



Server-side computing services provided by IS-ENES through the climate4impact.eu platform

CERFACS, KNMI, University of Cantabria, SMHI, Wageningen University & Research,
CNRS-IPSL, CMCC, STFC, DMI, INHGA

Christian Pagé



- Platform for impact researchers to explore climate data and perform analysis
- In-depth documentation and guidance
- Use cases from impact researchers
- **Perform calculations / Data processing – WPS**

<http://climate4impact.eu/>

[IS-ENES | Contact | Sign in](#)

IS-ENES climate4impact portal

Welcome to the IS-ENES climate4impact portal, oriented towards climate change impact modellers, impact and adaptation consultants, as well as other experts using climate change data.

Here you will find access to data and *quick looks* of global climate models (GCM) scenarios, as well as regional climate model (RCM) and downscaled higher resolution climate data. The portal provides data transformation tooling for tailoring data to your needs and mapping & plotting capabilities.

Guidance on how to use climate scenarios, documentation on the climate system, frequently asked questions and examples in several impact and adaptation themes are presented and described, along with the steps required to go from GCM data to impact model input data.

The climate4impact portal is now operational (15 April 2014): [read more](#).



Agriculture/Forestry



Energy



Health



Infrastructure/Urban



Marine/Coastal



Nature/Biodiversity



Tourism



Water Management

Click on one of these images to go to a specific climate change impact and adaptation theme.


 The IS-ENES project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration.



Online on-demand calculations

- C4I Statistical Downscaling REST API
 - Services provided by the University of Cantabria servers
 - Connected to ESGF
 - Friendly user interface on C4I
- C4I Climate Indices
 - All ETCCDI indices and simple statistics available
 - Native Python open-source ICCLIM software (fully validated against R.climdex)
 - Expandable to climate indicators as well

Documentation [Create beta](#) [Jobs beta](#) [Downscalings beta](#)

Load saved downscalings

Select a saved config

Select your Predictand

Variable PRECIPITATION TEMPERATURE

Tmax Tmin

Domain IBERIA

Dataset ECA VALUE blend GSN World

Predictand Predictand: VALUE_Iberia_ECA_Tmax

Downscaling method validation

Downscaling methods ALL ANALOGES LINEAR_REGRESSION

Analogues (default)

[Download validation report](#)

Run your Downscaling

Model CMIP5

CANESM2 CNRM-CM5 GFDL-ESM2M IPSL-CM5A-MR MIROC-ESM MPI-ESM-MR NORESM1-M

Experiment/RCP Run 1

historical_r1i1p1 rcp45_r1i1p1 rcp85_r1i1p1

Period

Start year End year

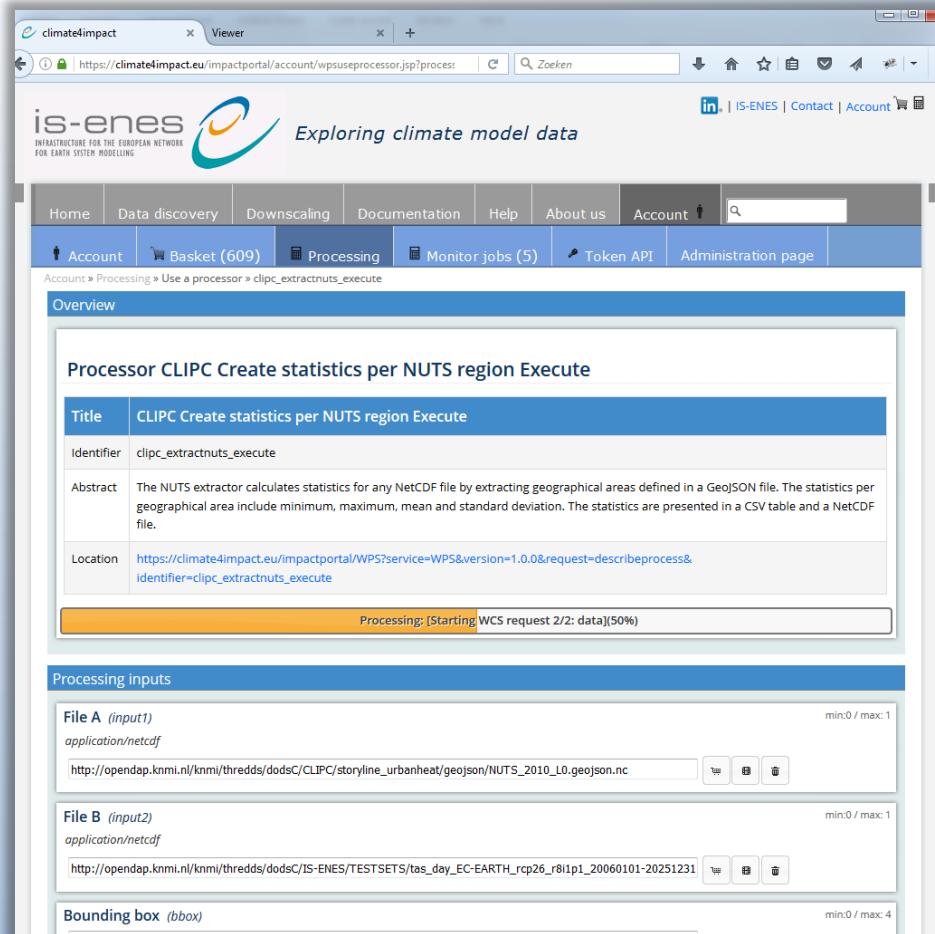
Downscalings

Job ID	Type	Predictand	Downscaling Method	Model	Experiment	Start year	End year	Status	Operations
41902	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CNRM-CM5	historical_r1i1p1	1991	2001	Finished	Download
41901	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	GFDL-ESM2M	rcp45_r1i1p1	2010	2021	Finished	Download
41811	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	historical_r1i1p1	1991	2001	Finished	Download
33915	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	rcp85_r1i1p1	2001	2009	Finished	Download
33913	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	rcp85_r1i1p1	2021	2030	Failed	X
33026	CLIMATE_CHANGE	VALUE_Iberia_ECA_Tmax	Analogues (default)	CANESM2	historical_r1i1p1	1951	1961	Finished	Download

