

Web-based, user-driven climate impact data extraction

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The **Inter-Sectoral Impact Model Intercomparison Project (ISIMIP)** is a community-driven climate impact modelling initiative that aims to contribute to a cross-sectoral synthesis of the various impacts of climate change, including associated uncertainties.

The **ISIMIP Repository** holds the world's largest collection of global climate impact model data. However, both the format (NetCDF) and file sizes represent a major barrier for many users.

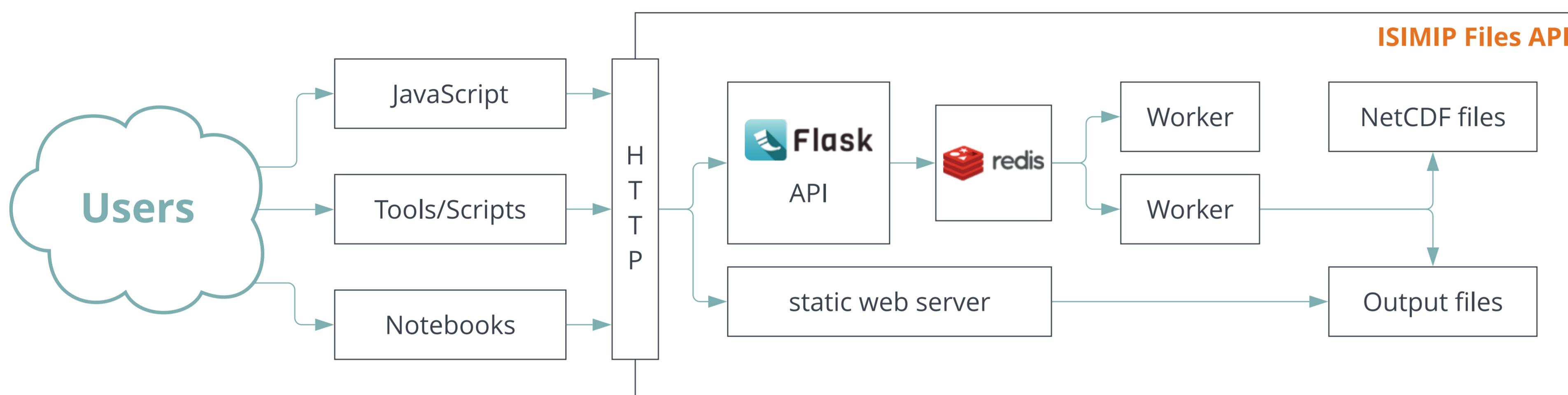
To address this, we've developed a web-based service which allows users to customise the data before downloading, making it much easier to use.

This **ISIMIP Files API** allows users to perform various operations on selected NetCDF files on the server:

- mask or cut-out a bounding box, a country, or from an uploaded custom shape file or GeoJSON
- create time series of mean values for regions or points
- create NetCDF or CSV files

The **NFDI4Earth incubator** allows us to improve the API in several ways: upload of user-defined regions, implementation of chained operations, improved access using notebooks and scripts.

How does it work?



Clients communicate with the API using HTTP requests and JSON data:

1. The initial request contains the **paths** of the datasets and the **operations** to perform.
2. The server answers with a **job id** and a url to retrieve the status of the job.
3. The job is **queued** on the server and eventually picked up by a **worker**.
4. The worker is using **CDO** or **NCKS** or a **custom script** to perform each operation.
5. When the task is done, the output files are stored in a **ZIP file** on a static web server.
6. The user can download the file, extract it and use it for their work 🚀.

The API can be used “raw”, integrated into interactive web pages, or using scripts/notebooks.

The code is released as **open source software** under the MIT license and, as the application is not tied to ISIMIP conventions, can be adopted for similar archives of NetCDF files. The setup is carefully documented and a **docker setup** is available. Releases on **PyPI** will follow.

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

The API is already usable with the ISIMIP Repository at: <https://files.isimip.org/api/v2>

Example notebooks are available at: <https://git.rwth-aachen.de/nfdi4earth/pilotsincubatorlab/incubator/climate-impact-data-extraction>

Examples

```
...
Example 1: Create a time series for Brasil as CSV file
...

import requests

# initial request with the path and the mask_country operation
requests.post('https://files.isimip.org/api/v1', json={
    'paths': [
        'ISIMIP3b/InputData/Climate/.../gfdl-esm4_r11p1f1_w5e5_ssp585_tas_global_daily_2015-2020.nc',
        ...
    ],
    'operations': [
        {
            'operation': 'mask_country',
            'country': 'bra',
            'compute_mean': True,
            'output_csv': True
        }
    ]
})
```

```
...
Example 2: Cut-out Switzerland from 1km high-resolution data
...

from pathlib import Path
import requests

requests.post(url, files={
    'data': json.dumps({
        'paths': [
            'ISIMIP3a/InputData/Climate/.../CHELSA-WSE5/chelsa-w5e5_obsclim_tas_30arcsec_global_daily_197901.nc',
            'ISIMIP3a/InputData/Climate/.../CHELSA-WSE5/chelsa-w5e5_obsclim_tas_30arcsec_global_daily_197902.nc',
            ...
        ],
        'operations': [
            # first, cut-out a region around switzerland
            {
                'operation': 'cutout_bbox',
                'bbox': {
                    5.800, # west
                    10.600, # east
                    45.800, # south
                    47.900 # north
                }
            },
            # next, create a mask from the shape with the resolution of the cut-out file
            {
                'operation': 'create_mask',
                'shape': 'che.json', # a GeoJSON with the shape of switzerland
                'mask': 'che.nc',
            },
            # lastly, mask the file using the created mask
            {
                'operation': 'mask_mask',
                'mask': 'che.nc',
            }
        ]
    })
}, {'che.geojson': Path('che.json').read_bytes()})
```

The new version of the API will be integrated into the ISIMIP Repository at data.isimip.org.

