirrus highresSST-present hist-all-nat2 G7cirrus highresSST-smoothed hist-1950 hist-stratO3 ssp534-over ssp460 esm-hist piSST-4xCO2-solar piControl ssp585 esm-piControl G6SST2-solar hist-CO2 hist-aer dcppA-assim dcppA-hindcast hist-all-aer2 dcppA-hindcast-niff dcppA-historical-niff hist-nat dcppB-forecast ssp245 hist-GHG amip hist-sol spinup-1950 ssp119 G6sulfur ssp126 hist-volc esm-hist-ext historical ssp245-aer G7SST2-cirrus historical-ext 1pctCO2 ssp434 ssp245-GHG ssp245-nat G6SST1 past1000 ssp245-stratO3 ssp370 G6solar control-1950 highres-future highresSST-4xCO2 G1

DKRZ

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Short Name	pr
Long Name	Precipitation
Standard Name	precipitation_flux
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Units	kg m-2 s-1
Realm	atmos
Cell Methods & Cell Measures	area: time: mean (Area and Time Mean) | area: areacella
Frequency	3hr
Dimensions	**time longitude|latitude** time/time (double, for time-mean fields) [days since ?] longitude/longitude (double) [degrees_east] latitude/latitude (double) [degrees_north]
Requested on Grid(s)	1deg, native
Positive Flux Direction	Not applicable
Provenance MIP	CCMI
MIP Table	3hr
Requested by MIPs	VIACSAB DAMIP LS3MIP CMIP GeoMIP HighResMIP
Requested for Experiments	highresSST-future G6SST2-sulfur highresSST-LAI futureSST-4xCO2-solar abrupt-4xCO2 highresSST-p4K G7SST1-cirrus highresSST-present hist-all-nat2 G7cirrus highresSST-smoothed hist-1950 hist-stratO3 ssp534-over ssp460 esm-hist piSST-4xCO2-solar piControl ssp585 esm-piControl G6SST2-solar hist-CO2 hist-aer dcppA-assim dcppA-hindcast hist-all-aer2 dcppA-hindcast-niff dcppA-historical-niff hist-nat dcppB-forecast ssp245 hist-GHG amip hist-sol spinup-1950 ssp119 G6sulfur ssp126 hist-volc esm-hist-ext historical ssp245-aer G7SST2-cirrus historical-ext 1pctCO2 ssp434 ssp245-GHG ssp245-nat G6SST1 past1000 ssp245-stratO3 ssp370 G6solar control-1950 highres-future highresSST-4xCO2 G1

Variable Information (Data Request

This Variable has been locked for you.

(Scroll to Mapping Information)

Short Name	pr
Long Name	Precipitation
Standard Name	precipitation_flux
Variable Description	includes both liquid and
Units	kg m-2 s-1
Realm	atmos

WebGUI: Variable Mapping

Requested for Experiments	highresSST-future G6SST2-sulfur highresSST-LAI futureSST-4xCO2-solar abrupt-4xCO2 highresSST-p4K G7SST1-cirrus highresSST-present hist-all-nat2 G7cirrus highresSST-smoothed hist-1950 hist-stratO3 ssp534-over ssp460 esm-hist piSST-4xCO2-solar piControl ssp585 esm-piControl G6SST2-solar hist-CO2 hist-aer dcppA-assim dcppA-hindcast hist-all-aer2 dcppA-hindcast-niff dcppA-historical-niff hist-nat dcppB-forecast ssp245 hist-GHG amip hist-sol spinup-1950 ssp119 G6sulfur ssp126 hist-volc esm-hist-ext historical ssp245-aer G7SST2-cirrus historical-ext 1pctCO2 ssp434 ssp245-GHG ssp245-nat G6SST1 past1000 ssp245-stratO3 ssp370 G6solar control-1950 highres-future highresSST-4xCO2 G1

▼ **Variable Definition Updates**

Current Data Request version: 01.00.27

Variable Definition changes in Data Request v01.00.09

Dimensions	✗ Temporal mean, Global field (single level) [XY-na] [tmean]	has been replaced with	✓ Temporal mean, Global field (single level) [XY-na] [am-tm]

Variable Definition changes in Data Request v01.00.06

Cell Methods	✗ CellMethods::tmean	has been replaced with	✓ CellMethods::am-tm

Variable Mapping Information (MPI-ESM-1-2 ECHAM6) Last Edited: Tuesday, 28. February 2017, 12:42 by dp.

(Scroll to Variable Information)

▸ **Examples and Help**

▸ **Suggested Input**

▸ **Mapping Information of other Submodels**

Availability	Model Variable Name	Model Variable Code	Post-Processing Recipe	Model Variable Units
Available		142|*echam3hr*.nc,143	pr= var142+var143	kg m-2 s-1

CMOR Variable-Attribute 'comment' (optional):

(Scroll to Variable Mapping Information)

Editor's Note

Submit Back

WebGUI: Variable Mapping

Requested for Experiments	highresSST-future G6SST2-sulfur highresSST-LAI futureSST-4xCO2-solar abrupt-4xCO2 highresSST-p4K G7SST1-cirrus highresSST-present hist-all-nat2 G7cirrus highresSST-smoothed hist-1950 hist-stratO3 ssp534-over ssp460 esm-hist piSST-4xCO2-solar piControl ssp585 esm-piControl G6SST2-solar hist-CO2 hist-aer dcppA-assim dcppA-hindcast hist-all-aer2 dcppA-hindcast-niff dcppA-historical-niff hist-nat dcppB-forecast ssp245 hist-GHG amip hist-sol spinup-1950 ssp119 G6sulfur ssp126 hist-volc esm-hist-ext historical ssp245-aer G7SST2-cirrus historical-ext 1pctCO2 ssp434 ssp245-GHG ssp245-nat G6SST1 past1000 ssp245-stratO3 ssp370 G6solar control-1950 highres-future highresSST-4xCO2 G1

Variable Definition Updates

Current Data Request version: 01.00.27

Variable Definition changes in Data Request v01.00.09

Dimensions	✗ Temporal mean, Global field (single level) [XY-na] [tmean]	has been replaced with	✓ Temporal mean, Global field (single level) [XY-na] [am-tm]

Variable Definition changes in Data Request v01.00.06

Cell Methods	✗ CellMethods::tmean	has been replaced with	✓ CellMethods::am-tm

Variable Mapping Information (MPI-ESM-1-2 ECHAM6) Last Edited: Tuesday, 28. February 2017, 12:42 by dp.

