

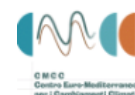
# climate4impact.eu (2.0)

Enhance usage of research data and support  
researchers with climate analysis.

Current state and Next steps

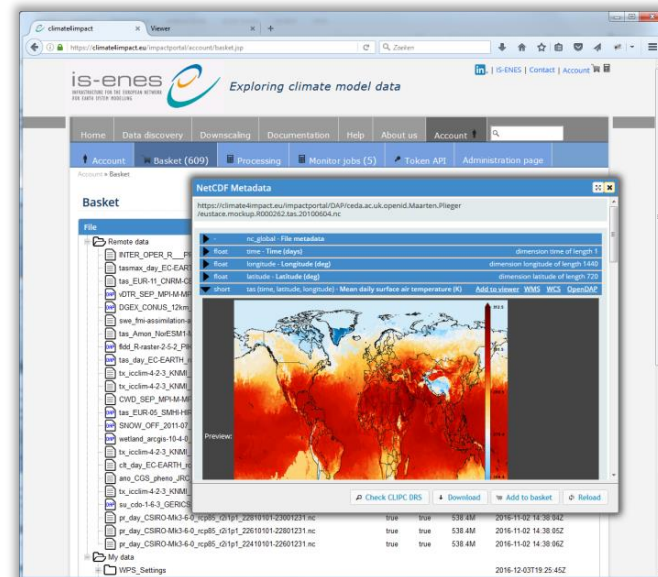
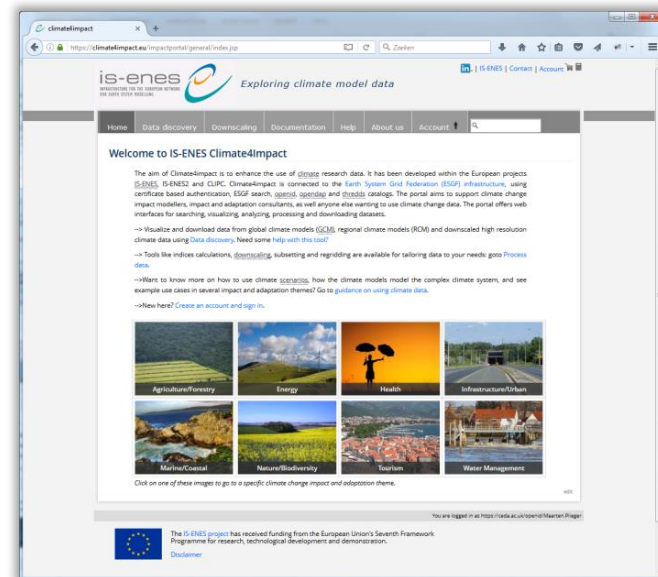
Christian Pagé, **Maarten Plieger**, Wim Som de Cerff, Alessandro Spinuso,  
Ernst de Vreede, Niels Drost

KNMI, CERFACS, Netherlands eScience Center



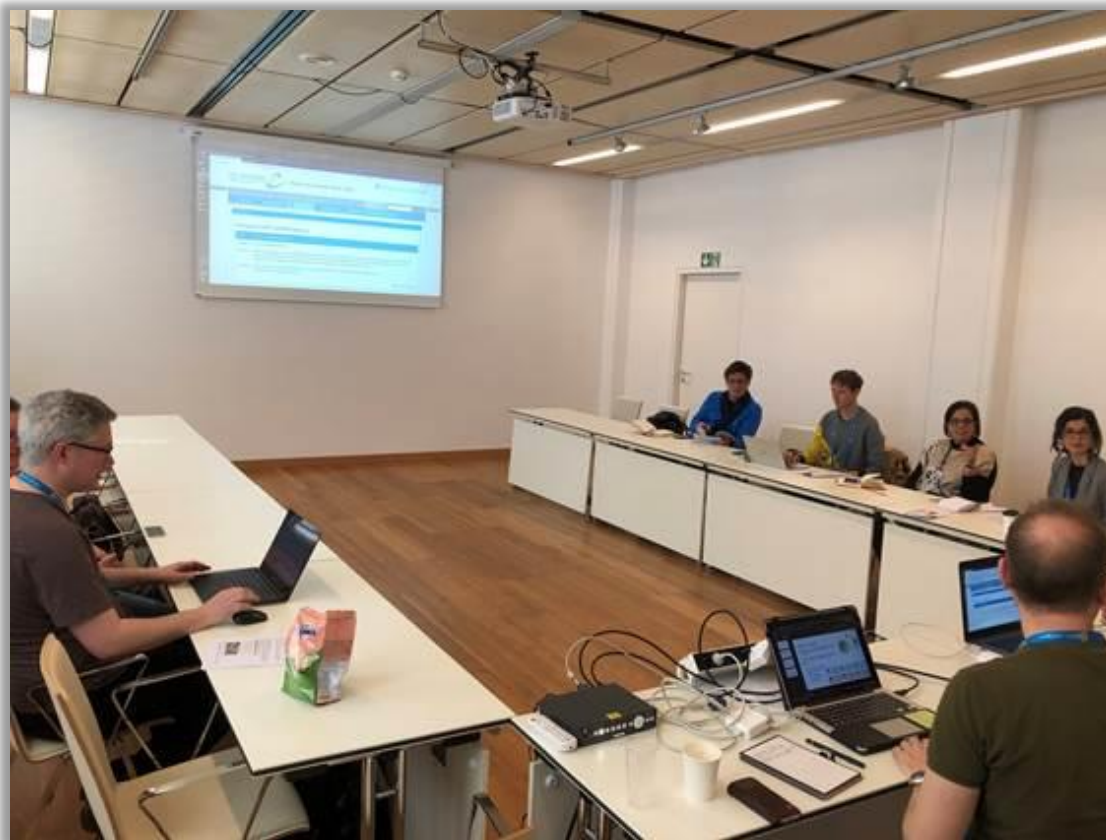
# What is the climate4impact portal?

- Platform for researchers to explore climate data and perform analysis
- Connects to ESGF web services
  - ESGF search, THREDDS support, Security
  - CMIP6, CMIP5, CORDEX, other MIPS
- Visualization via ADAGUC
  - Visualization system using Web Map Services
  - Web Coverage Services for data transformation
- Analysis using (Py)WPS to perform calculations
  - ICCLIM climate indices calculation, data reduction
  - Personal store for processing outcomes
- In production
  - Deployed in the cloud and is used
  - Will be one of the CMIP6 dissemination portals