ETCCDI: The joint CCI/CLIVAR/JCOMM
Expert Team (ET) on Climate Change Detection and Indices

Web Processing Service

- Generic WPS UI
 - Based on Describe Process XML file.
 - Links to basket
 - Selections populated dynamically
- Main WPS Processes
 - Climate indices calculation
 - Subsetting over a large time period
 - Regrid and reformat, extract regions
 - Combine climate indicators (CLIPC)
- Wizards
 - Indices calculation
 - Subsetting / file conversions (planned)



The screenshot shows a web browser window for the climate4impact service. The URL is https://climate4impact.eu/impactportal/account/wpsuseprocessor.jsp?process=clipc_extractnuts_execute. The page title is "Processor CLIPC Create statistics per NUTS region Execute". The main content area displays the process details:

Title	CLIPC Create statistics per NUTS region Execute
Identifier	clipc_extractnuts_execute
Abstract	The NUTS extractor calculates statistics for any NetCDF file by extracting geographical areas defined in a GeoJSON file. The statistics per geographical area include minimum, maximum, mean and standard deviation. The statistics are presented in a CSV table and a NetCDF file.
Location	https://climate4impact.eu/impactportal/WPS?service=WPS&version=1.0.0&request=describeprocess&Identifier=clipc_extractnuts_execute

Below the process details, a progress bar indicates "Processing: [Starting] WCS request 2/2: data(50%)".

The "Processing inputs" section contains two entries:

- File A (input)**: application/netcdf, http://opendap.knmi.nl/knmi/thredds/dodsC/CLIPC/storyline_urbanheat/geojson/NUTS_2010_L0.geojson.nc
- File B (input)**: application/netcdf, http://opendap.knmi.nl/knmi/thredds/dodsC/IS-ENES/TESTSETS/tas_day_EC-EARTH_rcp26_r8i1p1_20060101-20251231

At the bottom right, there is a "Bounding box (bbox)" input field with "min:0 / max:4" specified.

Web Processing Service

Job progress can be viewed from anywhere (also in other portals using the services, e.g. CLIPC)