(Scroll to Variable Information)

- Examples and Help
- Suggested Input
- Mapping Information of other Submodels

Availability	Model Variable Name	Model Variable Code	Post-Processing Recipe	Model Variable Units
Available		142|*echam3hr*.nc,143	pr= var142+var143	kg m-2 s-1

CMOR Variable-Attribute 'comment' (optional):

(Scroll to Variable Mapping Information)

Editor's Note

Submit Back

WebGUI: Variable Mapping

Requested for Experiments	highresSST-future G6SST2-sulfur highresSST-LAI futureSST-4xCO2-solar abrupt-4xCO2 highresSST-p4K G7SST1-cirrus highresSST-present hist-all-nat2 G7cirrus highresSST-smoothed hist-1950 hist-stratO3 ssp534-over ssp460 esm-hist piSST-4xCO2-solar piControl ssp585 esm-piControl G6SST2-solar hist-CO2 hist-aer dcppA-assim dcppA-hindcast hist-all-aer2 dcppA-hindcast-niff dcppA-historical-niff hist-nat dcppB-forecast ssp245 hist-GHG amip hist-sol spinup-1950 ssp119 G6sulfur ssp126 hist-volc esm-hist-ext historical ssp245-aer G7SST2-cirrus historical-ext 1pctCO2 ssp434 ssp245-GHG ssp245-nat G6SST1 past1000 ssp245-stratO3 ssp370 G6solar control-1950 highres-future highresSST-4xCO2 G1

▼ **Variable Definition Updates**

Current Data Request version: 01.00.27

Variable Definition changes in Data Request v01.00.09

Dimensions	✗ Temporal mean, Global field (single level) [XY-na] [tmean]	has been replaced with	✓ Temporal mean, Global field (single level) [XY-na] [am-tm]

Variable Definition changes in Data Request v01.00.06

Cell Methods	✗ CellMethods::tmean	has been replaced with	✓ CellMethods::am-tm

Variable Mapping Information (MPI-ESM-1-2 ECHAM6) Last Edited: Tuesday, 28. February 2017, 12:42 by dp.

(Scroll to Variable Information)

▸ **Examples and Help**

▸ **Suggested Input**

Availability	Model Variable Name	Model Variable Code	Post-Processing Recipe
Available		142|*echam3hr*.nc,143	pr= var142+var143

(Scroll to Variable Mapping Information)

Editor's Note

Submit Back

Max-Planck-Institut für Meteorologie **ICON-ESM**
ICOsahedral Non-hydrostatic Earth System Model

Select Submodel | Edit | Generate

Max-Planck-Institut für Meteorologie **MPI-ESM MiKlip**
MPI-M Earth System Model

Select Submodel | Edit | Generate

Existing Mapping Information for 'EMAC (EMAC-2-53-AerChem)'

Download Mapping-Table Files

392 completed (of 393 edited) variables.
of which 110 have a defined recipe.
and 392 have defined File information.
1 variables could not be included because of incomplete Variable Mapping Information (see Warnings!).
(2068 CMOR-Variables in total.)

Warning: Updates of the data request introduced changes in the definition of 8 variables
since their mapping information has last been edited.
It is recommended to check if the entered mapping information for those variables is still valid.
Affected Variables:
EmonZ: jo3, utendnogw, vtendnogw, xgwdparam, ygwdparam
CFsubhr: evspsbl
SImon: siconca
Amon: evspsbl

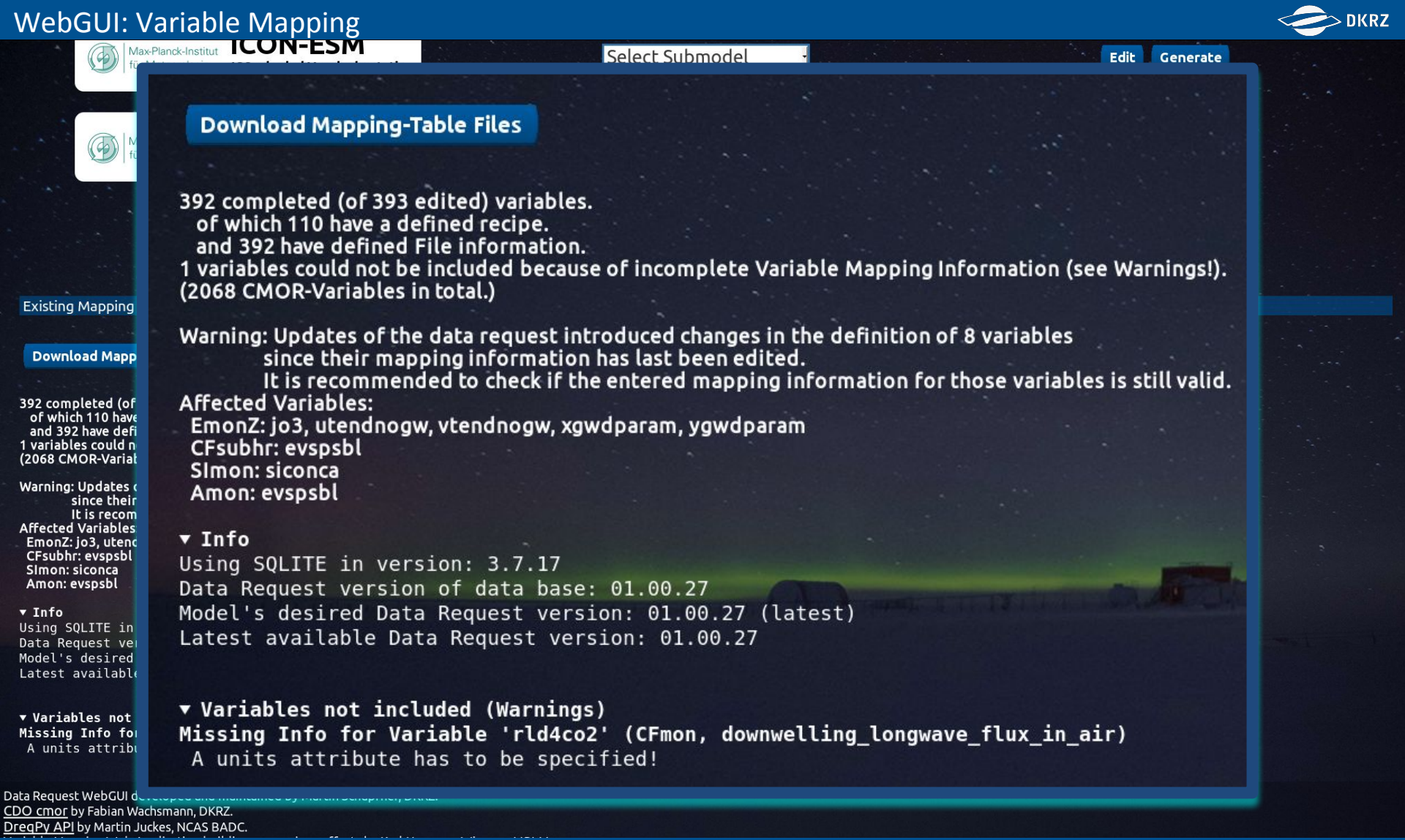
▼ **Info**

```
Using SQLITE in version: 3.7.17
Data Request version of data base: 01.00.27
Model's desired Data Request version: 01.00.27 (latest)
Latest available Data Request version: 01.00.27
```

▼ **Variables not included (Warnings)**

Missing Info for Variable 'rld4co2' (CFmon, downwelling_longwave_flux_in_air)
A units attribute has to be specified!

