

WP3 – Infrastructure for adaption to CMIP6 project standards

Martin Schupfner
Deutsches Klimarechenzentrum (DKRZ)

Outline

- Milestone 1: Script for diagnostic post processing of MPI-ESM1 raw model data
- Milestone 2: Tool to check the potential amount of variables requested by CMIP
 - Data Request Python API (DreqPy)
 - Data Request Web GUI
- Milestone 3: Script for conformal formatting of CMIP6 data
 - Variable mapping
 - cdo cmor operator
- Milestone 4: Software for flexible and modular workflow management
 - Post processing (aggregation, diagnostic & compliant rewrite)
 - Post processing: generating template scripts

Milestone 1: Script for diagnostic post processing of MPI-ESM1 raw model data

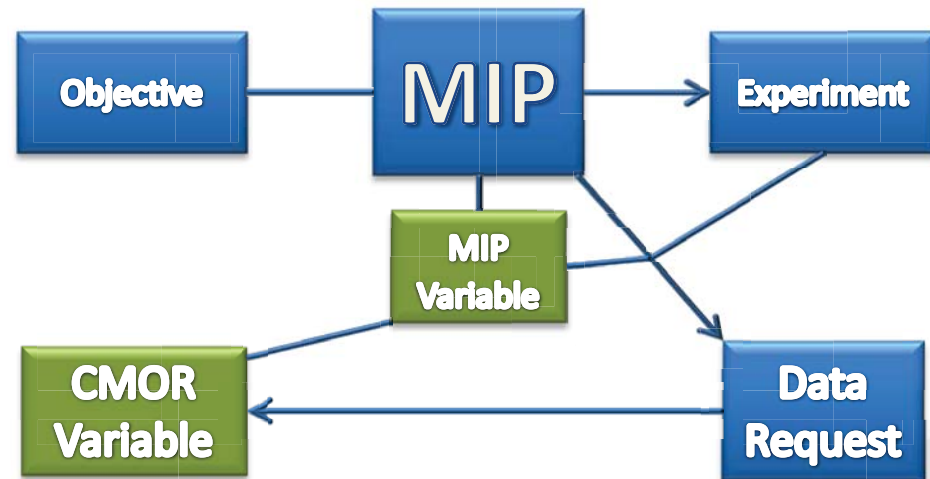
- Updated existing CMIP5 infrastructure for CMIP6
- Script generation and diagnostic possible for CMIP6 as far as the diagnostic did not change since CMIP5
- **Currently:** waiting for test raw data

Milestone 2: Tool to check the potential amount of variables requested by CMIP

- Data Request Python API (DreqPy)
- Data Request WebGUI

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)

DreqPy API

by Martin Juckes, BADC

- Interface for the CMIP6 data request written in Python
- Build customized data request (depending on MIP, experiment, variable priority, experiment tier)
- Interactive browsing of the data request possible via a collection of classes and functions
- Calculate data volume estimates
- Output as .csv file and excel sheet

Data Request Web GUI

by Martin Schupfner, DKRZ

- Web GUI using DreqPy to generate customized data requests and volume estimates for download
- No local installations required
- Created data requests to be used in the post processing workflow



Further Information

Official links, examples & further information:

- Redmine project wiki
<https://redmine.dkrz.de/projects/cmip6-dicad/wiki>
- <https://c6dreq.dkrz.de>
- Ipython/Jupyter notebook

DreqPy (Data Request Python API)

