

with *Climate4Impact 2.0a* and *iclim 6.1.5*

Christian Pagé (CERFACS, France)

christian.page@cerfacs.fr <https://linkedin.com/in/pagechristian> https://www.researchgate.net/profile/Christian_Page
CECI, Université de Toulouse, CNRS, CERFACS, Toulouse, France

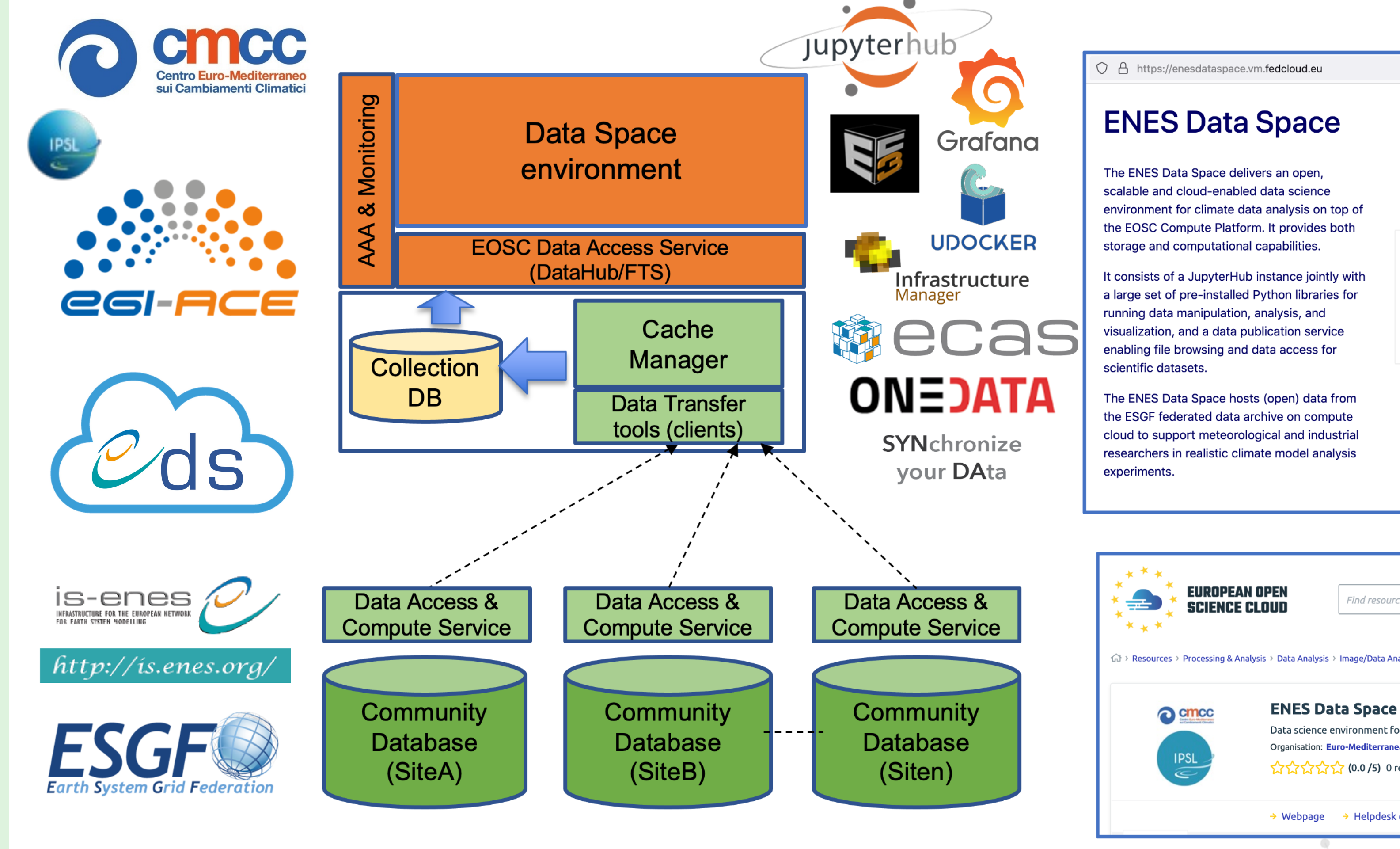
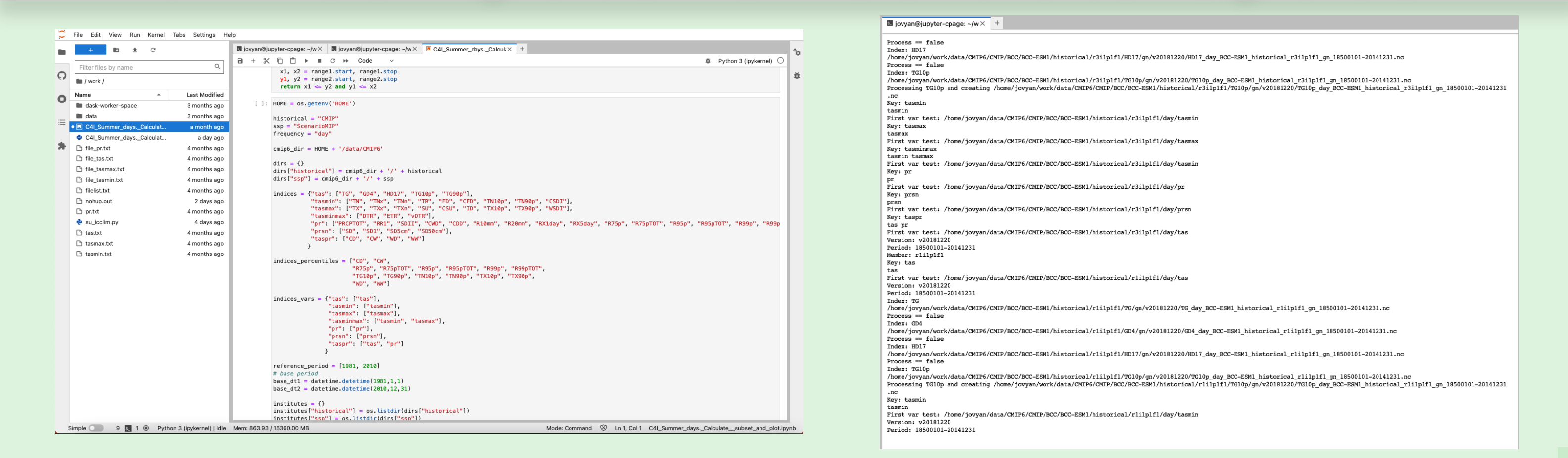
Abel Aoun (CERFACS, France) Alessandro Spinuso (KNMI, Netherlands) Klaus Zimmermann & Lars Barring (SMHI, Sweden)