Data Request WebGUI developed and maintained by Martin Schupfner, DKRZ.
CDO cmor by Fabian Wachsmann, DKRZ.
DreqPy API by Martin Juckes, NCAS BADC.


Max-Planck-Institut
ICON-ESM
Select Submodel
Edit
Generate
Download Mapping-Table Files
392 completed (of 393 edited) variables.
of which 110 have a defined recipe.
and 392 have defined File information.
1 variables could not be included because of incomplete Variable Mapping Information (see Warnings!).
(2068 CMOR-Variables in total.)
Warning: Updates of the data request introduced changes in the definition of 8 variables
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It is recommended to check if the entered mapping information for those variables is still valid.
Affected Variables:
EmonZ: jo3, utendnogw, vtendnogw, xgwdparam, ygwdparam
CFsubhr: evspsbl
SImon: siconca
Amon: evspsbl
▼ Info
Using SQLITE in version: 3.7.17
Data Request version of data base: 01.00.27
Model's desired Data Request version: 01.00.27 (latest)
Latest available Data Request version: 01.00.27
▼ Variables not included (Warnings)
Missing Info for Variable 'rld4co2' (CFmon, downwelling_longwave_flux_in_air)
A units attribute has to be specified!
Existing Mapping
Download Mapp
392 completed (of
of which 110 have
and 392 have defi
1 variables could n
(2068 CMOR-Variab
Warning: Updates
since their
It is recom
Affected Variables:
EmonZ: jo3, utend
CFsubhr: evspsbl
SImon: siconca
Amon: evspsbl
▼ Info
Using SQLITE in
Data Request ve
Model's desired
Latest available
▼ Variables not
Missing Info fo
A units attribu
Data Request WebGUI
CDO cmor by Fabian Wachsmann, DKRZ.
DreqPy API by Martin Juckes, NCAS BADC.

Script fragments

- Automatic creation of diagnostic and cmor rewrite script fragment out of recipe table
- Automatic creation of data request configuration out of recipe table and CMIP6 data request, further customizable by user

Diagnostic - **cdo merge** (of multiple inputfiles)
- **cdo expr**

```
#-- Diagnostic for echam6 (ESM: AWI-CM-1-0-HR) variable rlds / table 3hr
{ (if_requested $member $atmmod 3hr rlds $chunk && {
  find_file -e -p $period "$sdir" "TST_????01.01_echam.grb" ifile1
  find_file -e            "$sdir" "rlds_3hr_${period}*" ifile2
  $cdo -f nc -0 \
    expr,'rlds=var177-var205;' \
    -merge -selcode,177 $ifile1 -selcode,205 $ifile2 \
    in_cmor/3hr_rlds_$period.nc || echo ERROR
}; )&; }>$err.rlds.3hr 2>&1
```

CMOR rewrite - **cdo cmor** call

```
#-- CMOR-rewrite for echam6 (ESM: AWI-CM-1-0-HR) 3hr
cn='rlds hfls'
for var in $cn; do
  { (if_requested $member $atmmod 3hr $var $chunk || continue
  ifile=in_cmor/3hr_${var}_$period.nc
  $cdo cmor,3hr,mt=$mt,dr=$dr,cn=$var $ifile || echo ERROR
  )&; }>>$err.$var.3hr 2>&1
done
```

The script fragment does ...
- … test if variable is requested (data request, timeslice, user specifications)
- … find inputfile & call cdo

Script fragments

- Automatic creation of diagnostic and cmor rewrite script fragment out of recipe table
- Automatic creation of data request configuration out of recipe table and CMIP6 data request, further customizable by user

Diagnostic - **cdo merge** (of multiple inputfiles)
- **cdo expr**

```
#-- Diagnostic for echam6 (ESM: AWI-CM-1-0-HR) variable rlds / table 3hr
{ (if_requested $member $atmmod 3hr rlds $chunk && {
  find_file -e -p $period "$sdir" "TST_????01.01_echam.grb" ifile1
  find_file -e            "$sdir" "rlds_3hr_${period}*" ifile2
  $cdo -f nc -0 \
    expr,'rlds=var177-var205;' \
    -merge -selcode,177 $ifile1 -selcode,205 $ifile2 \
    in_cmor/3hr_rlds_$period.nc || echo ERROR
} )&; }>>$err.rlds.3hr 2>&1
```

CMOR rewrite - **cdo cmor** call

```
#-- CMOR-rewrite for echam6 (ESM: AWI-CM-1-0-HR) 3hr
cn='rlds hfls'
for var in $cn; do
  { (if_requested $member $atmmod 3hr $var $chunk || continue
  ifile=in_cmor/3hr_${var}_$period.nc
  $cdo cmor,3hr,mt=$mt,dr=$dr,cn=$var $ifile || echo ERROR
  )&; }>>$err.$var.3hr 2>&1
done
```

The script fragment does ...
- … test if variable is requested (data request, timeslice, user specifications)
- … find inputfile & call cdo

Script fragments

- Automatic creation of diagnostic and cmor rewrite script fragment out of recipe table
- Automatic creation of data request configuration out of recipe table and CMIP6 data request, further customizable by user

Diagnostic - **cdo merge** (of multiple inputfiles)
- **cdo expr**

```
#-- Diagnostic for echam6 (ESM: AWI-CM-1-0-HR) variable rlds / table 3hr
{ (if_requested $member $atmmod 3hr rlds $chunk && {
  find_file -e -p $period "$sdir" "ISI_??????01.01_echam.grb" ifile1
  find_file -e            "$sdir" "rlds_3hr_${period}*" ifile2
  $cdo -f nc -0 \
    expr,'rlds=var177-var205;' \
    -merge -selcode,177 $ifile1 -selcode,205 $ifile2 \
    in_cmor/3hr_rlds_$period.nc || echo ERROR
}; )&; }>$err.rlds.3hr 2>&1
```

CMOR rewrite - **cdo cmor** call

```
#-- CMOR-rewrite for echam6 (ESM: AWI-CM-1-0-HR) 3hr
cn='rlds hfls'
for var in $cn; do
  { (if_requested $member $atmmod 3hr $var $chunk || continue
  ifile in_cmor/3hr_${var}_$period.nc
  $cdo cmor,3hr,mt=$mt,dr=$dr,cn=$var $ifile || echo ERROR
  )&; }>>$err.$var.3hr 2>&1
done
```

