

ISIMIP/PROCLIAS workshop Prague 2023

# Automatic quality check / quality assessment of impact model output

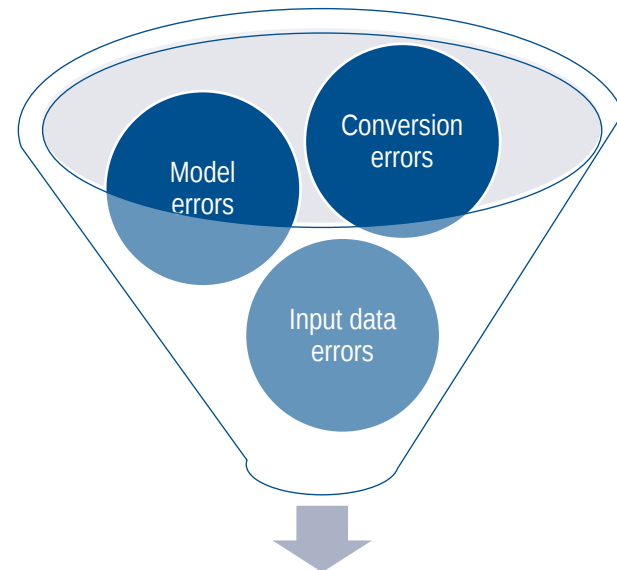
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Gerbrand Koren<sup>4</sup> + PROCLIAS TG1.2

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## Motivation & background

- Process-based impact models as valuable tools for simulating processes in a changing world (e.g., socio-economy, climate)
- Inter-Sectoral Model Intercomparison Project ([www.isimip.org](http://www.isimip.org)) act as umbrella for multiple sectors and ~ 100 modelling groups that follow a simulation protocol
- allows model intercomparison, evaluation and (cross-) sectoral (multi-) model impact assessments
- But: high quality model output is needed



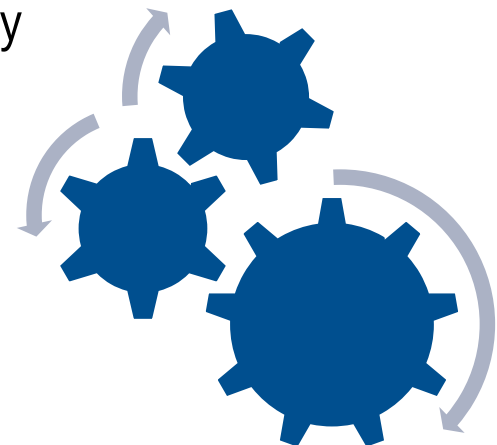
Flawed model output?