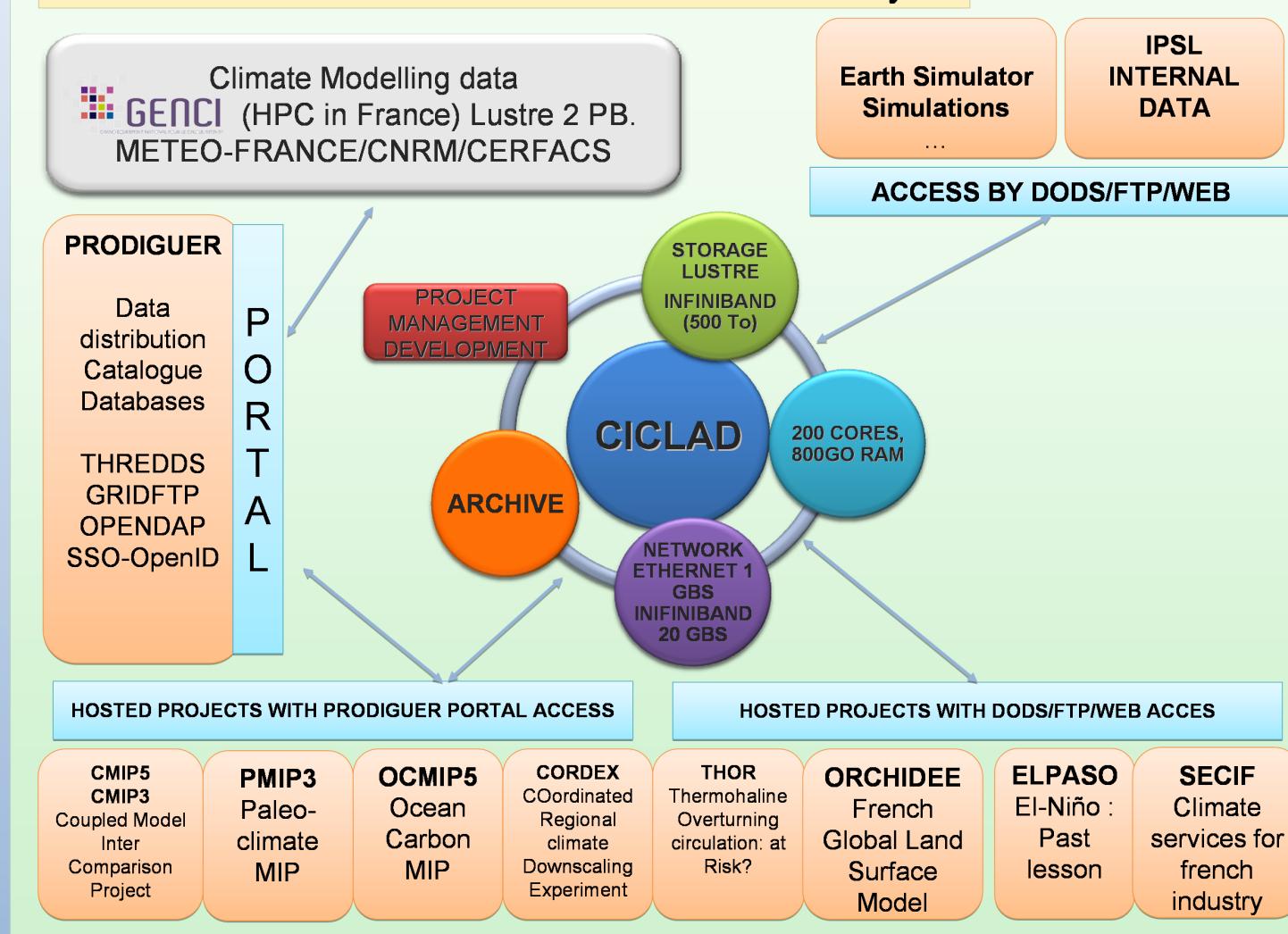
Account Basket (621) Processing Monitor jobs (10) Token API Administration page																																																																								
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<table border="1"> <thead> <tr> <th>Created at</th><th>Name</th><th>Status location</th><th>Progress</th><th>View</th><th>X</th></tr> </thead> <tbody> <tr> <td>2016-12-06 20:36:36Z</td><td>clipc_extractnuts_execute</td><td>pywps-aec7c400-bbf3-11e6-ac70-78e3b502c7d8.xml</td><td>ready</td><td>view</td><td>X</td></tr> <tr> <td>2016-12-06 20:35:32Z</td><td>clipc_simpleindicator_execute</td><td>pywps-8835e09c-bbf3-11e6-8874-78e3b502c7d8.xml</td><td>failed</td><td>view</td><td>X</td></tr> <tr> <td>2016-12-06 14:02:50Z</td><td>clipc_extractnuts_execute</td><td>pywps-ac876b46-bbbc-11e6-86ec-78e3b502c7d8.xml</td><td>ready</td><td>view</td><td>X</td></tr> <tr> <td>2016-12-05 10:32:43Z</td><td>clipc_extractnuts_execute</td><td>pywps-27bdecbe-bad6-11e6-96df-78e3b502c7d8.xml</td><td>ready</td><td>view</td><td>X</td></tr> <tr> <td>2016-12-05 10:32:00Z</td><td>clipc_extractnuts_execute</td><td>pywps-0ddf0c60-bad6-11e6-92df-78e3b502c7d8.xml</td><td>ready</td><td>view</td><td>X</td></tr> <tr> <td>2016-12-03 19:25:45Z</td><td>knmi_advanced_combine</td><td>pywps-4984287a-b98e-11e6-8d4b-78e3b502c7d8.xml</td><td>ready</td><td>view</td><td>X</td></tr> <tr> <td>2016-12-03 19:24:13Z</td><td>clipc_extractnuts_execute</td><td>pywps-1266efc6-b98e-11e6-a9ae-78e3b502c7d8.xml</td><td>ready</td><td>view</td><td>X</td></tr> <tr> <td>2016-12-02 13:16:55Z</td><td>clipc_combine_identify</td><td>pywps-98511b00-b891-11e6-9307-78e3b502c7d8.xml</td><td>ready</td><td>view</td><td>X</td></tr> <tr> <td>2016-12-02 12:55:03Z</td><td>knmi_advanced_combine</td><td>pywps-8a6e920e-b88e-11e6-b96f-78e3b502c7d8.xml</td><td>ready</td><td>view</td><td>X</td></tr> <tr> <td>2016-12-02 10:28:06Z</td><td>clipc_extractnuts_execute</td><td>pywps-03058ed0-b87a-11e6-a30f-78e3b502c7d8.xml</td><td>ready</td><td>view</td><td>X</td></tr> </tbody> </table>							Created at	Name	Status location	Progress	View	X	2016-12-06 20:36:36Z	clipc_extractnuts_execute	pywps-aec7c400-bbf3-11e6-ac70-78e3b502c7d8.xml	ready	view	X	2016-12-06 20:35:32Z	clipc_simpleindicator_execute	pywps-8835e09c-bbf3-11e6-8874-78e3b502c7d8.xml	failed	view	X	2016-12-06 14:02:50Z	clipc_extractnuts_execute	pywps-ac876b46-bbbc-11e6-86ec-78e3b502c7d8.xml	ready	view	X	2016-12-05 10:32:43Z	clipc_extractnuts_execute	pywps-27bdecbe-bad6-11e6-96df-78e3b502c7d8.xml	ready	view	X	2016-12-05 10:32:00Z	clipc_extractnuts_execute	pywps-0ddf0c60-bad6-11e6-92df-78e3b502c7d8.xml	ready	view	X	2016-12-03 19:25:45Z	knmi_advanced_combine	pywps-4984287a-b98e-11e6-8d4b-78e3b502c7d8.xml	ready	view	X	2016-12-03 19:24:13Z	clipc_extractnuts_execute	pywps-1266efc6-b98e-11e6-a9ae-78e3b502c7d8.xml	ready	view	X	2016-12-02 13:16:55Z	clipc_combine_identify	pywps-98511b00-b891-11e6-9307-78e3b502c7d8.xml	ready	view	X	2016-12-02 12:55:03Z	knmi_advanced_combine	pywps-8a6e920e-b88e-11e6-b96f-78e3b502c7d8.xml	ready	view	X	2016-12-02 10:28:06Z	clipc_extractnuts_execute	pywps-03058ed0-b87a-11e6-a30f-78e3b502c7d8.xml	ready	view	X
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Calculations near storage (or away from user's servers)

- **Dedicated high performance systems**
 - Replicate all needed data onto one large data service: all local data only
 - Expose services through standard protocols (http REST, WPS, OpenDAP, ...)
 - Give (selected) users command-line access
- **Remote Computing Services**
 - Expose computing services
 - Grab remote data and perform calculations on remote high capacity servers/clusters
 - Only send results to users
- **Central Computing Platform**
 - Portal/platform with standard services (WPS, ...)
 - Orchestrate calculations with, when possible, delegations to external services (computations, storage)
 - Grab results, and make available to users with more services (visualization, quicklook, download, ...)