Basic Imports

```
In [ ]: #!/usr/bin/python
# -*- coding: utf-8 -*-

# IPython Notebook created by Martin Schupfner, DKRZ
# Reference: Martin Juckes 2016 -
#           dreqPy (Data Request Python API) User's Guide

from dreqPy import dreq, scope

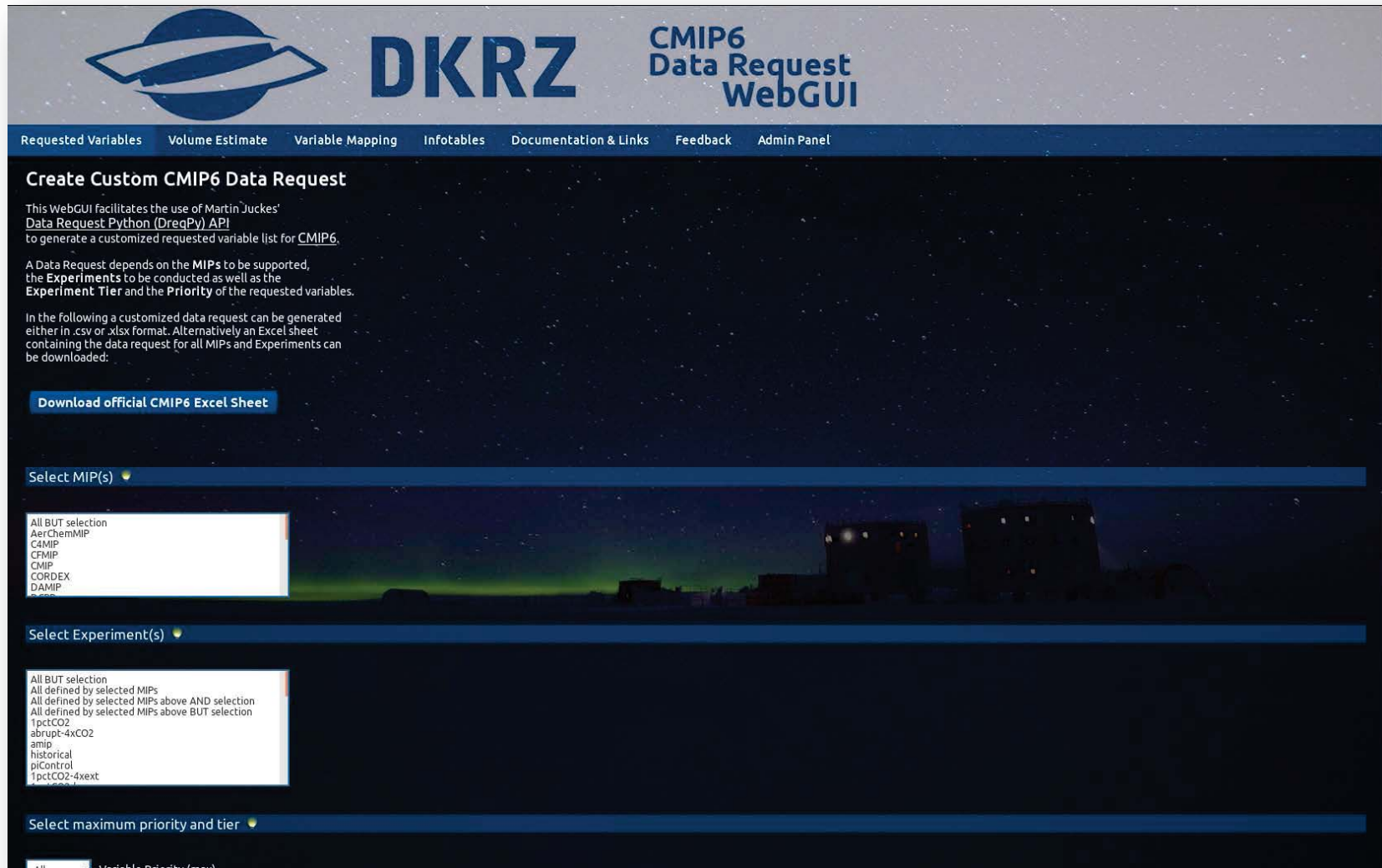
print "Using DreqPy (Data Request Python API) in version %s" \
      % str(dreq.version)

# Initialisation
dq = dreq.loadDreq()
```

dq.coll Examples

```
In [ ]: # dq.coll
# Content Object dq.coll is a dictionary containing the data request sections,
#   with 3 elements (named tuples) for each section:
# - header : named tuple with info such as title, table, etc.
# - attDefn: dictionary containing record attribute definitions
# - items  : list of records

# Print all entries of dq.coll
print "dq.coll Entries:\n", ", ".join(dq.coll.keys())
```



The screenshot shows the 'Create Custom CMIP6 Data Request' page of the DKRZ web GUI. The page features a dark blue header with the DKRZ logo and the title 'CMIP6 Data Request WebGUI'. Below the header is a navigation menu with links: 'Requested Variables', 'Volume Estimate', 'Variable Mapping', 'Infotables', 'Documentation & Links', 'Feedback', and 'Admin Panel'.