I Impacts of Climate Change



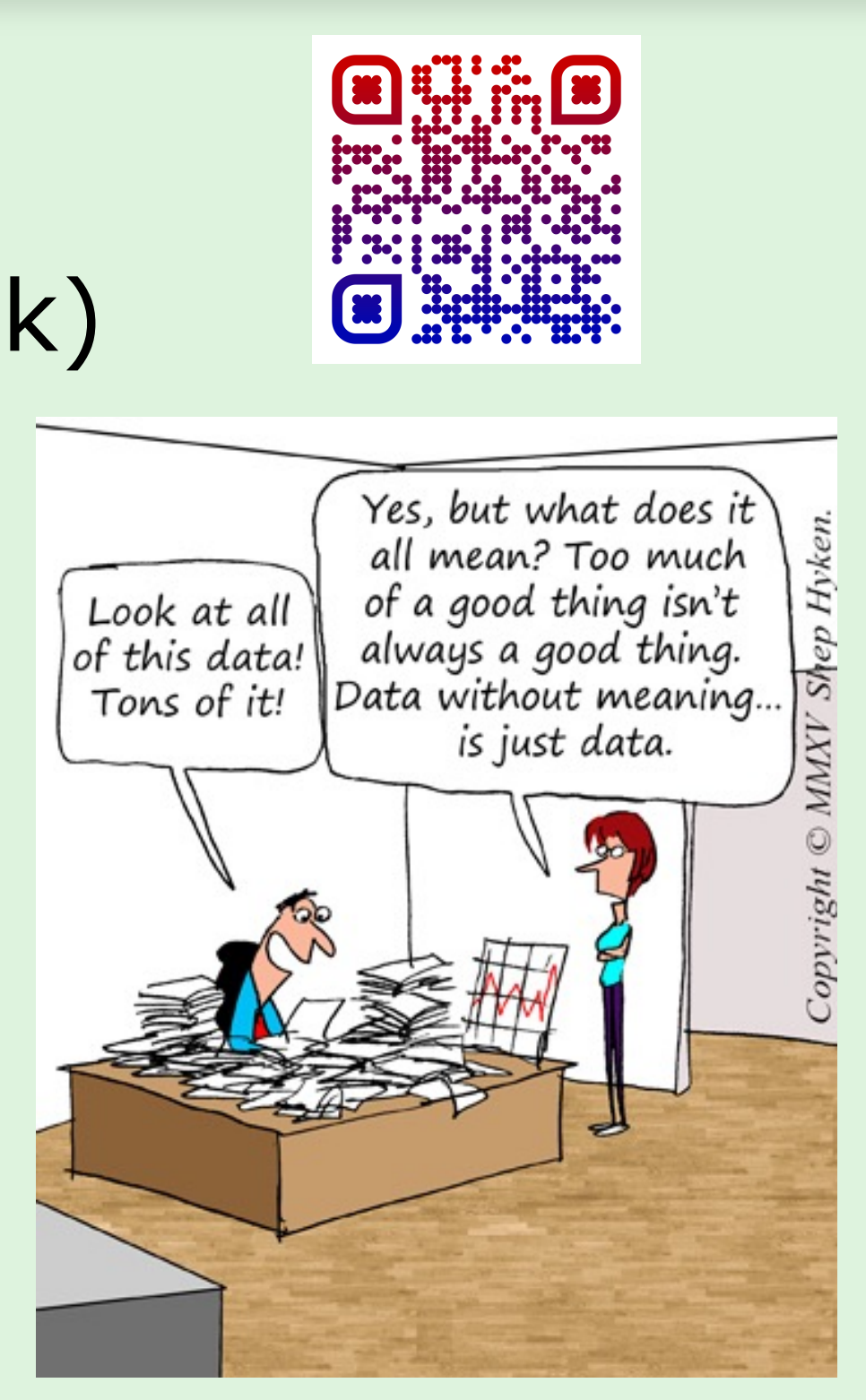
- Urgent needs of impact assessments
- Identify mitigation solutions
- Extreme events attribution
- Multiple domains: infrastructures, urban, agriculture, transportation, etc.
- Flexible tools needed for very diverse users
- Climate indices and indicators are widely needed**