## Splinter sessions, web seminars, classrooms

- Receive feedback from users
- Keep users in the loop, show them new features



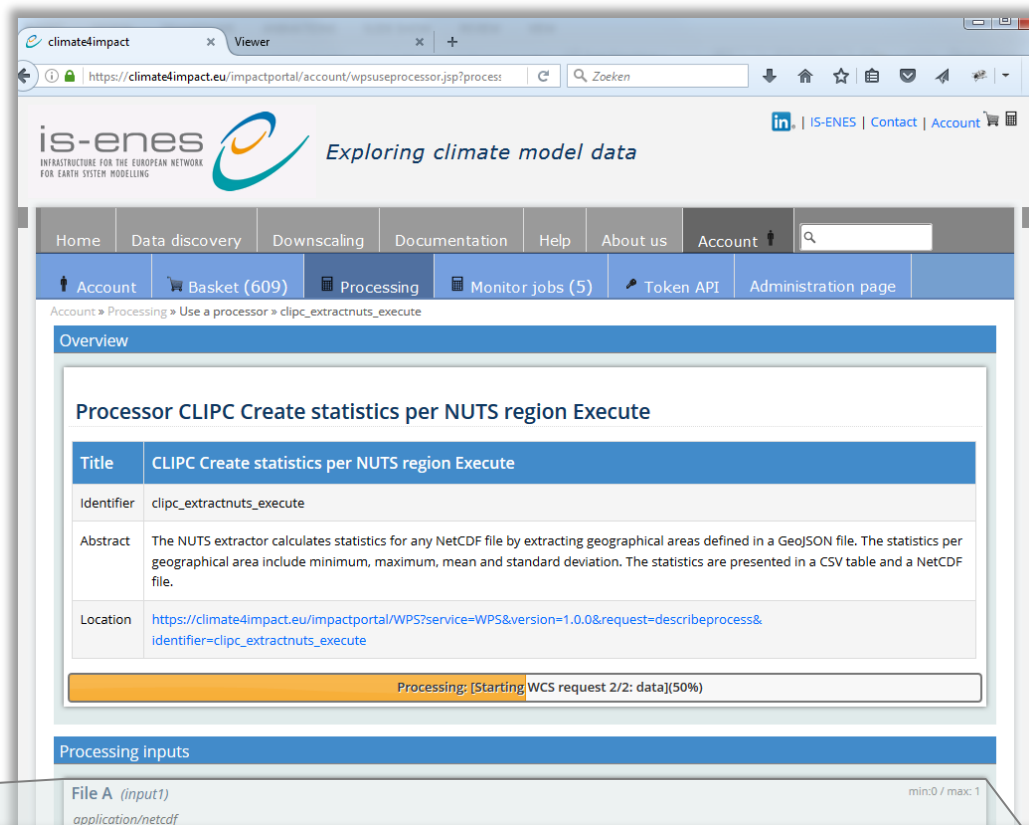
# Web based faceted search for any (climate) data via ESGF

- Drill down search results
- Tooltips for acronyms
- Quick select menus
- ES-DOC integration
- Preview of data
- Export search list to CSV

The screenshot displays the 'is-enes' web application interface for exploring climate model data. The header includes the 'is-enes' logo and the tagline 'Exploring climate model data'. A navigation bar contains links for Home, Data discovery, Downscaling, Documentation, Help, About us, and Account. Below this is a search bar and a 'Filters' section. The 'Filters' section shows various categories with counts: Project (23), Parameter (1721), Frequency (16), Experiment (177), Domain (30), Model (142), Date, Geobox, and Free text. A 'Quick select Parameter' menu is open, showing categories like Temperature, Precipitation, Humidity, Wind, Radiation, Pressure, and Evaporation, each with a list of sub-parameters and checkboxes. Below the filters, a 'Selected filters' section shows 'none'. A message indicates 'Found 672402 datasets. Displaying page 1 of 26897.' with pagination controls. The bottom of the page shows a list of dataset entries, each with a file icon, a name, and an 'es-doc' link.

# Web processing interface for your own data analysis

- Generated user interface
- Lightweight
- Links to preview
- Links to basket / cart
- Get info from input files



title identifier

**File A (input1)**  
application/netcdf

[http://opendap.knmi.nl/knmi/thredds/dodsC/CLIPC/storyline\\_urbanheat/geojson/NUTS\\_2010\\_L0.geojson.nc](http://opendap.knmi.nl/knmi/thredds/dodsC/CLIPC/storyline_urbanheat/geojson/NUTS_2010_L0.geojson.nc)

abstract value

What is the climate4impact portal? - Processing

basket

preview

delete



## Personal basket

- By default the basket contains:
  - “Remote data” for links
  - “My data” for your own data
- Script based download allows to select and download multiple files
- The basket allows for uploading your own files
  - Can be used in processing or visualization
  - NetCDF, CSV, GeoJSON, PNG
- Share your data located in your basket with others

The screenshot displays the 'Basket' interface of the climate4impact portal. The main content area shows a list of files under the 'Remote data' section. A modal window titled 'NetCDF Metadata retrieved via OPeNDAP' is open, showing the metadata for a selected file. The metadata table includes columns for variable name, data type, and units. The preview window shows a global map of temperature anomalies, with a color scale ranging from blue (cooler) to red (warmer). The map is labeled 'tasmax' and shows a significant warming trend over the Indian Ocean and surrounding landmasses. The interface also includes navigation tabs like 'Home', 'Data discovery', 'Downscaling', 'Documentation', 'Help', 'About us', and 'Account'. The 'Account' tab is active, showing the 'Basket' with 163 items. The 'NetCDF Metadata' window also displays a 'Download' button and a 'Add to basket' button.

# Visualization of (any) THREDDS catalogs and OPeNDAP

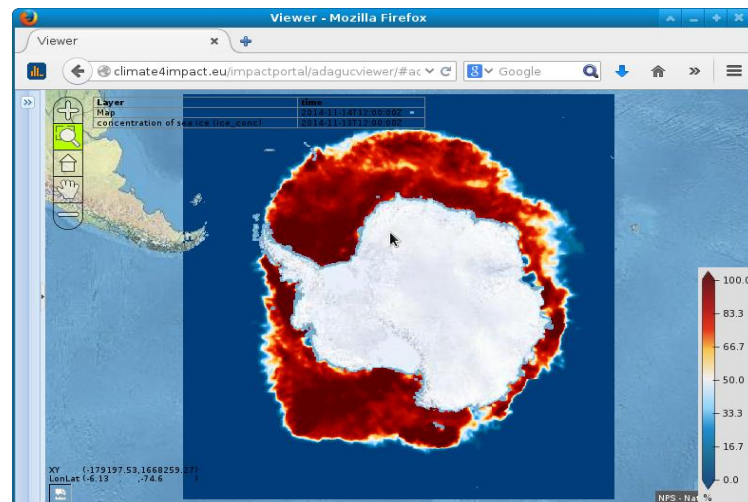
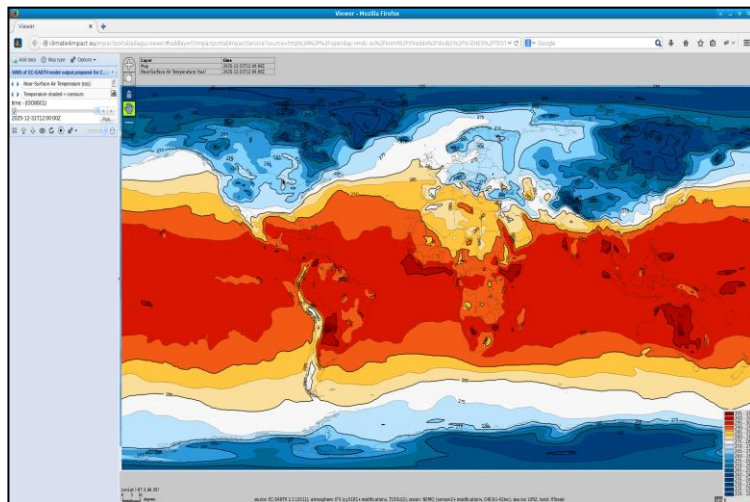
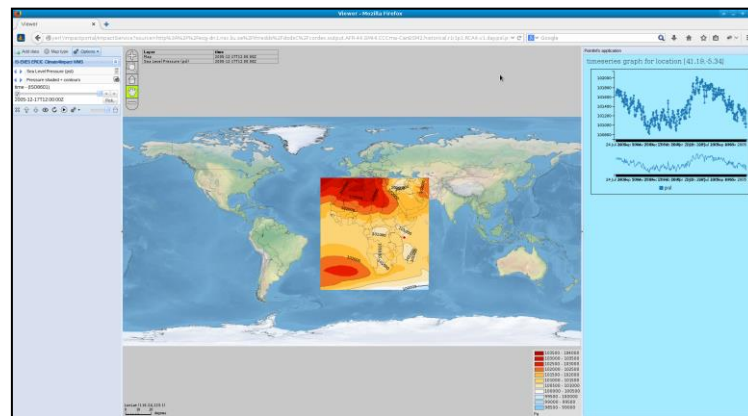
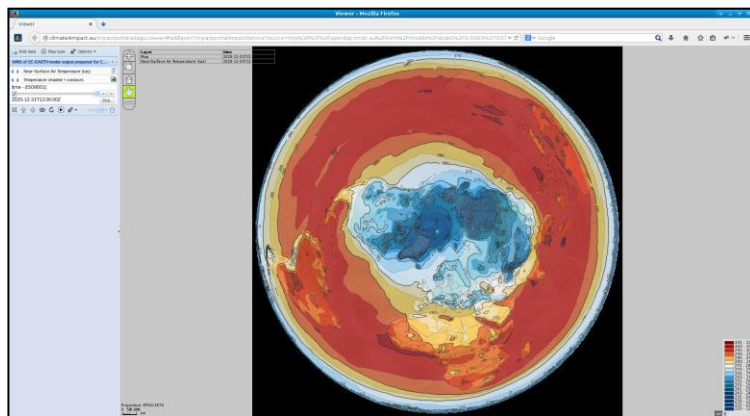
You can connect to remote datasets, not only data from the ESGF