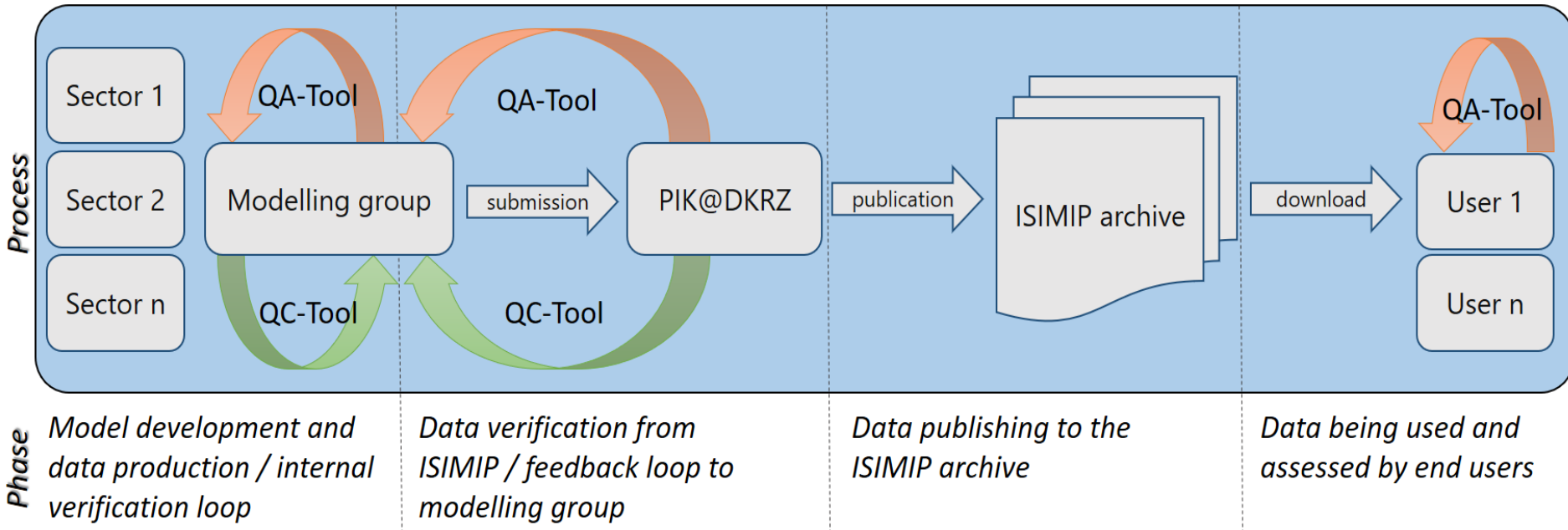
## Objective

- **Establish a QC/QA workflow with tools to**
  - check plausibility of the model output and proper data format (Quality control, QC), and afterwards do quality assessment (QA) to
    - assess model output in comparison to existing output and to
    - assess key variables with benchmark data
  - Serves model development (e.g. tools can be run at own institution)
  - Avoids publishing incorrect data at ISIMIP repository
  - supports model intercomparison
  - TG1.2 in PROCLIAS <https://proclias.eu>

**PRO**  **CLIAS**

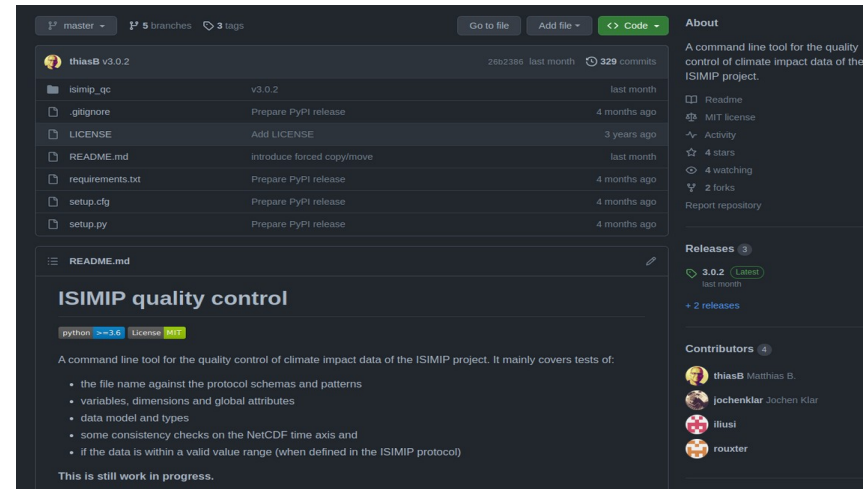


# ISIMIP QC/QA workflow



## Status of the QC tool

- QC-tool is existing (created by ISIMIP data management team) and in operational use with each data submission
- Command line tool
- Python package (Linux, macOS, Windows)
- It checks:
  - file name against the protocol schemas
  - variables, dimensions and attributes
  - Data model and types
  - consistency of NetCDF time axis
  - if the data is within a valid value range
- **Tool is easy-to-use also at modeller's institution (saves data transfer and time) and very helpful**
- Tool is also available in PyPI
- Tool is under MIT-license



