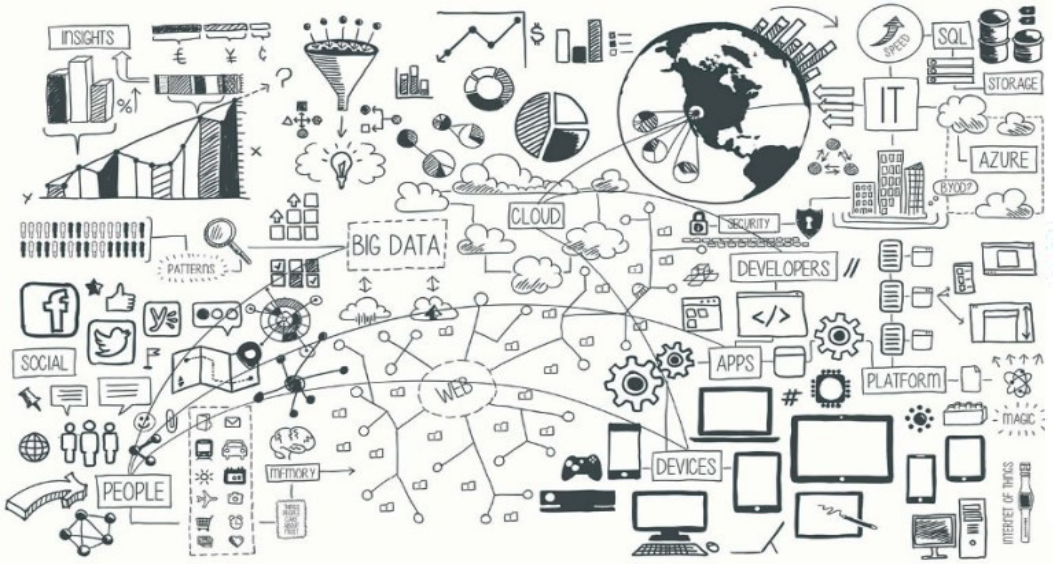
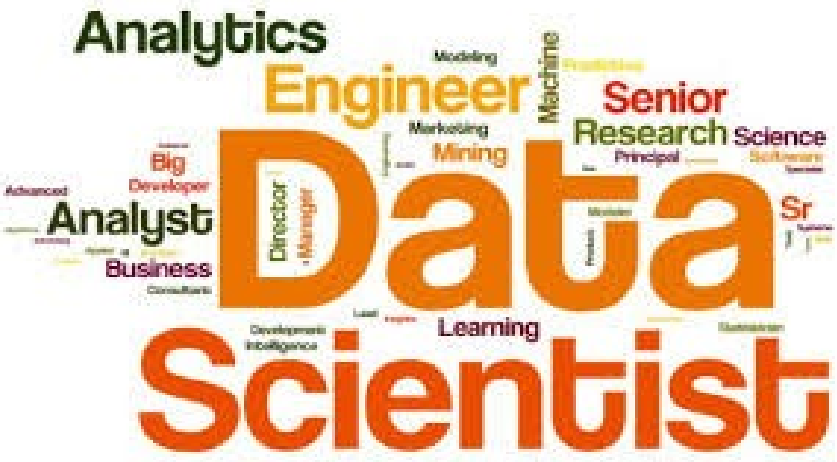
DataLab: Environment and Meteorology