Go to “Data discovery” →  
“Explore your own catalogs  
or files”

Metadata with variables to  
be visualized is displayed

ADAGUC viewer displaying the WMS

# Visualization – using ADAGUC web mapping tools



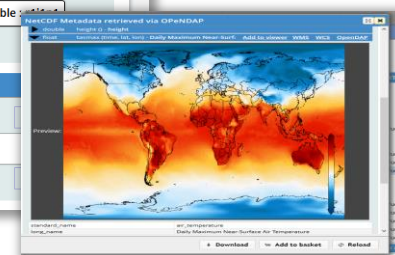
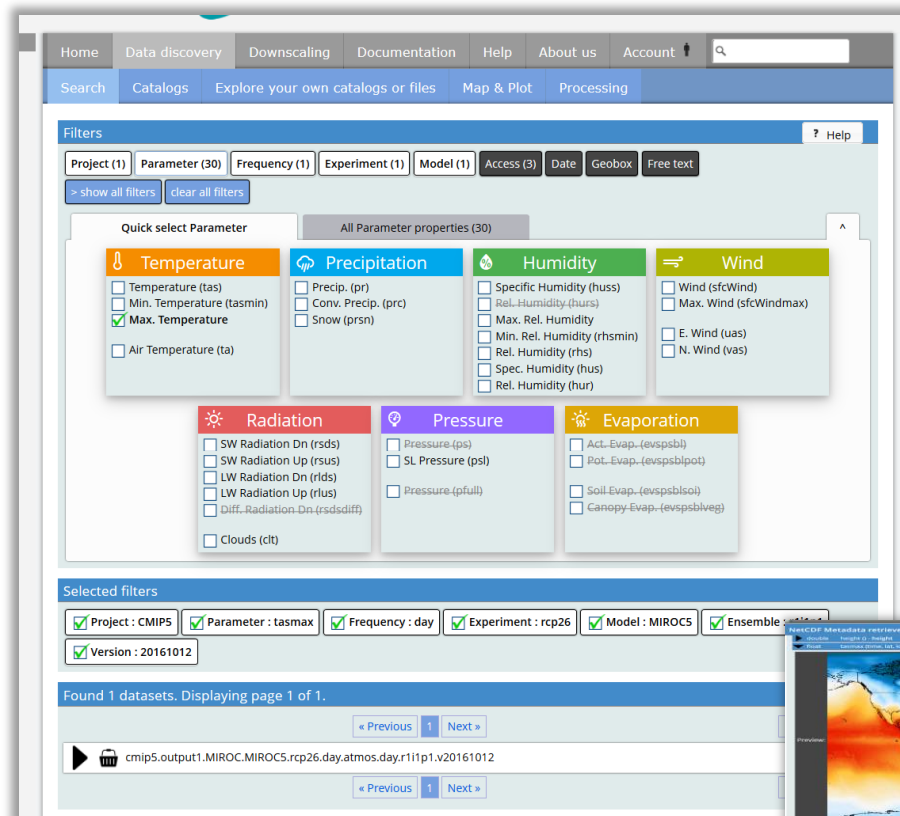
CMIP5 - global climate models

CORDEX - regional climate models



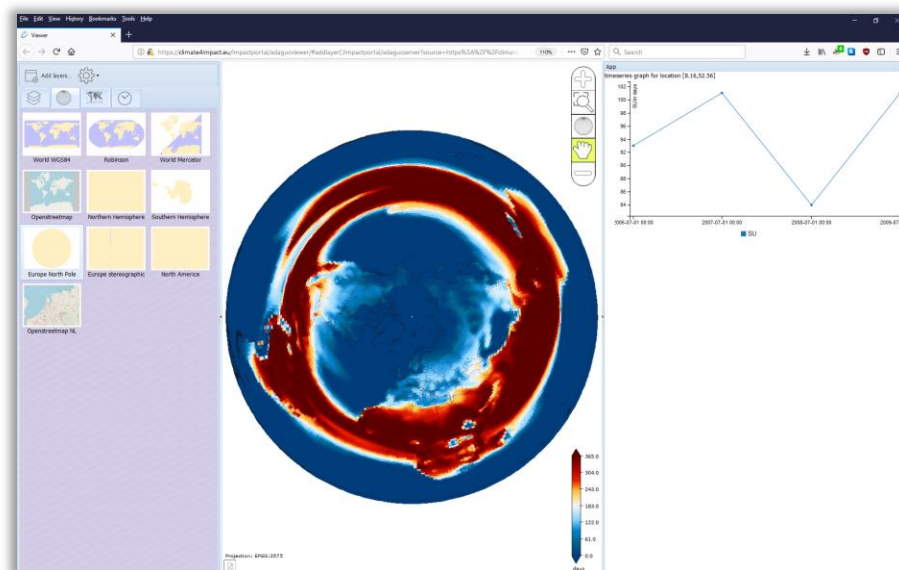
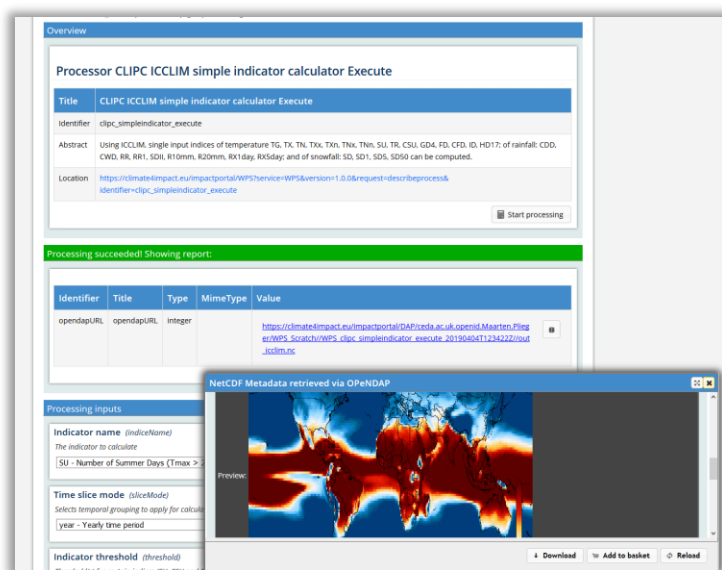
## Example use case: Calculating summer days (SU) - step 1