The script fragment does ...
- … test if variable is requested (data request, timeslice, user specifications)
- … find inputfile & call cdo

Script fragments

- Automatic creation of diagnostic and cmor rewrite script fragment out of recipe table
- Automatic creation of data request configuration out of recipe table and CMIP6 data request, further customizable by user

Diagnostic - **cdo merge** (of multiple inputfiles)
- **cdo expr**

```
#-- Diagnostic for echam6 (ESM: AWI-CM-1-0-HR) variable rlds / table 3hr
{ (if_requested $member $atmmod 3hr rlds $chunk && {
  find_file -e -p $period "$sdir" "TST_????01.01_echam.grb" ifile1
  find_file -e            "$sdir" "rlds_3hr_${period}*" ifile2
  $cdo -f nc -0 \
    expr,'rlds=var177-var205;' \
    -merge -selcode,177 $ifile1 -selcode,205 $ifile2 \
    in_cmor/3hr_rlds_$period.nc || echo ERROR
}; )&; }>$err.rlds.3hr 2>&1
```

CMOR rewrite - **cdo cmor** call

```
#-- CMOR-rewrite for echam6 (ESM: AWI-CM-1-0-HR) 3hr
cn='rlds hfls'
for var in $cn; do
  { (if_requested $member $atmmod 3hr $var $chunk || continue
  ifile=in_cmor/3hr_${var}_$period.nc
  $cdo cmor,3hr,mt=$mt,dr=$dr,cn=$var $ifile || echo ERROR
  )&; }>>$err.$var.3hr 2>&1
done
```

The script fragment does ...
- … test if variable is requested (data request, timeslice, user specifications)
- … find inputfile & call cdo

DKRZ CMIP6 Data Request WebGUI

Logout ms

Project | Mapping-Tables | Data Request (optional) | Script Creation

Build Post-Processing Scripts Fragments

Instructions to automatically build post-processing (diagnostic, CMOR rewrite) script fragments out of the variable mapping tables:

(1) **Select Project**: Select the project for which the script fragments have to be generated.
(2) **Generate Mapping-Tables**: Select the Models/Submodels you want the script fragments to be generated for.
(3) **Generate Data Request (optional)**: In case you want the processing of each variable to be dependent on the project's official data request, generate a customized data request.
(4) **Initiate Scripts Creation**: Submit your selected options by clicking the **Create Script Templates** button.

or display a list of previously created scripts:

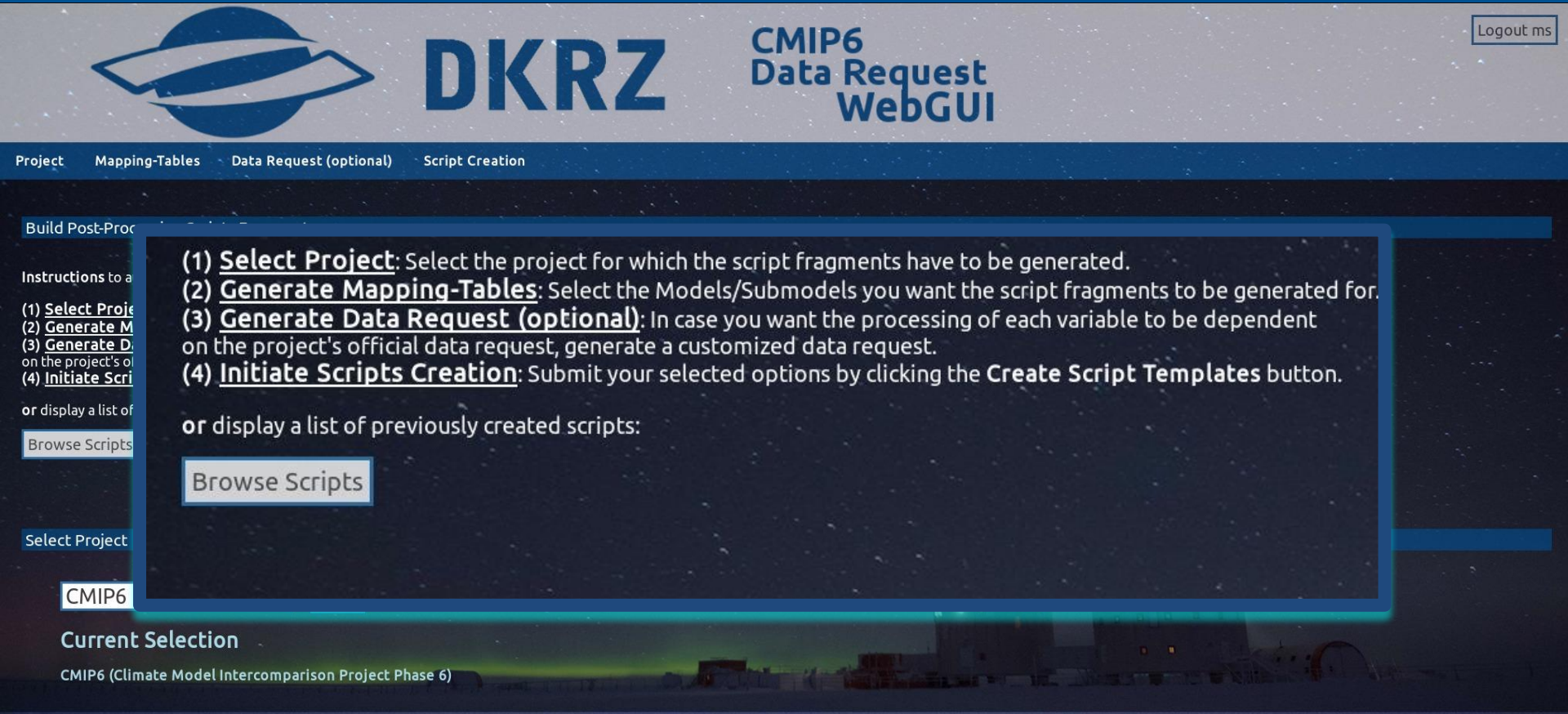
Browse Scripts

Select Project

CMIP6 Select

Current Selection

CMIP6 (Climate Model Intercomparison Project Phase 6)


DKRZ
CMIP6
Data Request
WebGUI
Logout ms
Project
Mapping-Tables
Data Request (optional)
Script Creation
Build Post-Proc
Instructions to a
(1) Select Proje
(2) Generate M
(3) Generate D
on the project's o
(4) Initiate Scri
or display a list of
Browse Scripts
(1) Select Project: Select the project for which the script fragments have to be generated.
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or display a list of previously created scripts:
Browse Scripts
Select Project
CMIP6
Current Selection
CMIP6 (Climate Model Intercomparison Project Phase 6)