The main content area is titled 'Create Custom CMIP6 Data Request' and contains the following text:

This WebGUI facilitates the use of Martin Jukes' [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](#)

The interface includes three dropdown menus for selection:

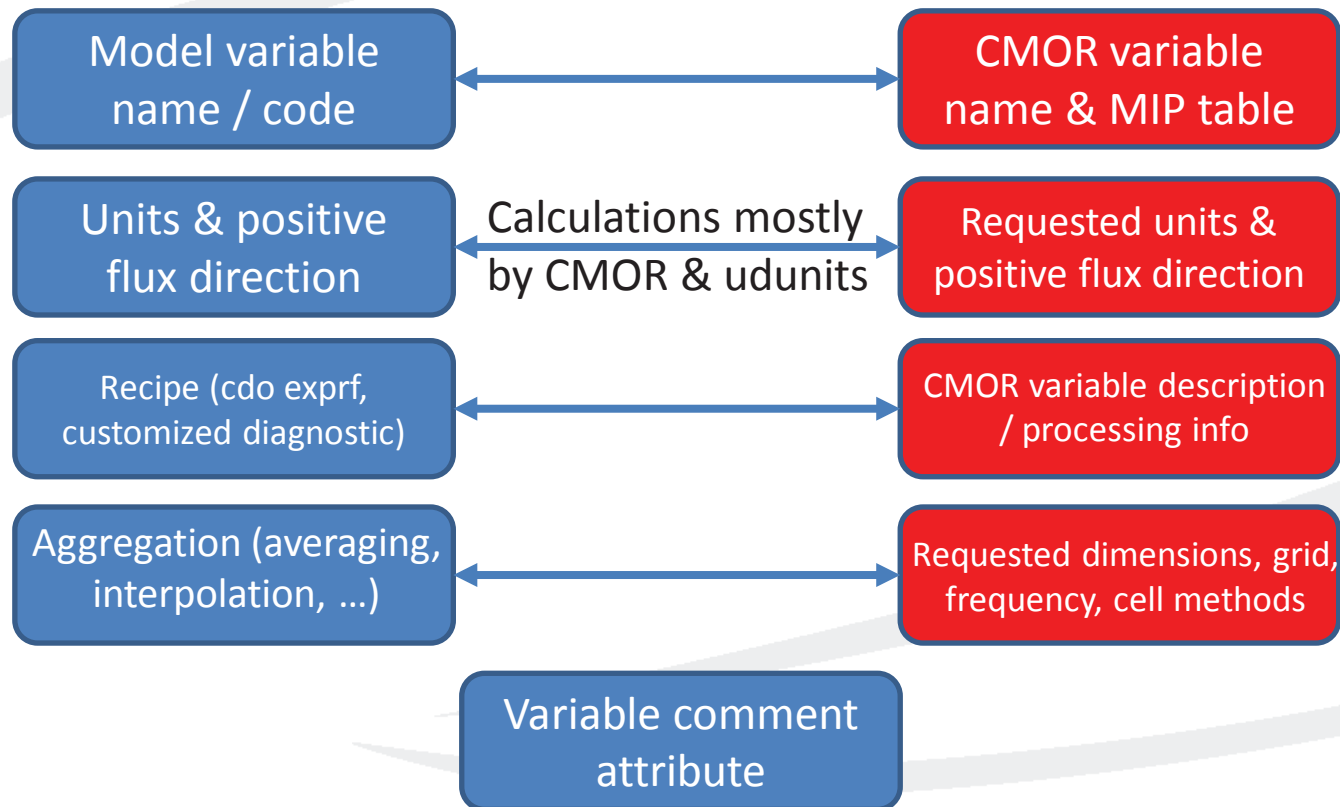
- Select MIP(s)**: A dropdown menu with a list of MIPs including 'All BUT selection', 'AerChemMIP', 'CMIP', 'CFMIP', 'CMIP', 'CORDEX', and 'DAMIP'.
- Select Experiment(s)**: A dropdown menu with a list of experiments including 'All BUT selection', 'All defined by selected MIPs', 'All defined by selected MIPs above AND selection', 'All defined by selected MIPs above BUT selection', '1pctCO2', 'abrupt-4xCO2', 'amip', 'historical', 'piControl', and '1pctCO2-4xext'.
- Select maximum priority and tier**: A dropdown menu with a list of options including 'All' and 'Variable Priority (max)'.