<https://github.com/ISI-MIP/isimip-qc>

## Status of the QA tool

- in development
- a tool to assess the data content
- Command line tool
- Two-step approach:
  - Extraction: Create (reduced) CSV files from NetCDF files, e.g. mean values for a region
  - Assessment: Create plots from the CSV files, with or without additional computations
- To compare different models / scenarios
- Extendable to sector specific assessments
- For the global water sector as pilot: assessment against observation data

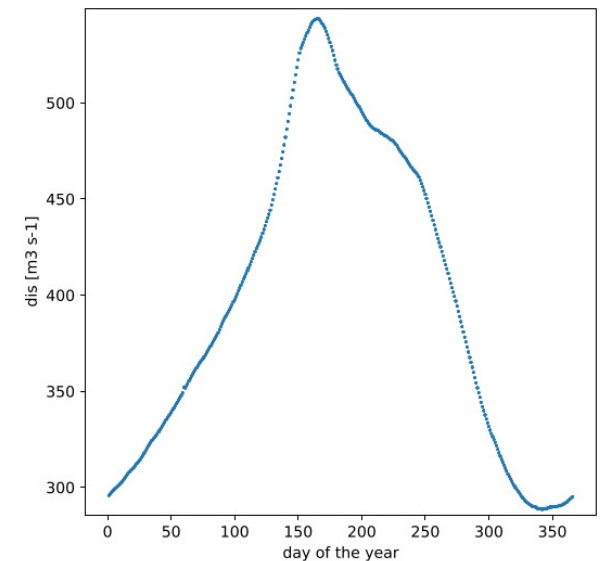
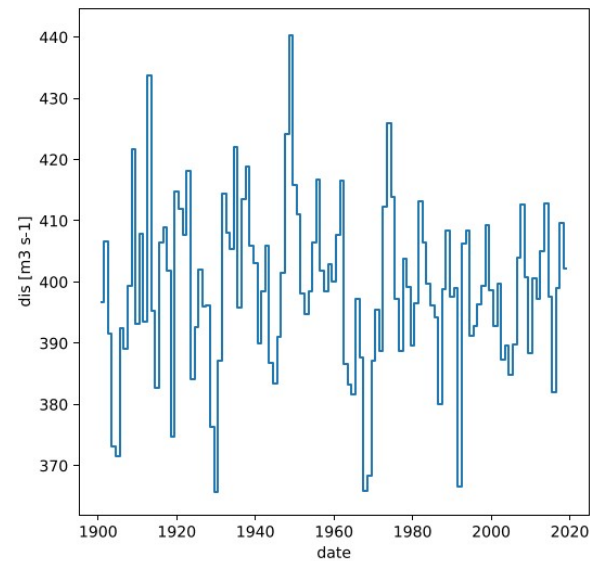
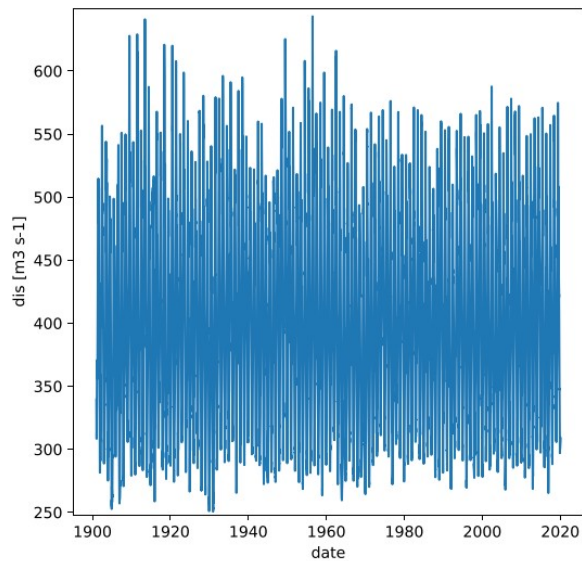