WebGUI: Script Fragments

Instructions to automatically build post-processing (diagnostic, CMOR rewrite) script fragments out of the variable mapping tables:

(1) **Select Project**: Select the project for which the script fragments have to be generated.
(2) **Generate Mapping-Tables**: Select the Models/Submodels you want the script fragments to be generated for.
(3) **Generate Data Request (optional)**: In case you want the processing of each variable to be dependent on the project's official data request, generate a customized data request.
(4) **Initiate Scripts Creation**: Submit your selected options by clicking the **Create Script Templates** button.

or display a list of previously created scripts:

Browse Scripts

Generate Mapping-Tables

Select at least one registered Submodel	Add a comment (optional)	Generate Tables
AWI-CM-1-0-HR: AWI-CM AWI-CM-1-0-HR: FESOM EMAC-2-53-AerChem: EMAC EMAC-2-53-AerChem: MPIOM ICON-MESSy: ICON-MESSy	Comment here...	Generate Tables

Current Selection

EMAC (EMAC-2-53-AerChem)

- File: EMAC_CMIP6_MappingTable.zip

MPIOM (EMAC-2-53-AerChem)

- File: EMAC_mpiom_CMIP6_MappingTable.zip

65 completed (of 66 edited) variables.
of which 34 have a defined recipe.
and 65 have defined File information.
1 variables could not be included because of incomplete Variable Mapping Information (see Warnings!).
(2068 CMOR-Variables in total.)

Warning: Updates of the data request introduced changes in the definition of 27 variables
since their mapping information has last been edited.
It is recommended to check if the entered mapping information for those variables is still valid.
Affected Variables:
SImon: siu, siv, siconca, siconc, sithick
Omon: zfullo, zhalfo, pbo, thkcello, soga, sos, pso, sosga, so
SIday: siu, siv, siconca, sithick
Oclim: difvmo, zfullo, zhalfo

WebGUI: Script Fragments

Project | Mapping-Tables | Data Request (optional) | Script Creation

Build Post-Processing Scripts Fragments

Instructions to automatically build post-processing (diagnostic, CMOR rewrite) script fragments out of the variable mapping tables:

(1) Select Project: Select the project for which the script fragments have to be generated.
(2) Generate Mapping-Tables: Select the Models/Submodels you want the script fragments to be generated for.
(3) Generate Data Request (optional): In case you want the processing of each variable to be dependent on the project's official data request, generate a customized data request.
(4) Initiate Scripts Creation: Submit your selected options by clicking the **Create Script Templates** button.

or display a list of previously created scripts:

Browse Scripts

Generate Data Request (optional)

Generate Data Request in CSV format	Add a comment (optional)	Confirm generation
Proceed to Form		Confirm generation

Opens the Data Request WebGUI homepage with pre-selected CSV-output options in a new tab. Select ONE experiment, all desired MIPs you want to support as well as the maximum desired experiment tier and variable priority. Then click on 'Create CSV'. Once the Data Request CSV sheet is generated successfully you can close the tab and click on 'Confirm generation' in the rightmost column to use this Data Request in the Script Creation process.

Data Request WebGUI developed and maintained by Martin Schupfner, DKRZ.
CDO cmor by Fabian Wachsmann, DKRZ.
DreqPy API by Martin Juckes, NCAS BADC.
Variable Mapping Web Application building on previous efforts by Karl-Hermann Wieners, MPI-M.

Background Image Source: Link © ESA/IPEV/PNRA–B. Healey

Build Post-Processing Scripts Fragments

Instructions to automatically build post-processing (diagnostic, CMOR rewrite) script fragments out of the variable mapping tables:

(1) **Select Project**: Select the project for which the script fragments have to be generated.
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(4) **Initiate Scripts Creation**: Submit your selected options by clicking the **Create Script Templates** button.

or display a list of previously created scripts:

Browse Scripts

Create Script Templates

Add comment (optional)	Create Script Templates
Comment.	Create Script Templates

Resulting Script for current Selection

▼ File: ScriptFragments_20180808144849.zip

```
###################################
NIMDI CMORewrite Script Creator
###################################

InputFiles:
EMAC EMAC_CMIP6_mapping.json EMAC_CMIP6_recipes.json
EMAC_mpiom EMAC_mpiom_CMIP6_mapping.json EMAC_mpiom_CMIP6_recipes.json
DataRequest DreqCustom_20180808144714.zip
DataRequest: 1279 requests have been read (DreqCustom_20180731134225_1pctCO2.csv).
DataRequest: 1302 requests have been read (DreqCustom_20180731134225_abrupt-4xCO2.csv).
DataRequest: 829 requests have been read (DreqCustom_20180731134225_amip.csv).
DataRequest: 1732 requests have been read (DreqCustom_20180731134225_historical.csv).
DataRequest: 1693 requests have been read (DreqCustom_20180731134225_piControl.csv).
DataRequest: 2797 requests have been read (DreqCustom_20180731134225_TOTAL.csv).
Clim-Variable: ch4Clim Amon ( monC )
Clim-Variable: co2Clim Amon ( monC )
Clim-Variable: co2massClim Amon ( monC )
```

Summary - Workflow

MIPs requesting data

WebGUI:

- Data request
- Variable mapping
- Global attributes table (cdo cmor)
- Automated generation of script fragments

Diagnostic

CMOR rewrite

Script

...

Include script fragments in post processing script

...

cdo cmor

calling CMOR library

Thanks for your attention!