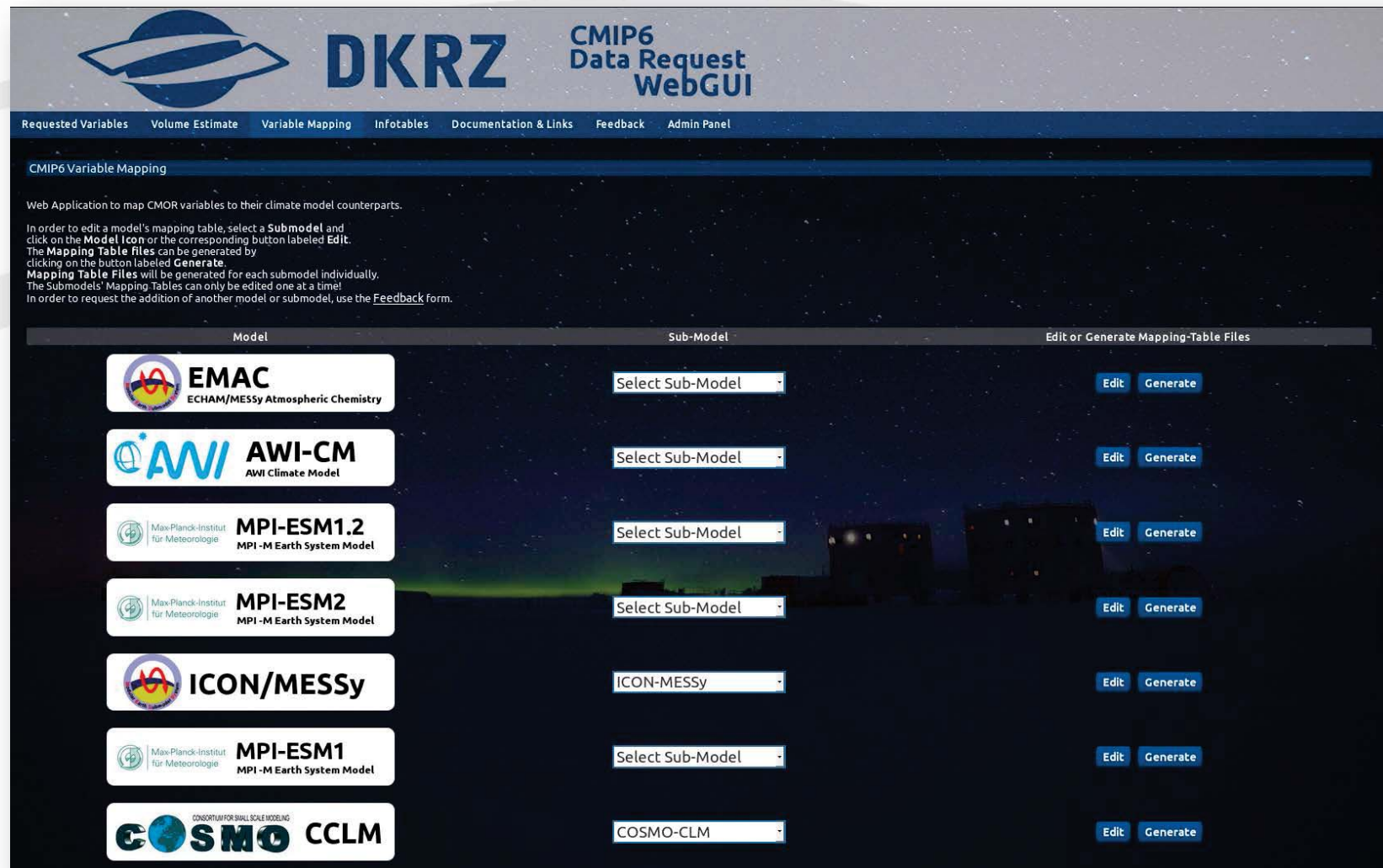
Milestone 3: Script for conformal formatting of CMIP6 data

- Variable mapping
- Operational use of the cdo cmor operator

Variable Mapping

Map Model Variable to CMOR Variable












DKRZ CMIP6 Data Request WebGUI

Requested Variables | Volume Estimate | **Variable Mapping** | Infotables | Documentation & Links | Feedback | Admin Panel