- Calculate number of days where maximum temperature is above 25 degrees per European country, based on experiment RCP 2.6 and model MIROC5
- Go to C4I and sign in
- Go to Search and select:
  1. Model: CMIP5
  2. Parameter: tasmax
  3. Time frequency: daily
  4. Experiment: rcp26
  5. Model: MIROC5,
  6. Ensemble: r1i1p1
  7. Select the latest version
- Select a file from the dataset and add it to your basket



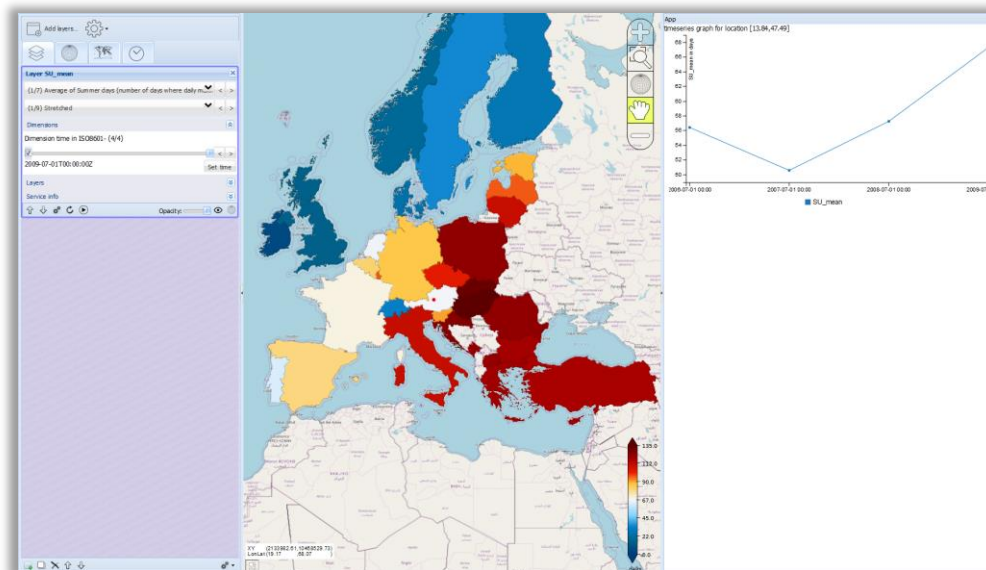
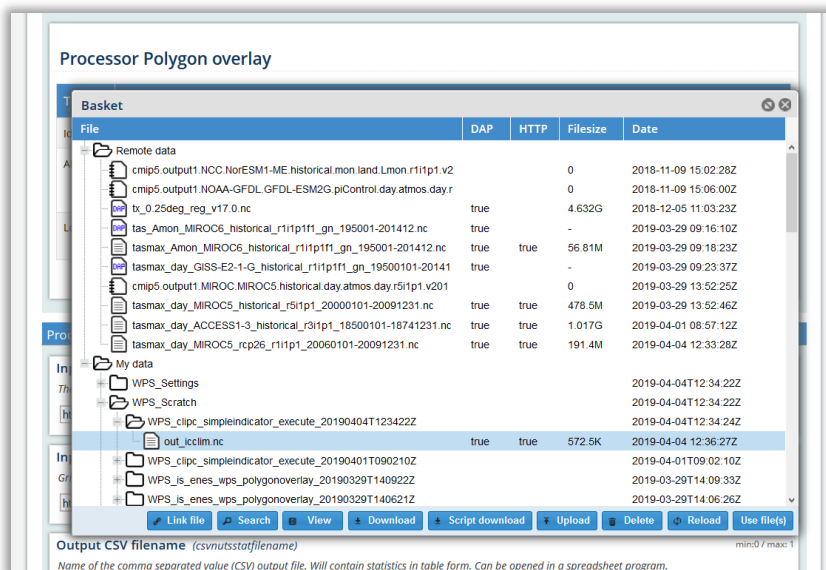
## Calculate Summer days – step 2

- Go to Processing and select ICCLIM simple indicator calculations
- Select SU, Summer days. Leave the threshold to 25 degrees Celsius
- Select the file from your basket and click “Start processing”
- Inspect the output



## Calculate region statistics – step 3

- Go to Processing and select Polygon overlay
- For “Input File B - Gridded data”, choose the latest result with SU from your basket. This is the most recent folder under WPS\_Scratch
- As variable select “SU”, as time range select “\*”
- Click “Start processing”



Result: Summer days per European country for MIROC5 / RCP26 !

## What can be improved? – Next steps in IS-ENES3

- Currently C4I handles ESGF data on file level
  - ✗ Fragmentation of files is a barrier for many users and hurts user experience
    - ➔ Hide file structure, work with datasets and search patterns
    - ➔ Especially important for **CMIP6**, C4I will become one of the data distribution endpoints for CMIP6
- Currently the Processing services are on the same machine as the portal
  - ✗ Currently not scalable and processing load effects the portal
    - ➔ Make use of distributed Web Processing Services
    - ➔ E.g. DKRZ's BirdHouse WPS framework, ESGF CWT and results from H2020 DARE
    - ➔ Adaguc-services framework allows execution of remote WPS services
- Currently the frontend uses old technologies (JSP, JQuery, ExtJS)
  - ✗ Difficult to maintain, and it is difficult to re-use results from other work
    - ➔ Migrate to ReactJS (Based on work done in C3S-Magic)
    - ➔ Good moment to re-design the user interface in collaboration with users.
- Currently the viewer is running in a separate tab
  - By using ReactJS, it is easier to make use of an embedded viewer (adaguc-webmapjs)
- Currently provenance tracking is limited to a few processes
  - Enhance usage of W3C PROV-DM standard and WPS\_PROV toolkit