IPSL e-infrastructure to sustain climate analysis



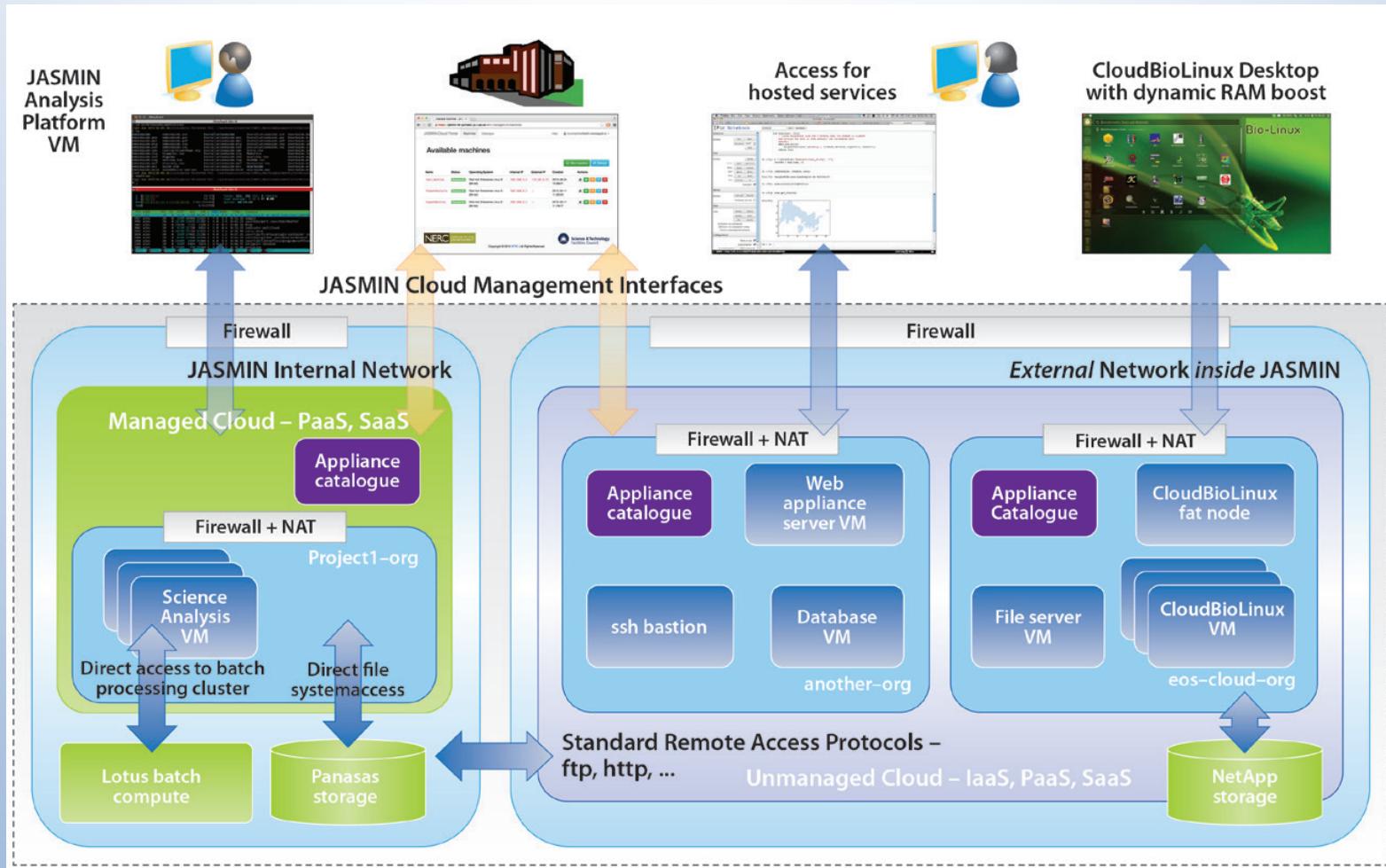
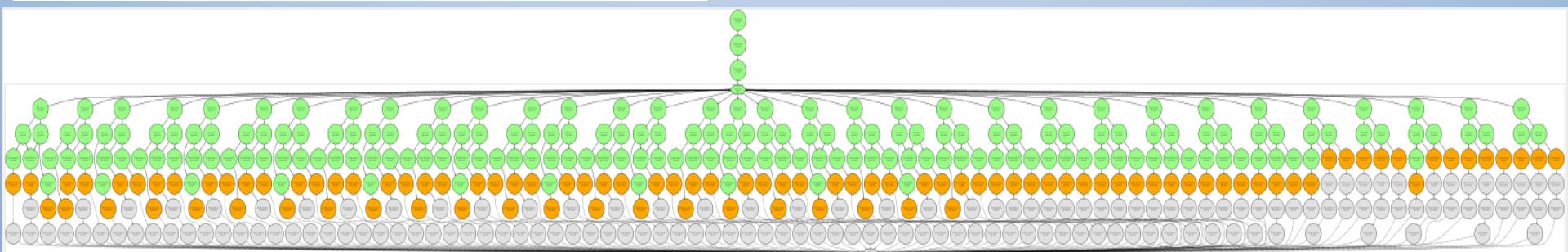
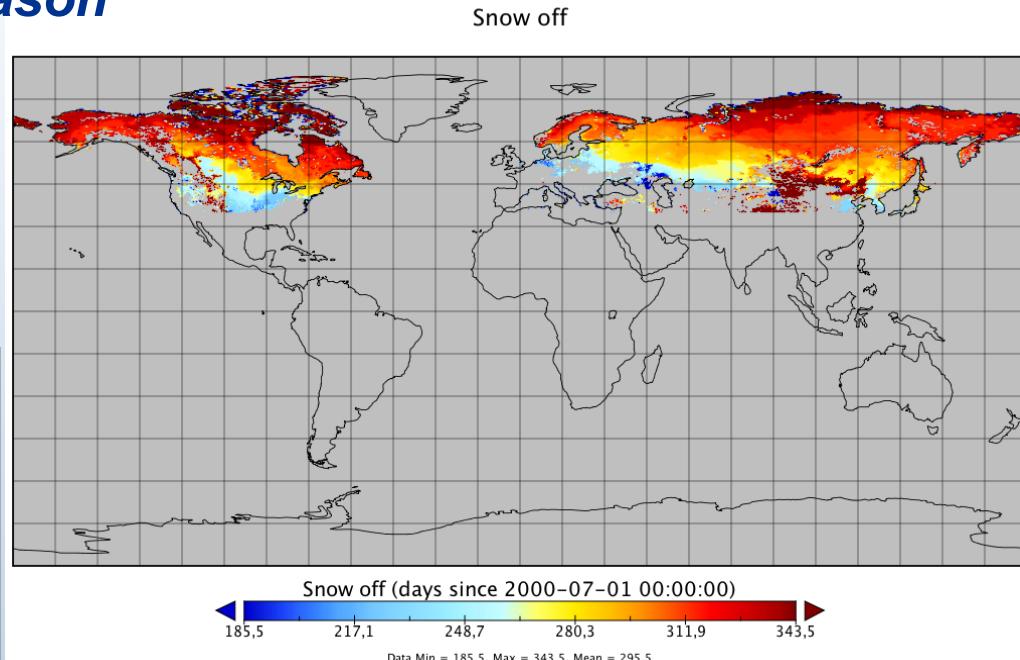
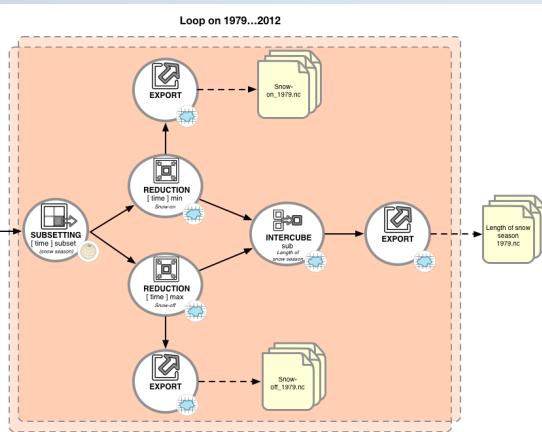