questions to

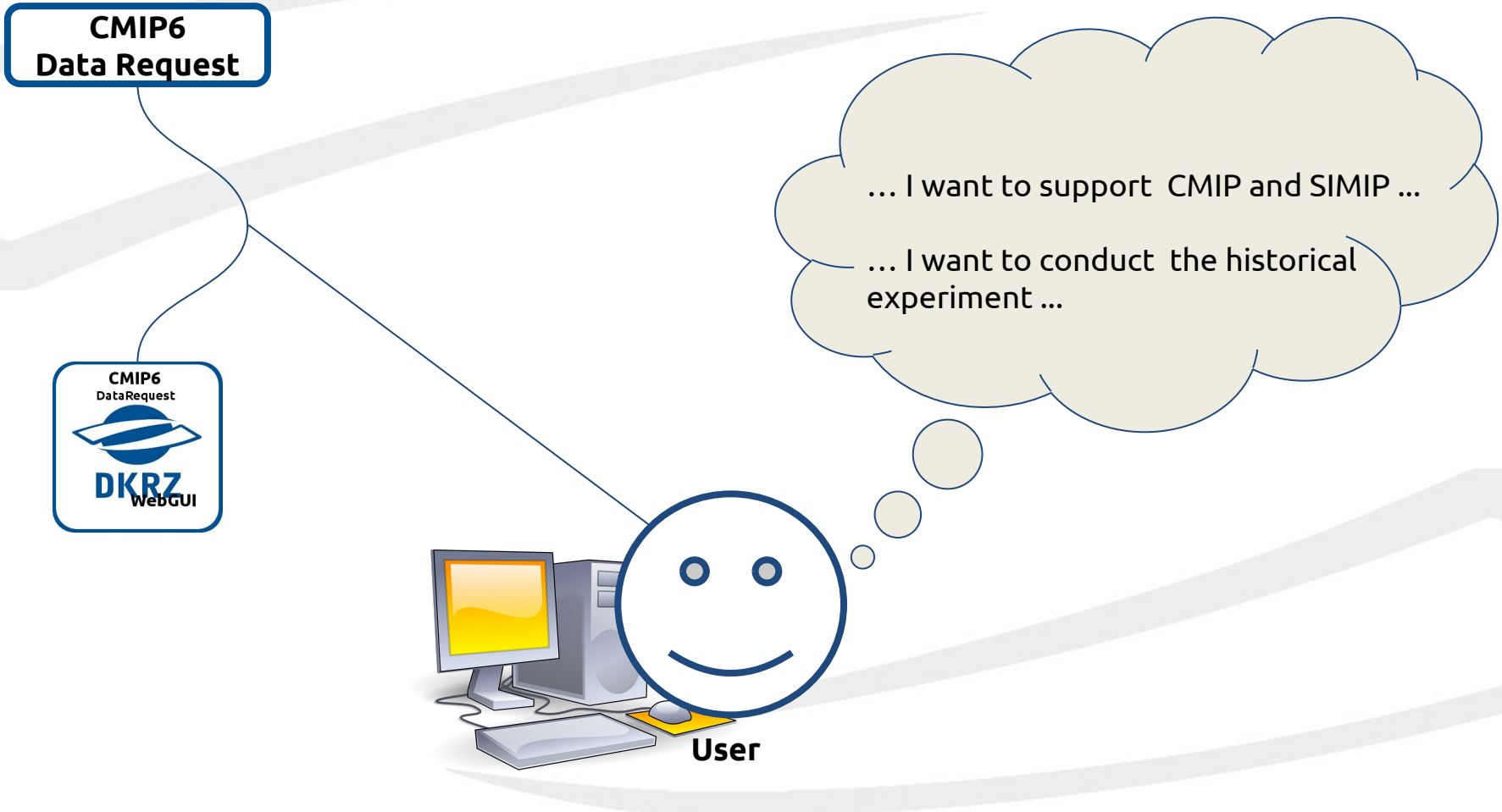
wachsmann@dkrz.de and schupfner@dkrz.de

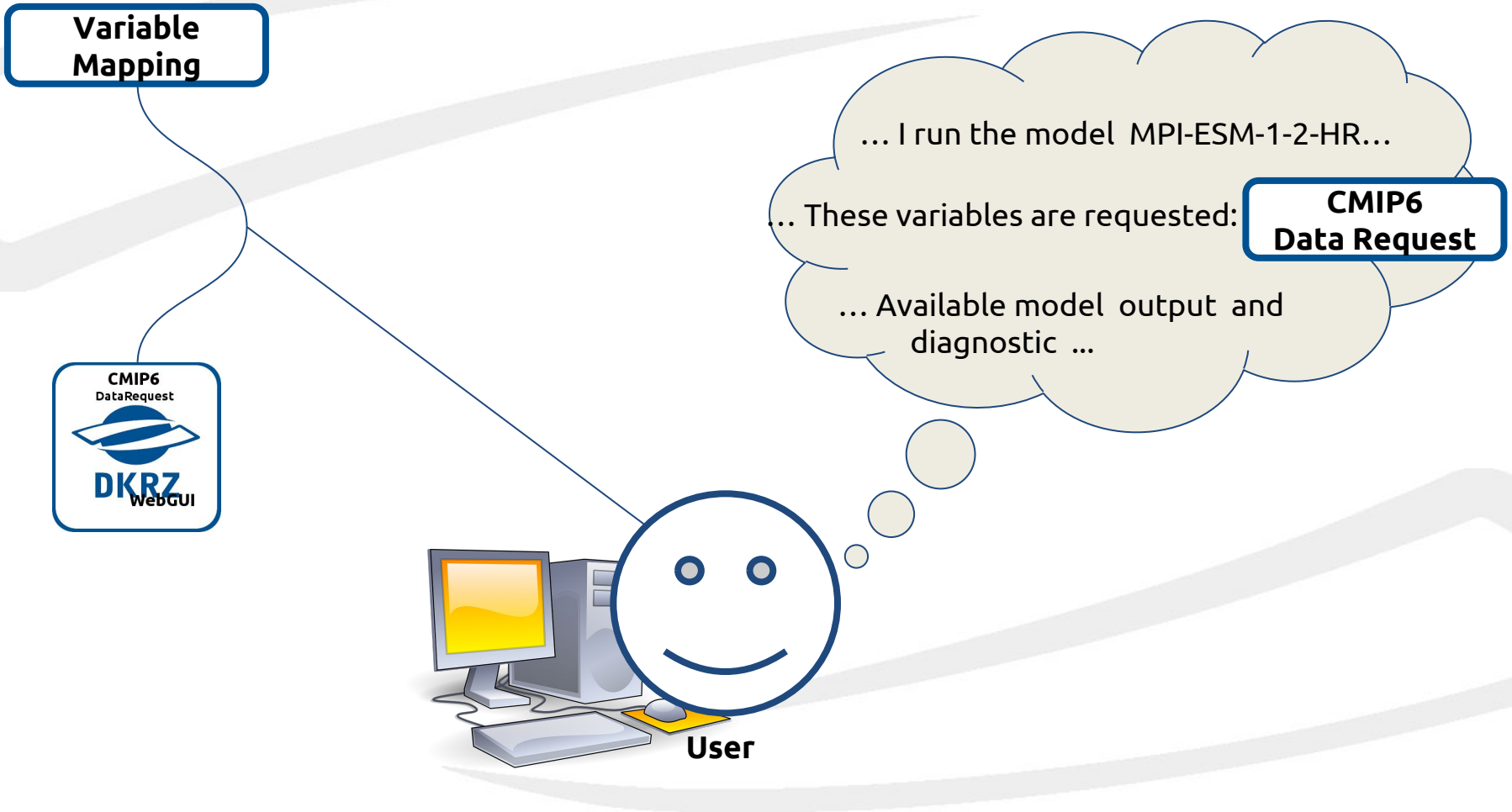
find support on

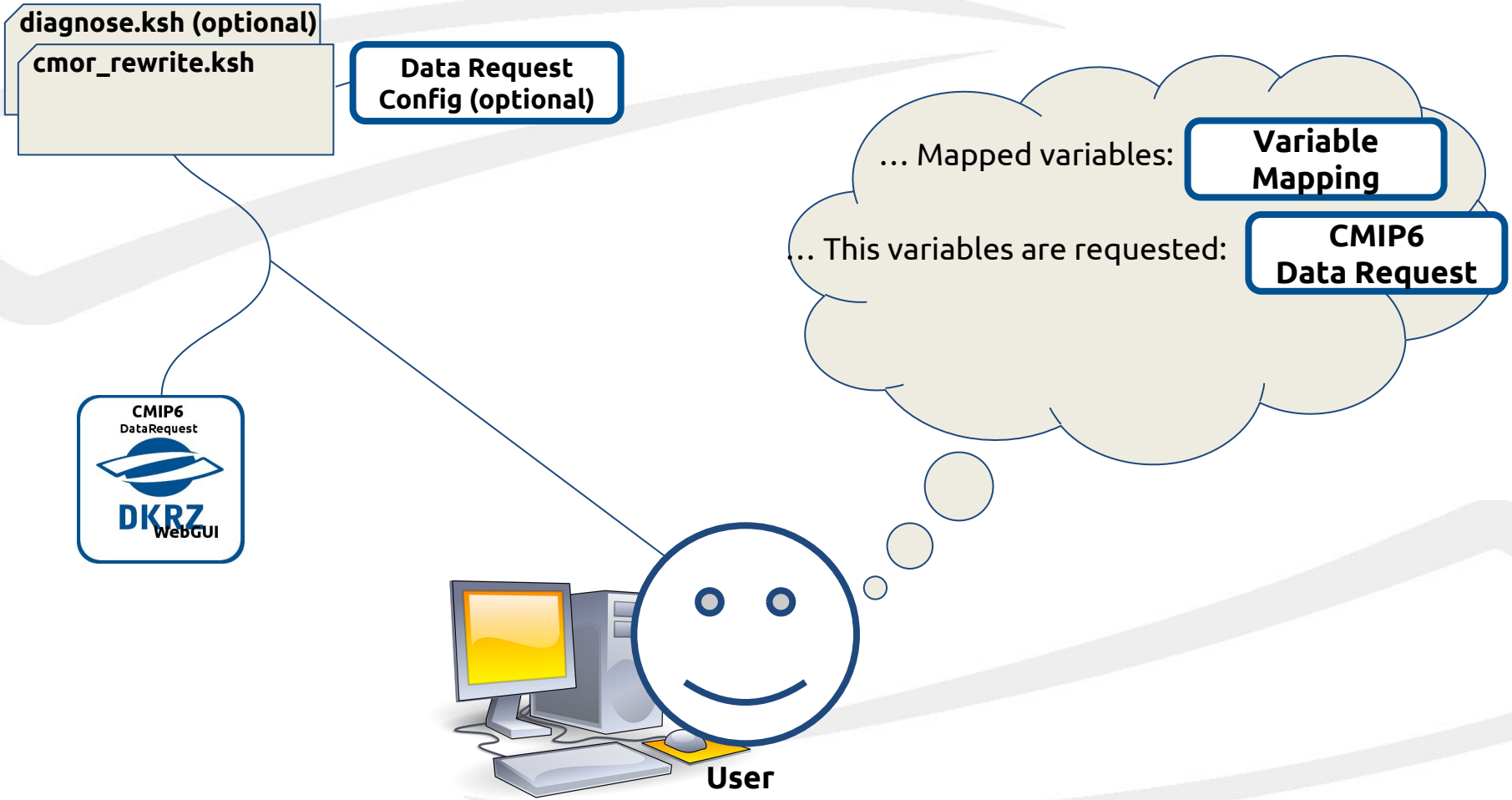
https://c6dreq.dkrz.de

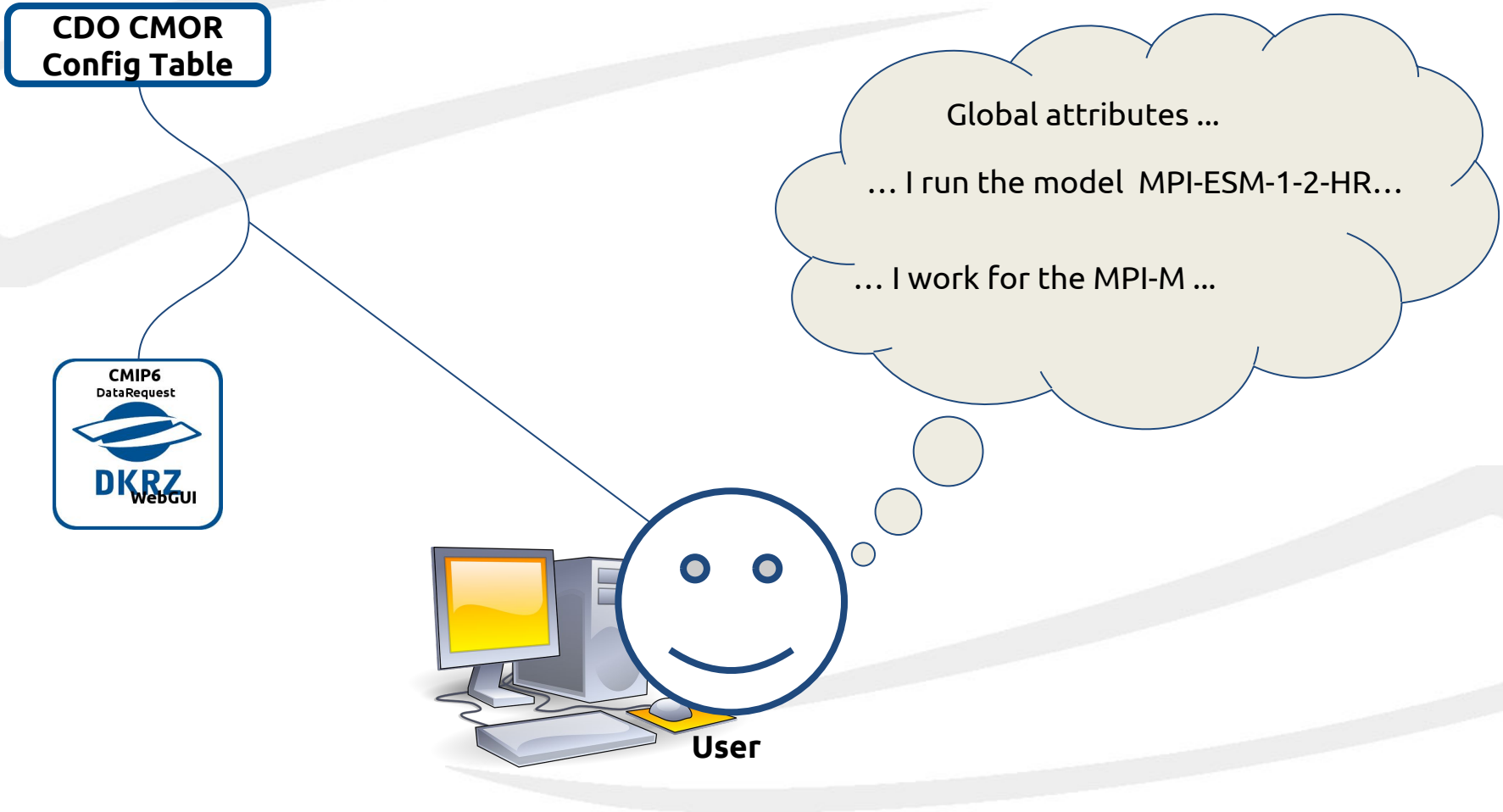
and

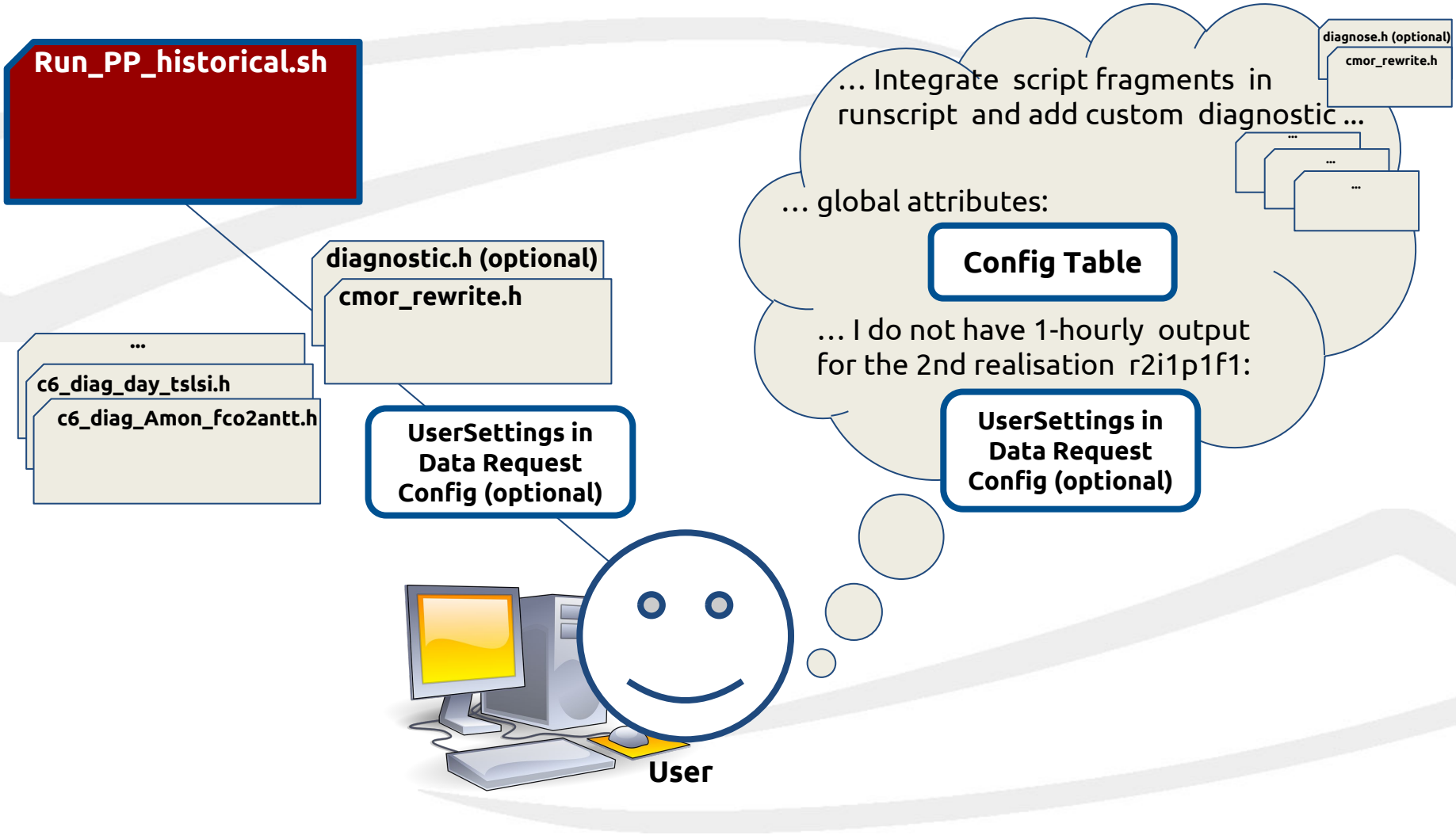
https://code.mpimet.mpg.de/projects/cdo


CMIP6
Data Request
CMIP6
DataRequest
DKRZ
WebGUI
… I want to support CMIP and SIMIP …
… I want to conduct the historical experiment …
User


Variable Mapping
CMIP6 DataRequest
DKRZ WebGUI
… I run the model MPI-ESM-1-2-HR…
… These variables are requested:
CMIP6 Data Request
… Available model output and diagnostic …
User


diagnose.ksh (optional)
cmor_rewrite.ksh
Data Request Config (optional)