IV Compute: ENES Data Space



II iclim: Climate Indices

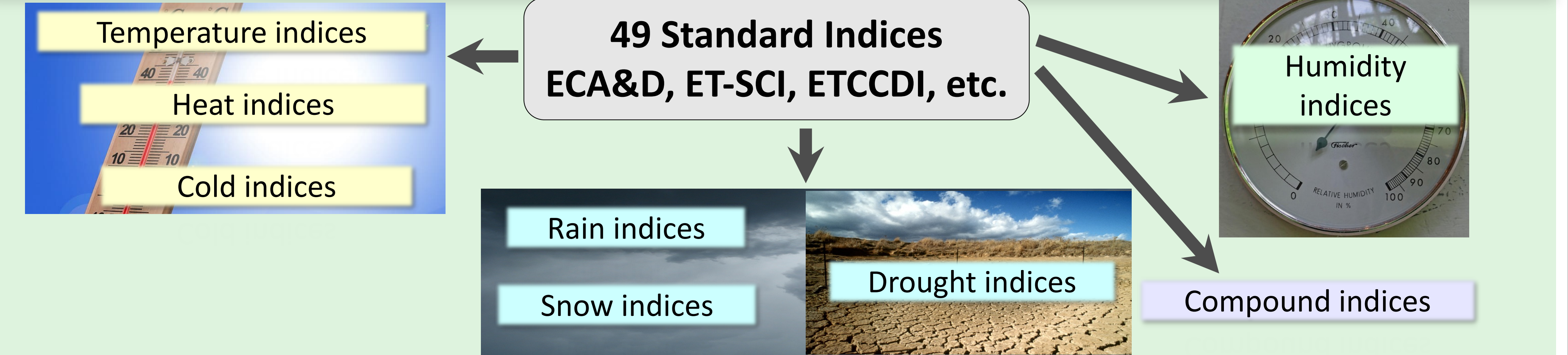
- Python code developed@CERFACS since 2013
- Performance optimized (xarray, dask)
- Fully compliant to CF and Metadata Standards
- Validated against climact & xclim
- Easy install: `pip install iclim`
- Implement the proper percentile indices calculations when calculation period overlaps reference period: bootstrapping method



Take Home Messages

- Wide Needs for tools to easily calculate climate indices
- iclim is a flexible, robust and fast python software for calculating climate indices
- Creating pre-calculated standard indices datasets for CMIP6 is really a need
- A web platform for easy and FAIR-enabled access to climate data, tools and actionable products is essential