Downloading Climate Data – ESGF & MARS





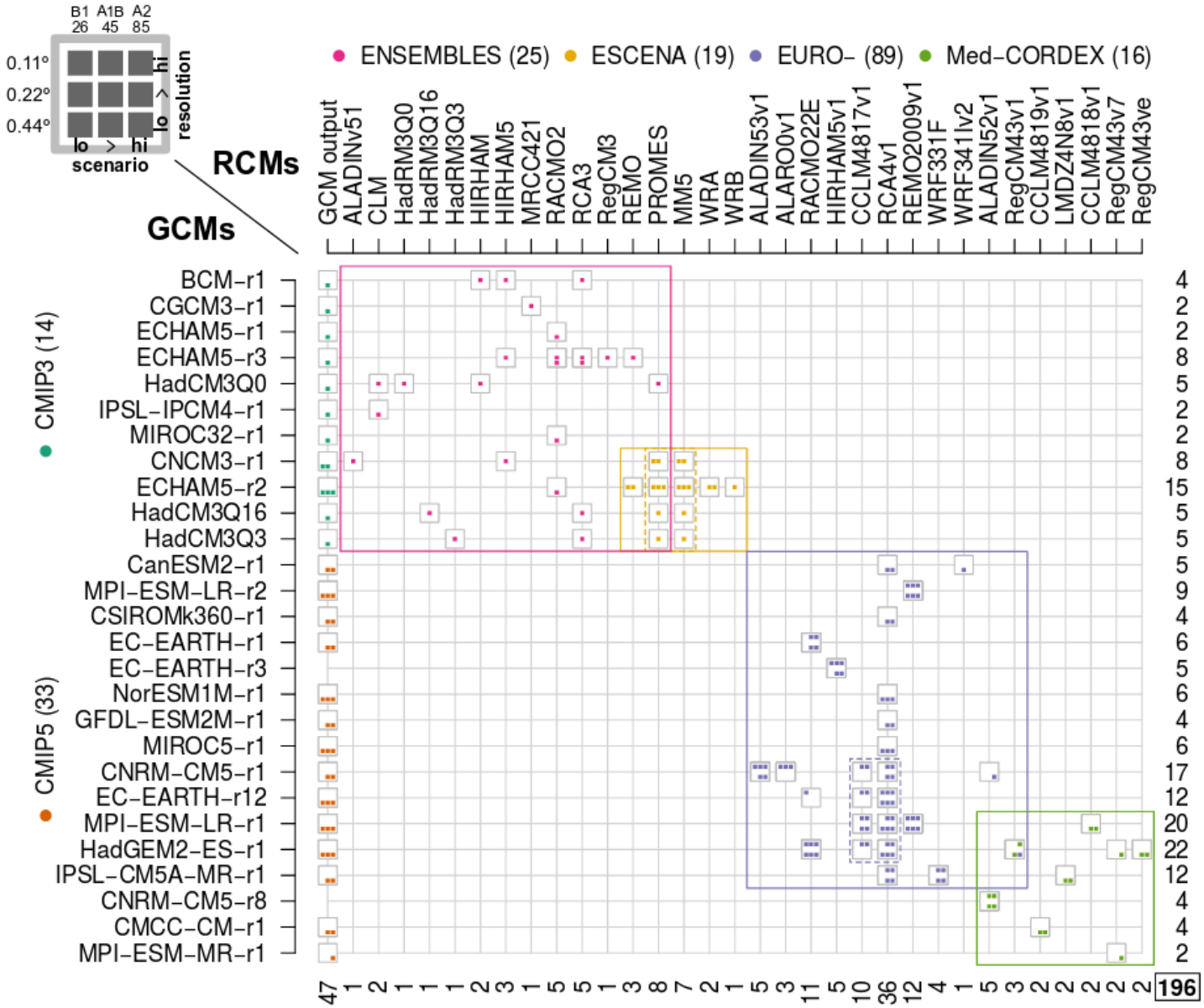
Sixto Herrera García

Grupo de Meteorología

Univ. de Cantabria – CSIC
MACC / IFCA

M1980 – Data Laboratory: Environment & Meteorology (16:00-18:00) Virtual classroom: https://meet.jit.si/M1980				
03/25	X	Introduction and Climate4R package	TL	JB
03/26	J	Climatic System & Models (DM & ML in Climate Science)	T	SH
03/27	**V**	**Data Repositories: ESGF & MARS**	**TL**	**SH**
03/30	**L**	**Data Repositories: ESGF & MARS**	**TL**	**SH**
03/31	M	Lab: Climate4R – Example 1	L	JB
04/01	X	Lab: Climate4R – Example 2	L	JB
04/02	J	Downscaling: Data Mining in Clime	T	SH
04/03	V	Lab: downscaleR	L	JB
04/06	L	Evaluation and Validation	T	SH
04/07	M	Lab: Evaluation and Validation	L	JB
04/08	X	Impacts	L	JB
04/13	L	Impacts	L	JB