<https://github.com/ISI-MIP/isimip-qa>

## Example for a single model

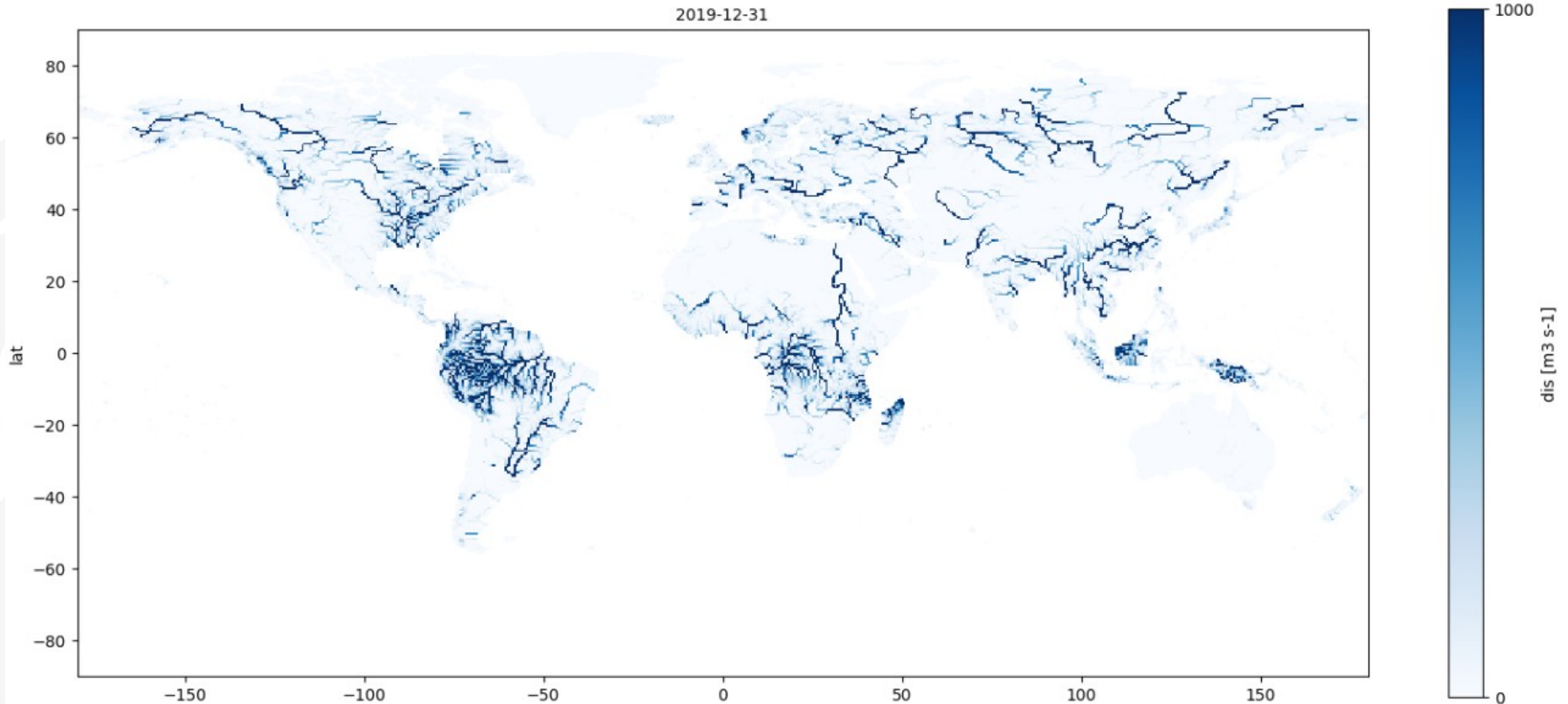
```
isimip-qa ISIMIP3a/OutputData/water_global/WaterGAP2-2e/gswp3-w5e5/historical/  
watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_dis_global_daily
```

```
ISIMIP3a/.../watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_dis_global_daily_mean.csv
```