Fig. 13. CEDA's JASMIN analysis platform. JASMIN integrates cloud architecture, container technologies, and virtual machines to improve flexibility and performance and track maintenance.

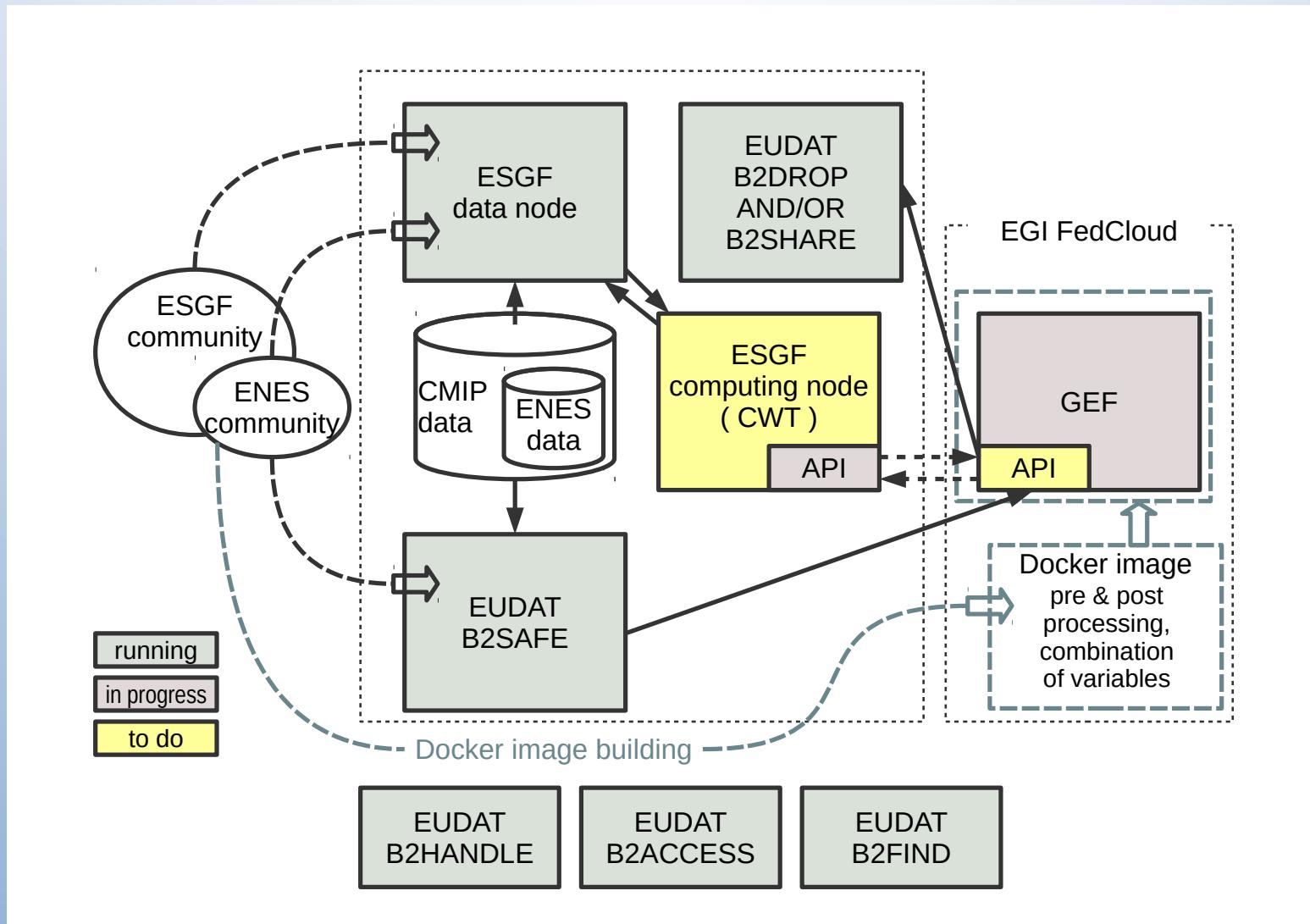
Tier1 indicators using Ophidia (CLIPC)