III iclim: 50 Standard Climate Indices

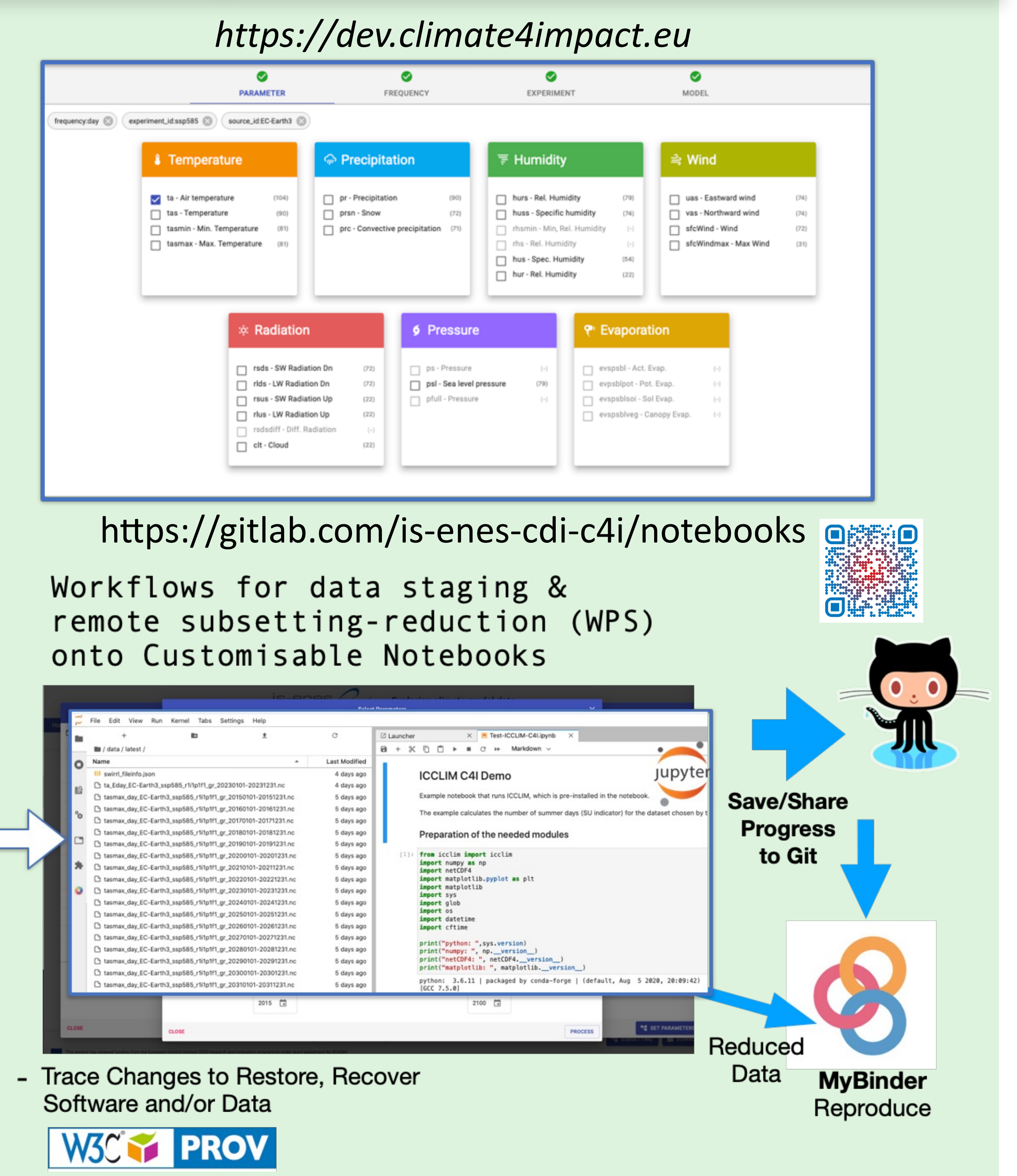


- Intra-period extreme temperature range [$^{\circ}$ C] - **ETR**
- Warm days (days with mean temperature > 90th percentile of daily mean temperature) - **TG90p**
- Summer days (days with max temperature $\geq 25^{\circ}$ C) - **SU**

```
>>> files = ['tasmax_day_CNRM-CM5_historical_r1i1p1_19950101-19991231.nc', 'tasmax_day_CNRM-CM5_historical_r1i1p1_20000101-20041231.nc', 'tasmax_day_CNRM-CM5_historical_r1i1p1_20050101-20051231.nc']
>>> dt1 = datetime.datetime(1998,1,1)
>>> dt2 = datetime.datetime(2005,12,31)
>>> out_f = 'SU_JJA_CNRM-CM5_historical_r1i1p1_1998-2005.nc'
# OUTPUT FILE: summer season values of SU
>>> iclim.su(in_files=files, time_range=[dt1, dt2], slice_mode='JJA', out_file=out_f)
```

V Climate4Impact: C4I

- Front-end to climate data infrastructure (ESGF)
- Tailored Search Interface with view modes
- Jupyter-Lab enhanced environment SWIRRL
- Notebooks gallery
- Flexible analysis features
- Climate indices calculation: iclim
- Personal store for processing outcome
- Pages for Models Performance Comparison (ESMValTool)
- Automated reproducibility mechanisms and documentation (Data/Analysis)



VI Climate Indices Database

- 50 standard climate indices over most of CMIP6 simulations
 - Institutes/Climate Models
 - Historical and SSPs
 - Members
 - Versions
 - Time Periods (1850-2100)
 - Can be extended to CORDEX, CMIP5, ERA5, ...
- Special thanks to the EGI-ACE and CMCC support!