## Example to generate maps

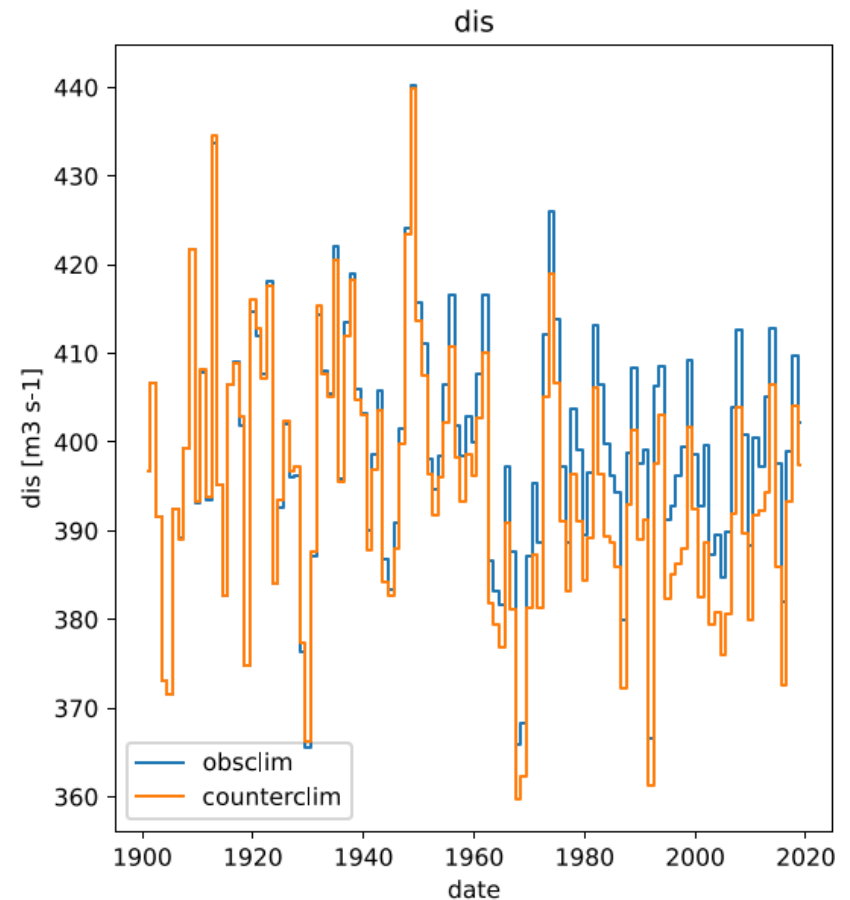
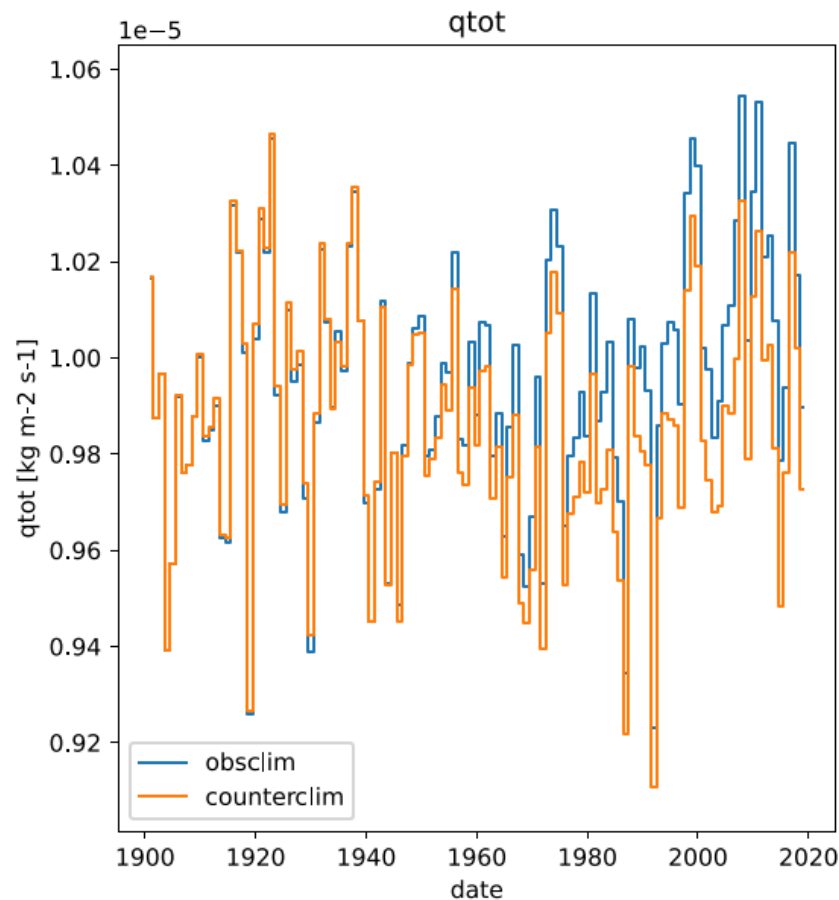
```
isimip-qa -a map --vmin=0 --vmax=1000 --cmap=Blues \  
ISIMIP3a/OutputData/water_global/WaterGAP2-2e/gswp3-w5e5/historical/  
watergap2-2e_gswp3-w5e5_obsclim_histsoc_default_dis_global_daily
```