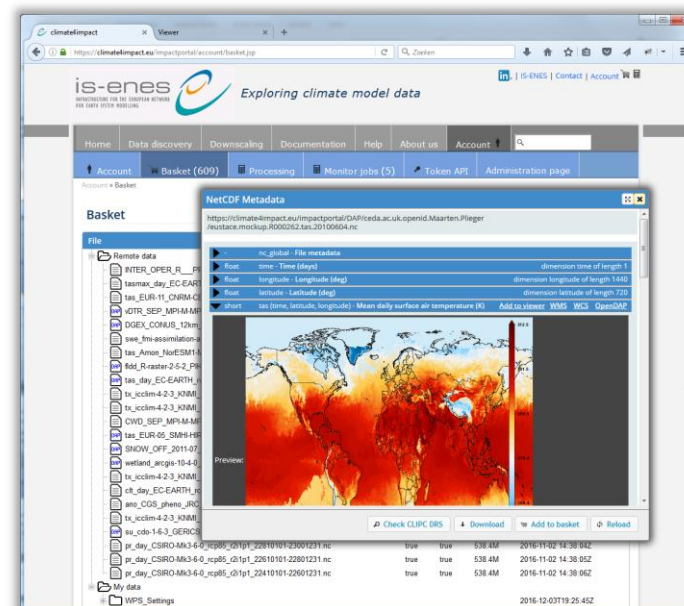
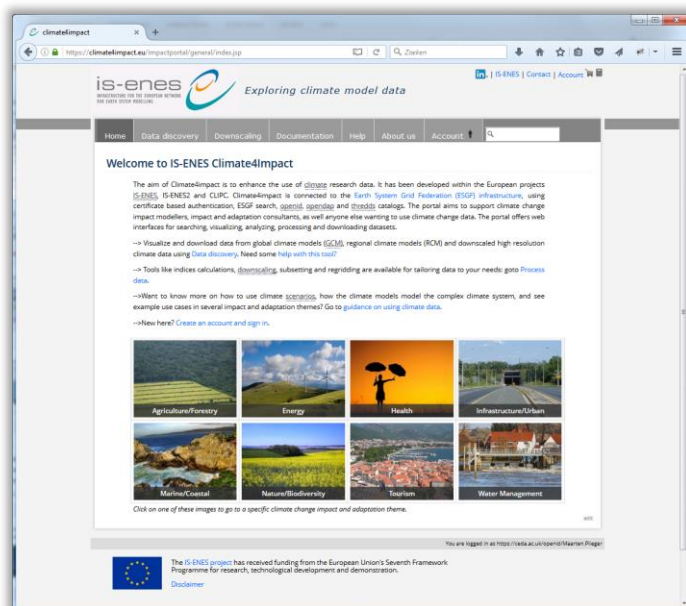
We are looking for users who are willing to help to improve the platform!



# Thank you for your attention!

The climate4impact team

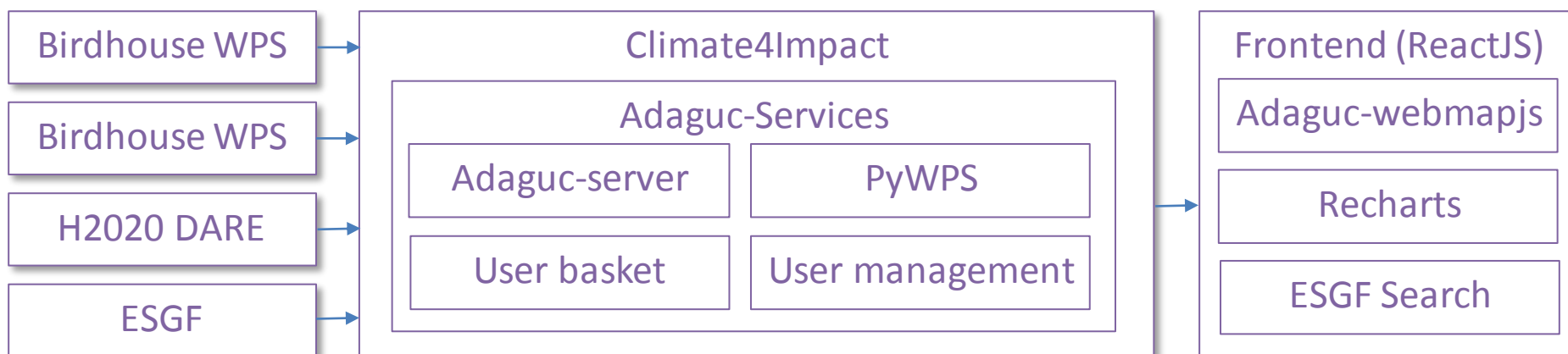
- Check out our ADAGUC poster on Friday 8:30-10:15, location X1.62
- For questions, suggestions, feedback and help, please contact
  - maarten.plieger@knmi.nl
  - wim.som.de.cerff@knmi.nl
  - christian.page@cerfacs.fr





## Next steps ...

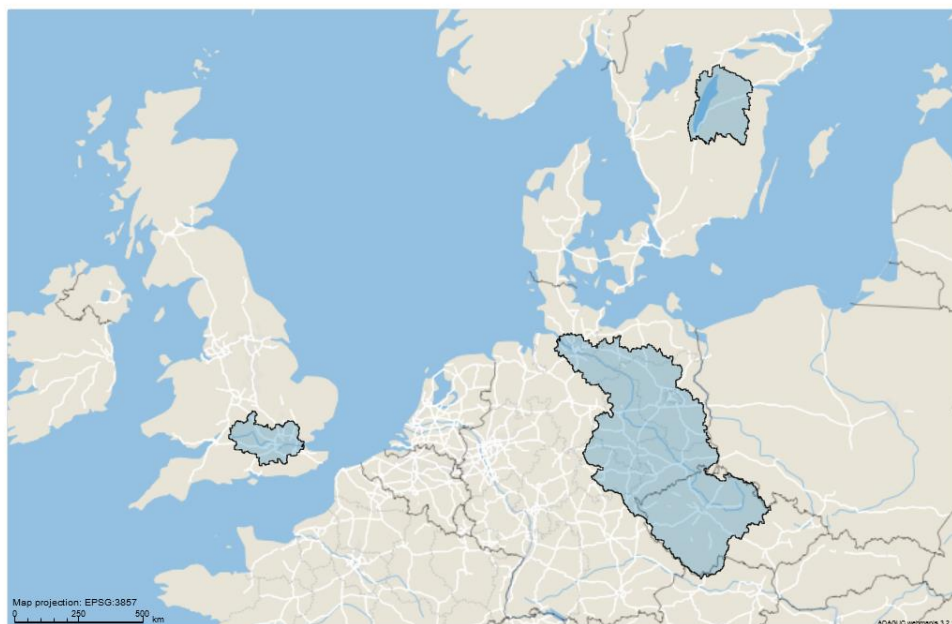
- ADAGUC-Services is a framework to build backend for portals
  - Java Spring based, offers open standards
  - Per user environment – including certificates
  - Sign in via OAuth2, in combination with CEDA's certificate service
  - Connects to ESGF – (*ESGF search, ESGF catalogs, ESGF data*)
  - Implements the “User basket” where personal files can be stored.
    - Share data, supports sharing of data,
    - Supports OpenDAP, Supports visualization via ADAGUC WMS
    - Files can be uploaded and used for own analysis.
  - Connects with remote WPS services, results are copied to local basket
    - Use of remote processing services like DKRZ's Birdhouse WPS framework



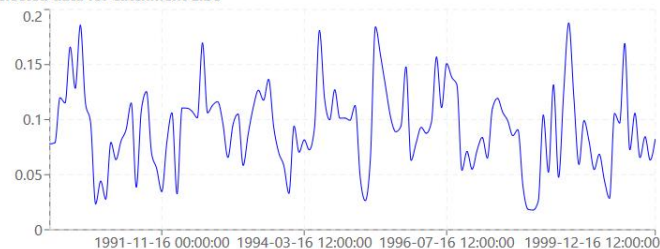
# New frontend using ReactJS – based on previous work

## Hydrology - catchment selector

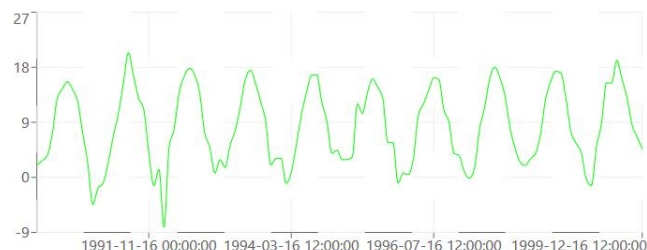
Impact models often require extraction of gridded data for irregular regions, typically defined by a shapefile. This is a tool for extracting gridded data for a user defined shapefile, here exemplified by three river catchments in Europe. The tool identifies grid points within the shapefile, or a representative point when no grid points are included, and outputs timeseries for selected variables. Here, a typical selection of daily temperature and precipitation time series are extracted as area averages for the shapefile. Outputs are available for download as either NetCDF or Excel format. Please check the [shapefile selection metric](#) to calculate.