Snow on/off – Length of snow season

- ✓ Dataset time range: 1979-2012
- ✓ 50 GB of input data
- ✓ 434 tasks performed
- ✓ 99 NetCDF output files



Delegations of some calculations; integration of services



Background: Integration of European and International projects



IS-ENES2 (FP7)
23 partners

Infrastructure for the European Network of Earth System Modelling

Access to large climate datasets for climate impact researchers **C4I**
<http://climate4impact.eu/>

Objective: **C4I** backend for on-demand calculations: **icclim**



CLIPC (FP7)
22 partners

Copernicus Climate Information Platform
 Developing icclim for climate indices and indicators calculation
 Defining metadata standards for automated processing

Objective: **C4I**

Delegates selected processing/storage to EUDAT B2 Services



EUDAT2020 (H2020)
35 partners

Collaborative Pan-European infrastructure

Developing Generic Execution Framework: Providing data processing on EGI Federated Cloud using EUDAT B2 Services

Objective: **C4I**

Delegates selected processing to future ESGF Computing Nodes



ESGF-CWT

Compute Working Team

Worldwide (mainly US-Europe) Collaboration on Data Processing of climate data near data storage

Design of API and Implementation of Processing Capabilities for ESGF

Conclusion and next steps

- ESGF + climate4impact enables impact research
 - Requires ESGF Search API, OpenDAP and THREDDS catalogs
 - Climate4impact processing, search and visualization is a layer over ESGF
 - Support of Downscaling ESGF datasets on the fly
- Climate4impact is flexible due to applied technologies and standards
 - PyWPS with ICCLIM as generic processing framework for climate indices
 - ADAGUC WMS can be used to visualize local and remote files
 - OPeNDAP can be used to access small bits of large files over the internet
 - Many APIs developed to integrate C4I services into CLIPC portal
<https://dev.knmi.nl/projects/impactportal/wiki/API>
- Next steps
 - Implement more use cases from climate impact researchers
 - Climate indices calculation wizard
 - File abstraction: focus on physical parameters

Sustainability Issues

- CLIPC and IS-ENES2 ending
 - Currently 2-3 Coding Sprints per year for development and implementation: needed to improve but not only.
 - Very good core of dev people within IS-ENES2/CLIPC
 - Long to-do list based on user requirements
- What will happen after?
 - New project proposals to further develop and use the C4I platform
 - Limited staff, but we want to continue working together (own institutes funding, related projects)
 - Will need to adapt the platform and portal to future ESGF changes
 - Involvement in ESGF CWT will continue
 - Will need to tackle new datasets, new projects, CMIP6 and +
 - More dissemination needed
 - Support to users
 - Improvements
 - Delegate calculations to ESGF Computing Nodes, External Computing Resources (EGI, Ophidia, etc.)



<http://climate4impact.eu/>

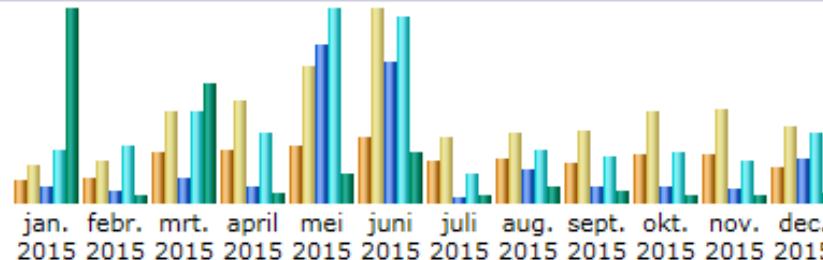
<http://icclim.readthedocs.org/>

Samenvatting

Rapportageperiode	Maand jan. 2015				
Eerste bezoek	01 jan. 2015 - 01.16				
Laatste bezoek	31 jan. 2015 - 23.24				
	Unieke bezoekers	Aantal bezoeken	Pagina's	Hits	Bytes
Bekken verkeer *	1002	1644 (1.64 bezoeken/bezoeker)	43149 (26.24 Pagina's/bezoek)	142263 (86.53 Hits/bezoek)	48.08 GB (30668.11 KB/bezoek)
Niet-bekken verkeer *			80506	82125	3.66 GB

* „Niet bekken“ is verkeer dat gegenereerd werd door robots of wormen, of respons met een speciale HTTP-statuscode.