… Mapped variables:
Variable Mapping
… This variables are requested:
CMIP6 Data Request
CMIP6 DataRequest
DKRZ WebGUI
User


CDO CMOR
Config Table
CMIP6
DataRequest
DKRZ
WebGUI
Global attributes ...
… I run the model MPI-ESM-1-2-HR…
… I work for the MPI-M ...
User


Run_PP_historical.sh
diagnostic.h (optional)
cmor_rewrite.h
...
c6_diag_day_tslsi.h
c6_diag_Amon_fco2antt.h
UserSettings in Data Request Config (optional)
User
... Integrate script fragments in runscript and add custom diagnostic ...
diagnose.h (optional)
cmor_rewrite.h
... global attributes:
Config Table
... I do not have 1-hourly output for the 2nd realisation r2i1p1f1:
UserSettings in Data Request Config (optional)

Data Request Config - *CMIP6_historical_requested_vars.conf*

```
################################################
EXP=historical
################################################

DREQSETTINGS
SIday        : SIday     = slice: piControl030,piControl050,piControl100
sispeed      : SIday     = slice: piControl100
Emon         : Emon      = slice: TOTAL
Emon         : hus       = slice: piControl100
thetaot300   : Emon      = False
EmonZ        : EmonZ     = False
Amon         : no2       = False

USERSETTINGS
# ---> Specify your settings for Experiment historical here
sispeed      : SIday     = slice: piControl100,1900010100-1914123124
day          : day = False
Lmon         : echam6    = False
E1hr         : r2i1p1f1  = False
# <---- Specify your settings for Experiment historical here
```