Selected data for catchment Elbe



Precipitation in mm/h



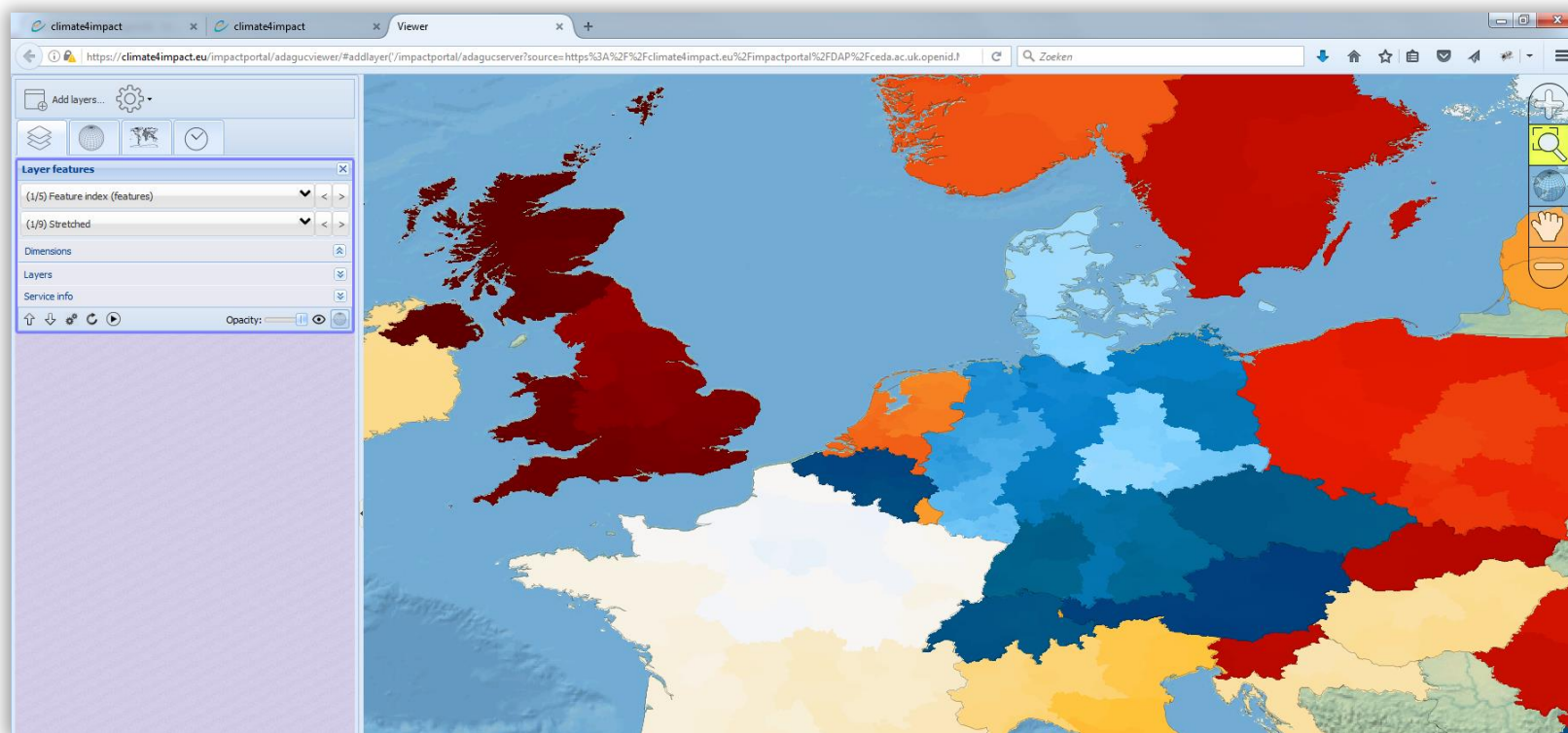
Temperature in degrees Celsius

- React components and NPM packages

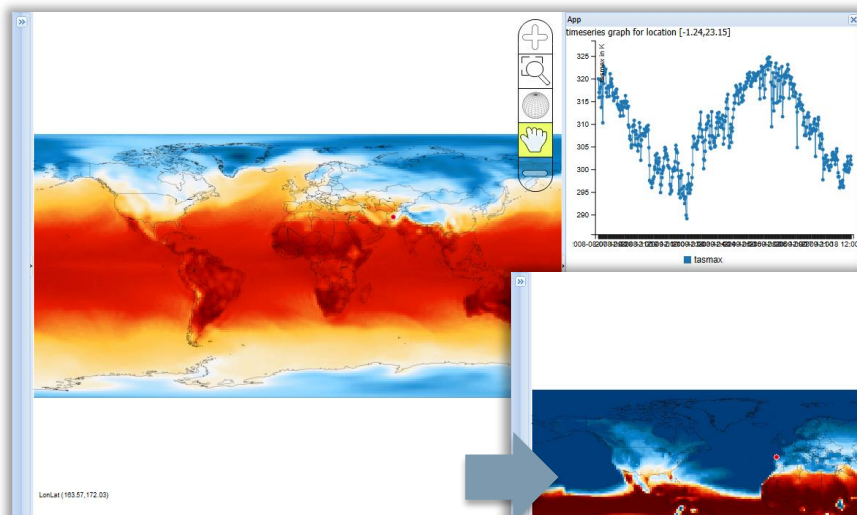


## Use your own vector data defined in GeoJSON

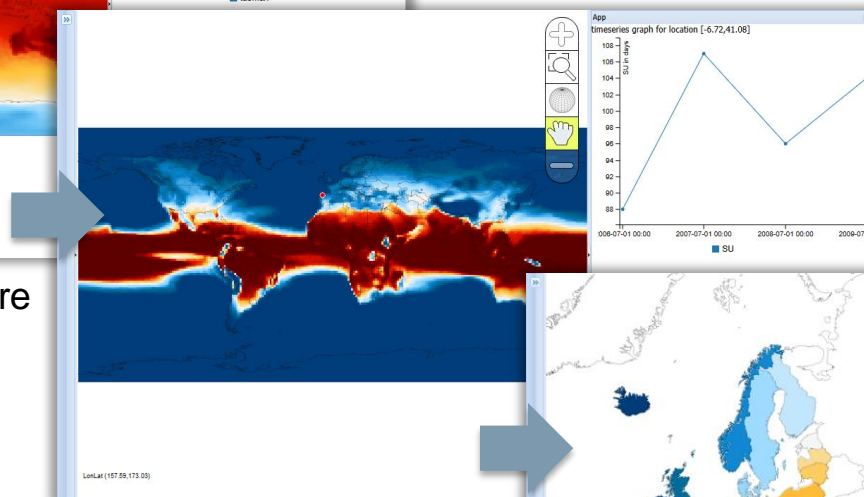
- ADAGUC-Server supports GeoJSON via WMS and WCS
- GeoJSON can be rasterized to any grid using the Web Coverage Service
- Allows for various operations like statistics per polygon, area extraction, etc..