Maandelijkse historie



Maand	Unieke bezoekers	Aantal bezoeken	Pagina's	Hits	Bytes
jan. 2015	1002	1644	43149	142263	48.08 GB
febr. 2015	1059	1855	32931	153179	1.90 GB
mrt. 2015	2186	3923	64718	247721	29.51 GB
april 2015	2255	4430	41533	187479	2.46 GB
mei 2015	2490	5920	429910	525534	7.25 GB
juni 2015	2843	8358	383313	505838	12.60 GB
juli 2015	1806	2819	15752	81211	2.01 GB
aug. 2015	1907	3027	91892	145005	4.20 GB
sept. 2015	1688	3099	42509	123899	2.82 GB
okt. 2015	2074	3924	43705	139625	2.08 GB
nov. 2015	2049	4019	39164	115474	1.85 GB
dec. 2015	1497	3317	122402	191622	2.50 GB
Totaal	22856	46335	1350978	2558850	117.26 GB

Samenvatting

Rapportageperiode	Maand jan. 2016				
Eerste bezoek	01 jan. 2016 - 00.00				
Laatste bezoek	31 jan. 2016 - 23.54				
	Unieke bezoekers	Aantal bezoeken	Pagina's	Hits	Bytes
Bekken verkeer *	1556	3063 (1.96 bezoeken/bezoeker)	193052 (63.02 Pagina's/bezoek)	319625 (104.35 Hits/bezoek)	4.21 GB (1441.05 KB/bezoek)
Niet-bekken verkeer *			159418	161593	3.08 GB

* „Niet bekken“ is verkeer dat gegenereerd werd door robots of wormen, of respons met een speciale HTTP-statuscode.

Maandelijkse historie

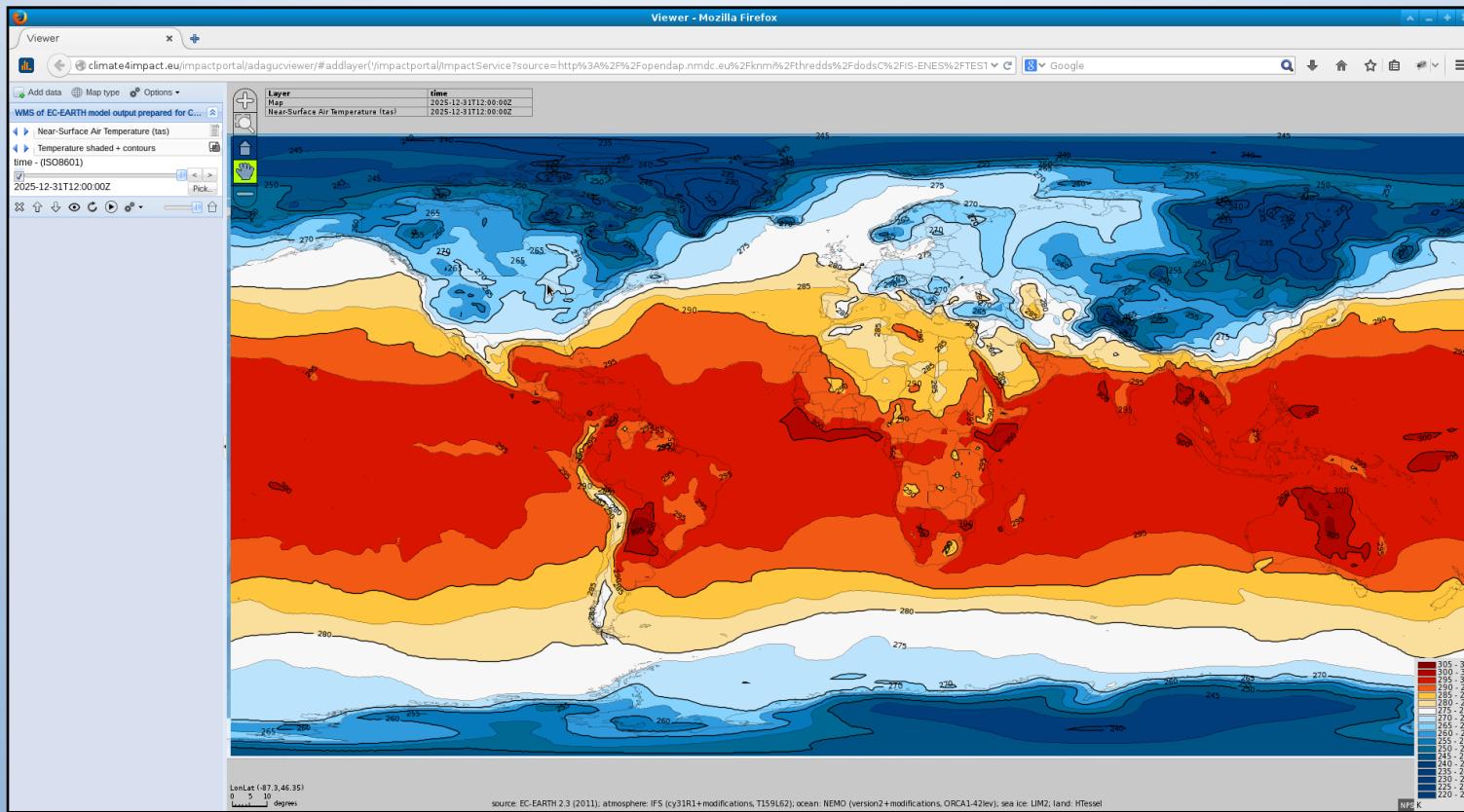


jan. 2016	febr. 2016	mrt. 2016	april 2016	mei 2016	juni 2016	juli 2016	aug. 2016	sept. 2016	okt. 2016	nov. 2016	dec. 2016
2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016

Maand	Unieke bezoekers	Aantal bezoeken	Pagina's	Hits	Bytes
jan. 2016	1556	3063	193052	319625	4.21 GB
febr. 2016	955	1684	73453	154556	2.22 GB
mrt. 2016	0	0	0	0	0
april 2016	0	0	0	0	0
mei 2016	0	0	0	0	0
juni 2016	0	0	0	0	0
juli 2016	0	0	0	0	0
aug. 2016	0	0	0	0	0
sept. 2016	0	0	0	0	0
okt. 2016	0	0	0	0	0
nov. 2016	0	0	0	0	0
dec. 2016	0	0	0	0	0
Totaal	2511	4747	266505	474181	6.43 GB