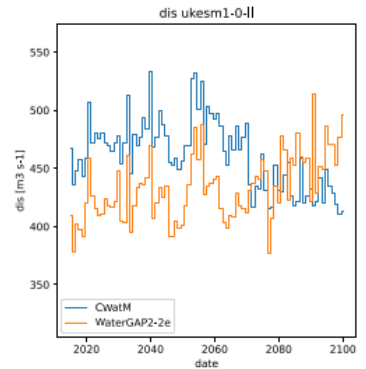
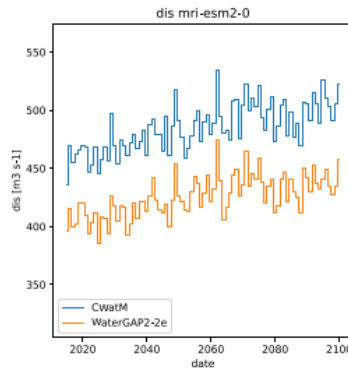
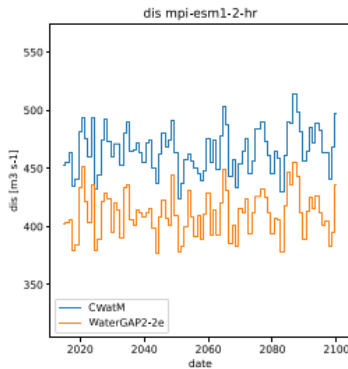
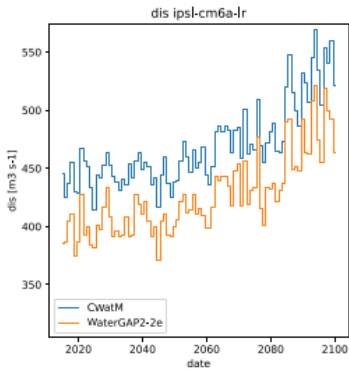
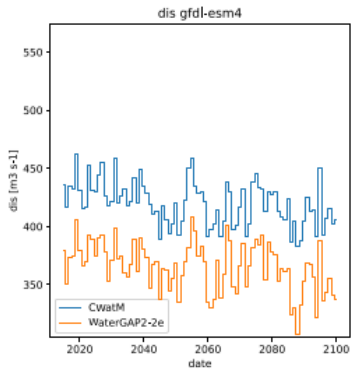
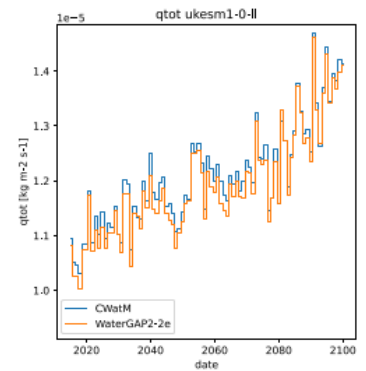
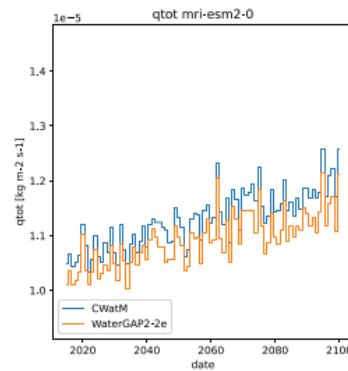
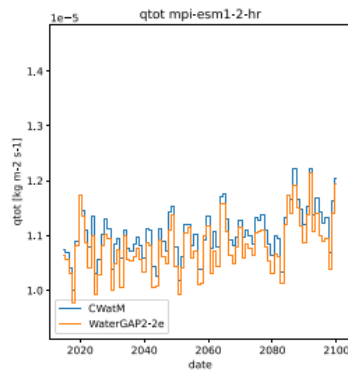
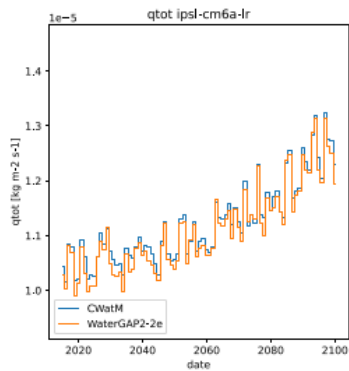
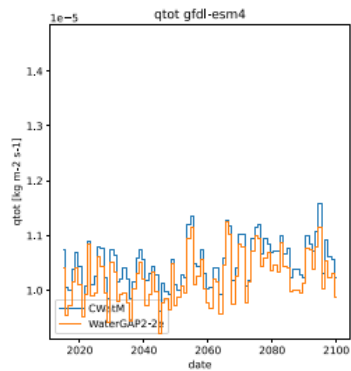
## Example for working with placeholders

```
isimip-qa -g 1 ISIMIP3a/OutputData/water_global/WaterGAP2-2e/gswp3-w5e5/historical/  
watergap2-2e_gswp3-w5e5_{climate_scenario}_histsoc_default_{variable}_global_daily  
variable=qtot,dis climate_scenario=obsclim,counterclim
```