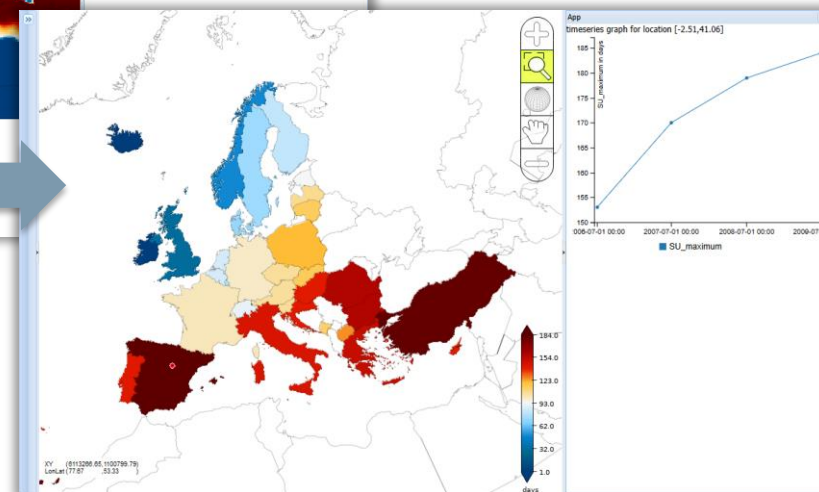
To summarize:



Daily Maximum temperature



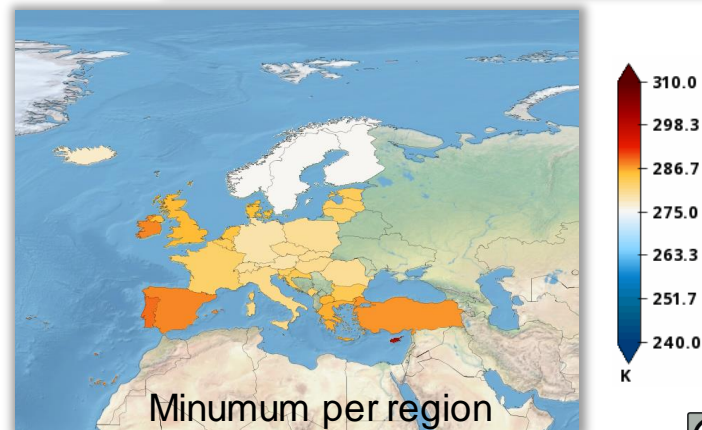
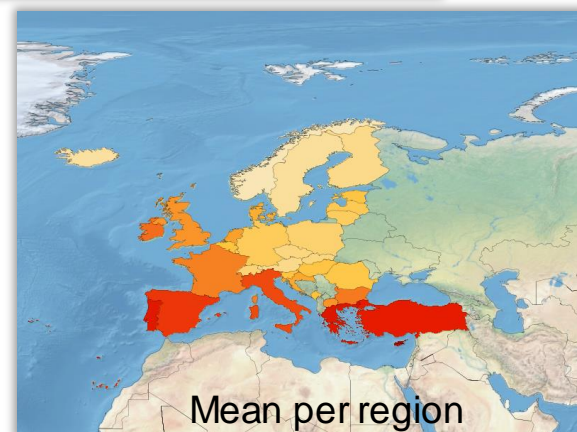
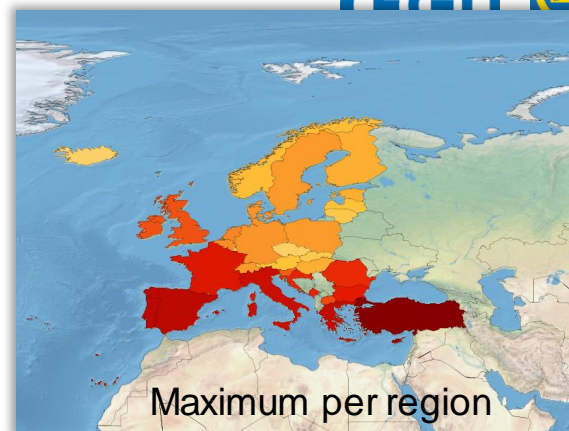
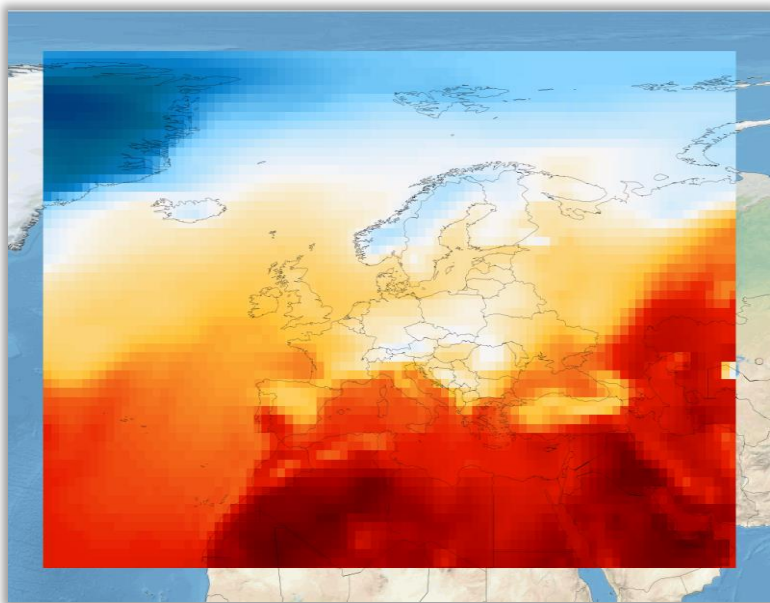
Summer days ( $T > 25$ )



Maximum summer days per country

## WPS for statistics per region

- Calculates statistics per region
- Mean, min, max, etc ...



- Outputs CSV table and NetCDF files
- Based on NUTS regions in GeoJSON



# Wizards for subsetting and regriding climate data

Account Basket (6) Processing Monitor jobs (11) Administration page

Account » Processing » Wizard convert and subset

## Convert and subset

Resource

Variable

Projection

Bounding box  
North:   
West:  East:   
South:

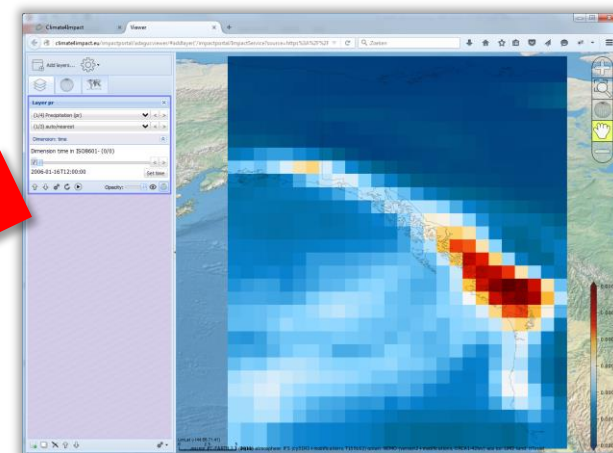
Resolution  
Horizontal:  width:   
Vertical:  height:

Dates  
Start date:   
Stop date:   
Time resolution:

Format  
  
 name

Start processing

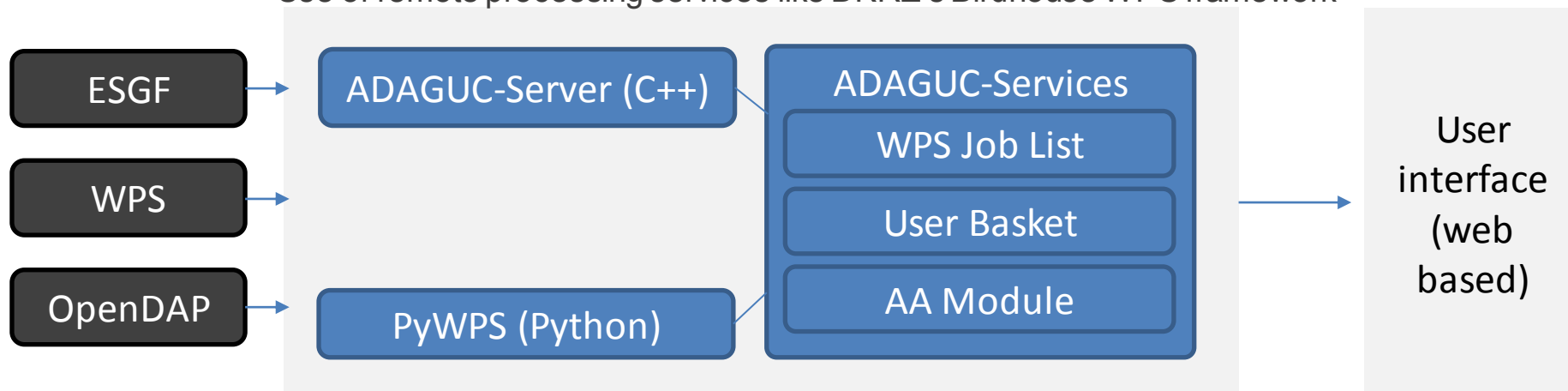
- Data reduction
- Subsetting
- GIS formats
- Reprojection
- Regridding





## ADAGUC Services framework as backend

- Underlying technology (deployed at AWS and SurfSara HPC)
- ADAGUC-Services is a framework which wraps Adaguc-Server and PyWPS
  - Connects to ESGF – ( *ESGF search, ESGF catalogs, ESGF data* )
  - Implements the “User basket” where personal files can be stored.
    - Supports visualization via ADAGUC WMS
    - Share data, supports sharing of data,
    - Supports OpenDAP.
    - Files can be uploaded.
  - Connects with remote WPS services, results are copied to local basket
    - Use of remote processing services like DKRZ’s Birdhouse WPS framework



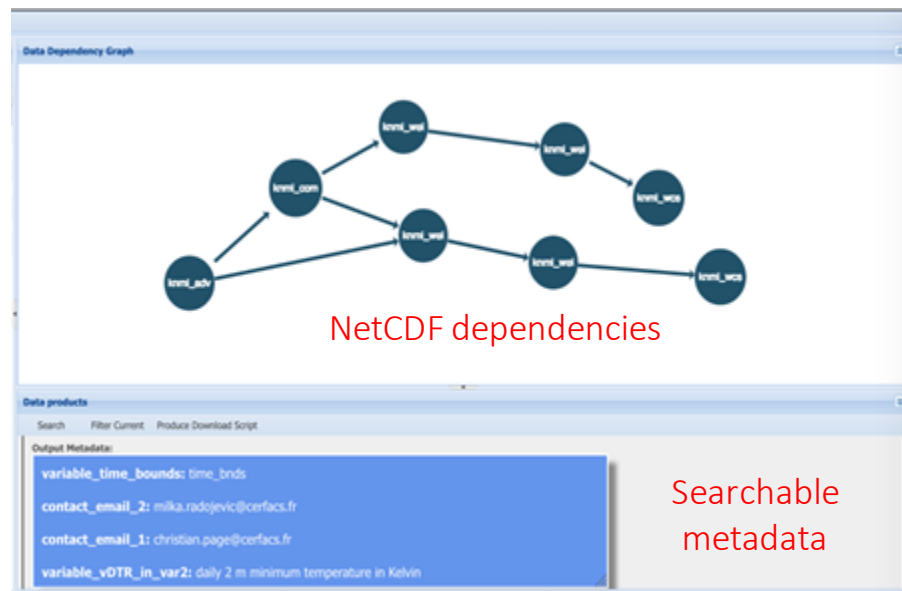
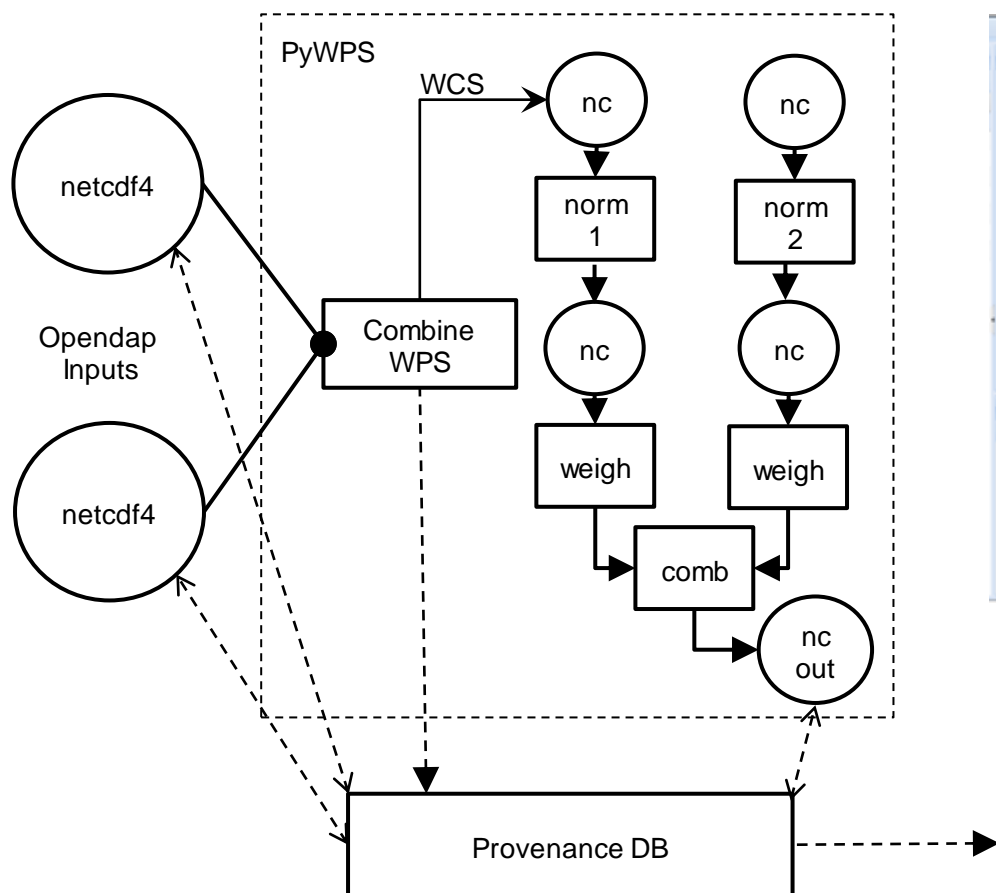
# Workflows, Provenance, Tracability and Reproducibility

## Combine WPS, five steps involved

- Provenance module: WPS\_PROV
- Provenance metadata is stored in NetCDF
- W3C PROV-DM standard

## Visual analytics techniques on provenance

- Highlighting data-reuse, even for cached data
- User interactions
- Exploitation of resources



## Backup slides