Use of open standards and open source software

- Data access over OPeNDAP → THREDDS
- Online analysis using WPS → PyWPS and CERFACS ICCLIM
- Online visualization using WMS → KNMI ADAGUC
- Single Sign On using OpenID, and OAuth2, delegation using MyProxy X509





Search using ESGF Search API – New faceted search

The screenshot shows the is-enes search interface with the following details:

- Header:** The is-enes logo and "Exploring climate model data" tagline.
- Top Navigation:** Home, Data discovery, Downscaling, Documentation, Help, About us, Account, and a search bar.
- Secondary Navigation:** Search, Catalogs, Explore your own catalogs or files, Map & Plot, Processing.
- Filters Section:** A "Filters" section with a "Help" link. It includes a "Project (23)" dropdown and a "Parameter (1721)" dropdown, which is currently selected. Other filter categories shown include Frequency (16), Experiment (177), Domain (30), Model (142), Date, Geobox, and Free text.
- Faceted Filter Grid:** A grid of filters categorized by parameter type:
 - Temperature:** Temperature (tas), Min. Temperature (tasmin), Max. Temperature (tasmax), Air Temperature (ta).
 - Precipitation:** Precip. (pr), Conv. Precip. (prc), Snow (prsn).
 - Humidity:** Specific Humidity (huss), Rel. Humidity (hurs), Max. Rel. Humidity, Min. Rel. Humidity (rhsmin), Rel. Humidity (rhs), Spec. Humidity (hus), Rel. Humidity (hur).
 - Wind:** Wind (sfcWind), Max. Wind (sfcWindmax), E. Wind (uas), N. Wind (vas).
 - Radiation:** SW Radiation Dn (rsds), SW Radiation Up (rsus), LW Radiation Dn (rids), LW Radiation Up (rlus), Diff. Radiation Dn (rsdssdiff), Clouds (clt).
 - Pressure:** Pressure (ps), SL Pressure (psl), Pressure (pfull).
 - Evaporation:** Act. Evap. (evpsbl), Pot. Evap. (evpsblpot), Soil Evap. (evpsblsoi), Canopy Evap. (evpsblveg).
- Selected filters:** A section labeled "Selected filters" with "none" listed.
- Results Summary:** "Found 672402 datasets. Displaying page 1 of 26897." with navigation links from 1 to 26897 and a "Next »" button.
- Export:** An "Export to CSV" button.
- Logos:** es-doc Earth System Documentation logos.
- Bottom Right:** Creative Commons Attribution (CC BY) license logo.

Search using ESGF Search API – **New** faceted search

- Search interface has been improved based on feedback from impact users
- Search interface speed has greatly been improved by using short lived (1 minute) caches
- Improved error handling in C4I for ESGF data nodes, catalogs are checked in advance for availability. Catalog status is clearly indicated to the user.
- Started with handling search queries as an aggregated dataset, e.g. use a search query as input for your processing.

Download

- By default the basket contains:
 - “Remote data” for links
 - “My data” for your own data
- Script based download: select and batch download multiple files
- The basket allows for uploading your own files
 - Can be used in processing or visualization
 - A per-user OpenDAP server on files in user's basket
- In development: **abstraction of the file concept. Packaging results.**

The screenshot shows a web browser window for the Climate4Impact portal. The URL is <http://dev.climate4impact.eu/impactportal/account/basket.jsp>. The page title is "Climate4Impact". The header includes the is-enes logo and the text "Exploring climate model data". The navigation menu has tabs for Home, Data discovery, Downscaling, Documentation, Help, About us, Account, and a search bar. Below the menu, there are four buttons: Account (selected), Basket (11), Processing, and Monitor jobs (8). The main content area is titled "Basket" and shows a table of files. The table has columns for File, DAP, HTTP, Filesize, and Date. The "File" column lists file names under two categories: "Remote data" and "My data". The "Remote data" section contains several historical climate model files from IPSL-CM5A-LR. The "My data" section contains two files related to the "tasmax" variable. At the bottom of the table are buttons for View/Browse file, Download file, Script download, Upload file, Delete file(s), and Reload basket. A message at the bottom right says "You are logged in as https://esgf-dp.openid/marartenplieger".

File	DAP	HTTP	Filesize	Date
0.50 deg. regular grid				2015-01-22...
0.44 deg. rotated grid				2015-01-22...
tx_0.44deg_rot_v10.0.nc	true	true	691.9M	2015-01-22...
tn_0.44deg_rot_v10.0.nc	true	true	691.9M	2015-01-22...
tg_0.44deg_rot_v10.0.nc	true	true	691.9M	2015-01-22...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_18500101-18991231.nc	true	true	673.2M	2015-03-19...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_18500101-19491231.nc	true	true	1.346G	2015-03-19...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_19000101-19491231.nc	true	true	673.2M	2015-03-19...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_19500101-19991231.nc	true	true	673.2M	2015-03-19...
tasmax_day_IPSL-CM5A-LR_historical_r1i1p1_19500101-20051231.nc	true	true	754.0M	2015-03-19...
tasmax_AFR-44_CNRM-CERFACS-CNRM-CM5_rcp45_r1i1p1_CLMcom-CCLM4-8-17_v1_day_2096	true		-	2015-04-01...
polar_stereo_m.nc	true	true	906.824K	2015-01-23...
tas_WAS-44_ECMWF-ERAINT_evaluation_r1i1p1_ITM-RegCM4-1_v411_mon_198901-199012.nc	true	true	2.314M	2015-01-23...
tas_WAS-44_ECMWF-ERAINT_evaluation_r1i1p1_ITM-RegCM4-1_v411_day_19890101-19901231.nc	true	true	70.463M	2015-01-23...

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