## Example for multiple placeholders

```
isimip-qa ISIMIP3b/OutputData/water_global/{model}/{climate_forcing}/future/  
{model}_{climate_forcing}_w5e5_ssp370_2015soc-from-histsoc_default_{variable}_global_daily  
climate_forcing=gfdl-esm4,ipsl-cm6a-lr,mpi-esm1-2-hr,mri-esm2-0,ukesm1-0-ll  
variable=qtot,dis  
model=CWatM,WaterGAP2-2e
```



## Outlook

### QC-tool

- Small improvements, tool is finished and in operational use; extensions possible (e.g. integration of new variables / variable ranges)

### QA-tool

- Automatic fetching of already existing extractions from ISIMIP repository
- Deployment in the quality control / publication workflow
- Quantitative assessment using thresholds
- With global water sector as pilot sector:
  - Compare key variables (streamflow, total water storage anomalies) against observations
  - We submitted a proposal to fund tool development and provisioning of benchmark data/metrics/visualizations; user manual / tutorial
  - Additional checks like functional relationships (e.g. precipitation and groundwater recharge)
  - Hackathon Utrecht September 2023
  - Extension to other sectors

## Contact

### QC/QA-Tool:

ISIMIP data management team (Jochen Klar,  
Matthias Büchner, Iliusi Vega):

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### Participation in TG 1.2:

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### Hackathon Utrecht:

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