CMIP6 Variable Mapping

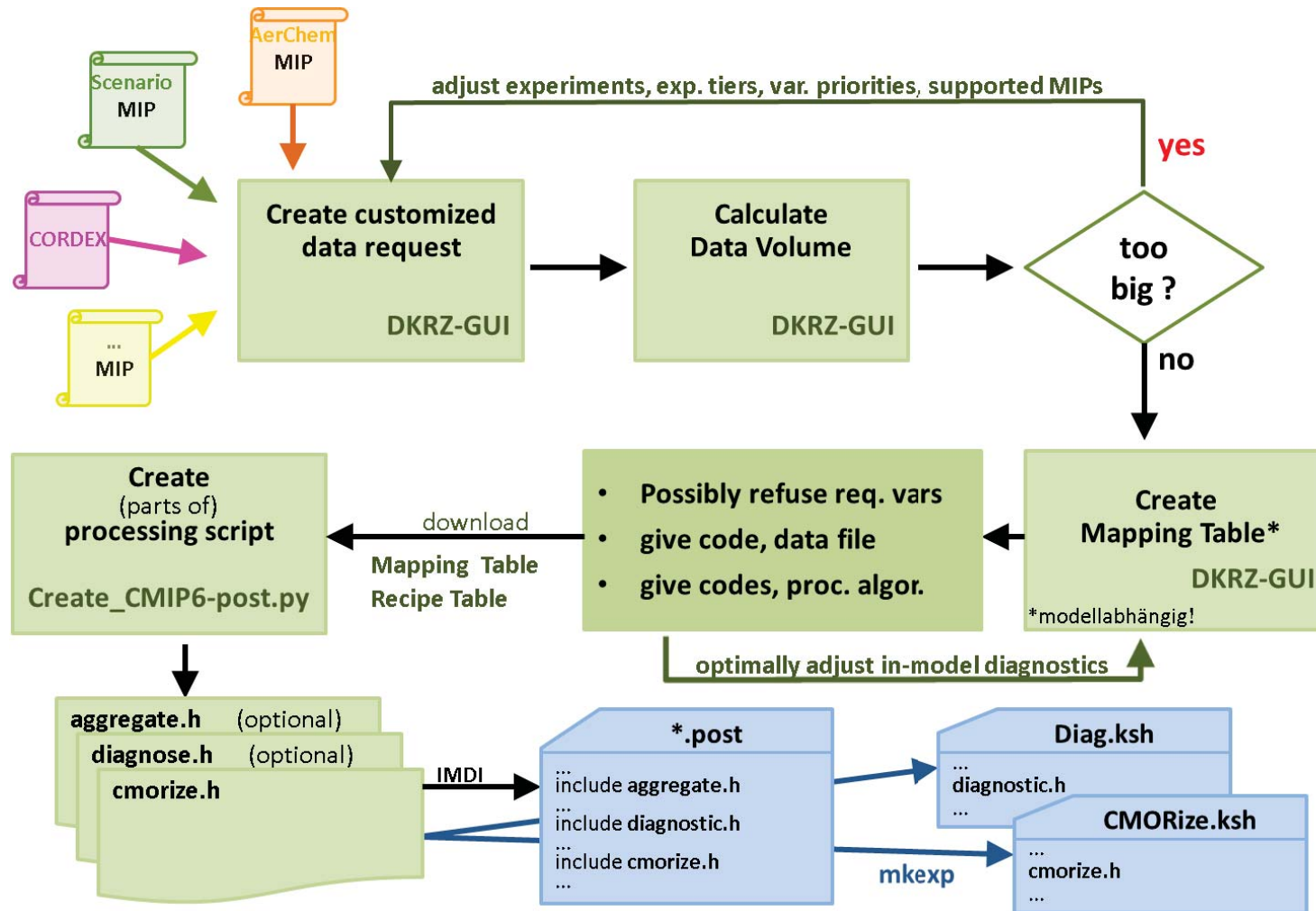
Web Application to map CMOR variables to their climate model counterparts.

In order to edit a model's mapping table, select a **Submodel** and click on the **Model Icon** or the corresponding button labeled **Edit**. The **Mapping Table Files** can be generated by clicking on the button labeled **Generate**. **Mapping Table Files** will be generated for each submodel individually. The Submodels' Mapping Tables can only be edited one at a time! In order to request the addition of another model or submodel, use the **Feedback** form.

Model	Sub-Model	Edit or Generate Mapping-Table Files
 EMAC ECHAM/MESSy Atmospheric Chemistry	Select Sub-Model	Edit Generate
 AWI-CM AWI Climate Model	Select Sub-Model	Edit Generate
 MPI-ESM1.2 MPI-M Earth System Model	Select Sub-Model	Edit Generate
 MPI-ESM2 MPI-M Earth System Model	Select Sub-Model	Edit Generate
 ICON/MESSy	ICON-MESSy	Edit Generate
 MPI-ESM1 MPI-M Earth System Model	Select Sub-Model	Edit Generate
 COSMO CCLM	COSMO-CLM	Edit Generate

Milestone 4: Software for flexible and modular workflow management

- Aggregation, diagnostic & compliant rewrite
- Generating template scripts



Template scripts

- Automatic creation of diagnostic and cmor rewrite template out of recipe table
- Automatic creation of data request settings out of recipe table and CMIP6 data request, further customizable by user

Diagnostic

- One block per diagnostic
- Test if variable is requested (data request, timeslice, user configuration)
- Find inputfile
- cdo commands:
 - cdo merge in case of multiple inputfiles
 - cdo exprf

CMOR rewrite

- One block per MIP table and input file (or diagnosed variable)
- Test if variable is requested (data request, timeslice, user configuration)
- Find inputfile
- ,cdo cmor' call

Thanks for your attention!

Discussion:

- Modularity template script (diagnostic & cdo cmor)
- Modularity template script (variables)
- Workflow in general
- Mapping table uniqueness!