SH - Sixto Herrera | **JB** – Joaquín Bedia

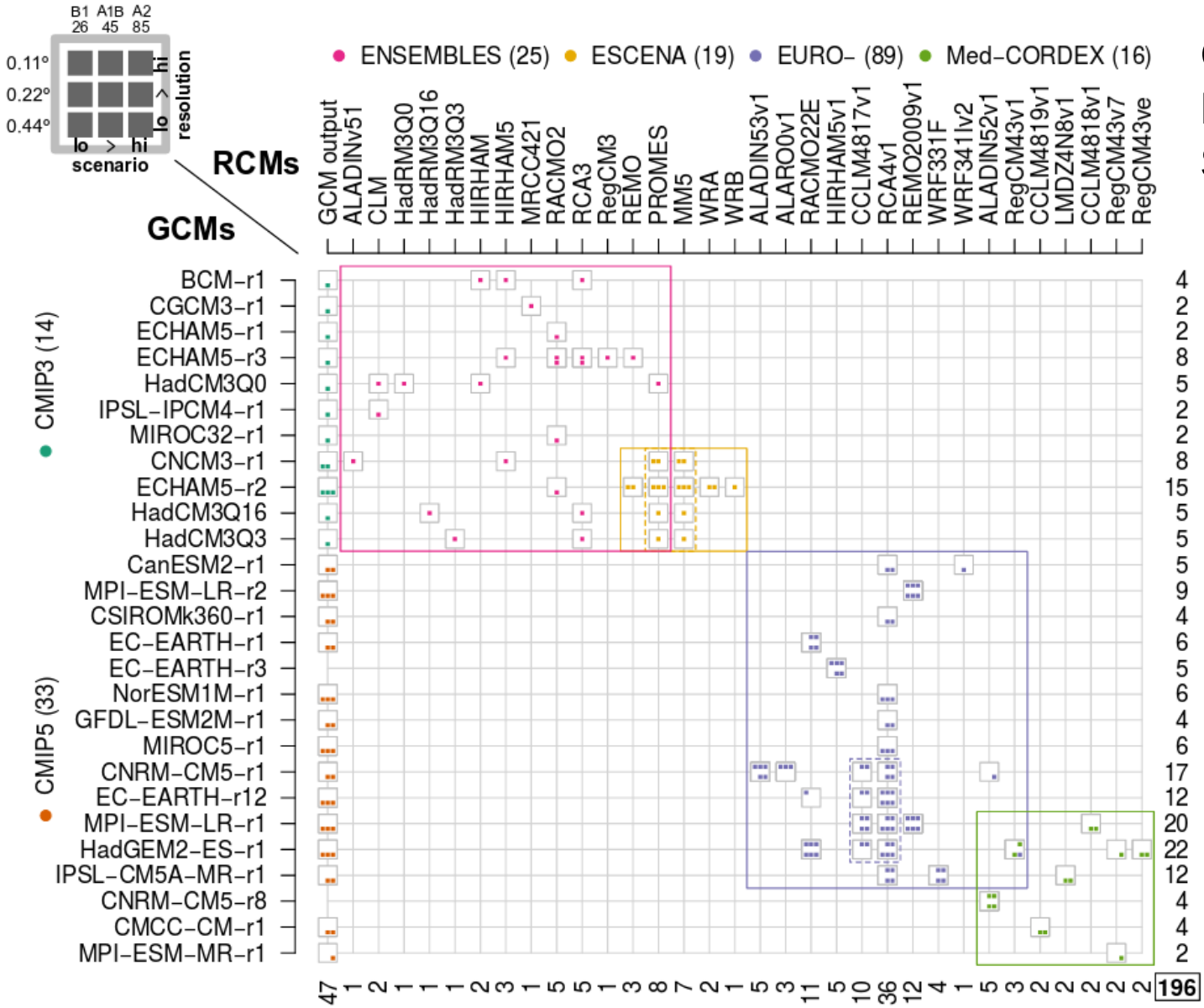


Observations
Reanalysis
Seasonal Forecast:
- Member
- Initialization
- …

Climate Change:
- Global Models (**GCM**)
- Regional Models (**RCM**)
- Scenarios/Experiments
- Runs
- Parameterizations
- ...

Petabytes → Exabytes!!!

Source: Fernández, J. et al. 2018, Consistency of climate change projections from multiple global and regional model intercomparison projects. Climate Dynamics. Doi:10.1007/s00382-018-4181-8



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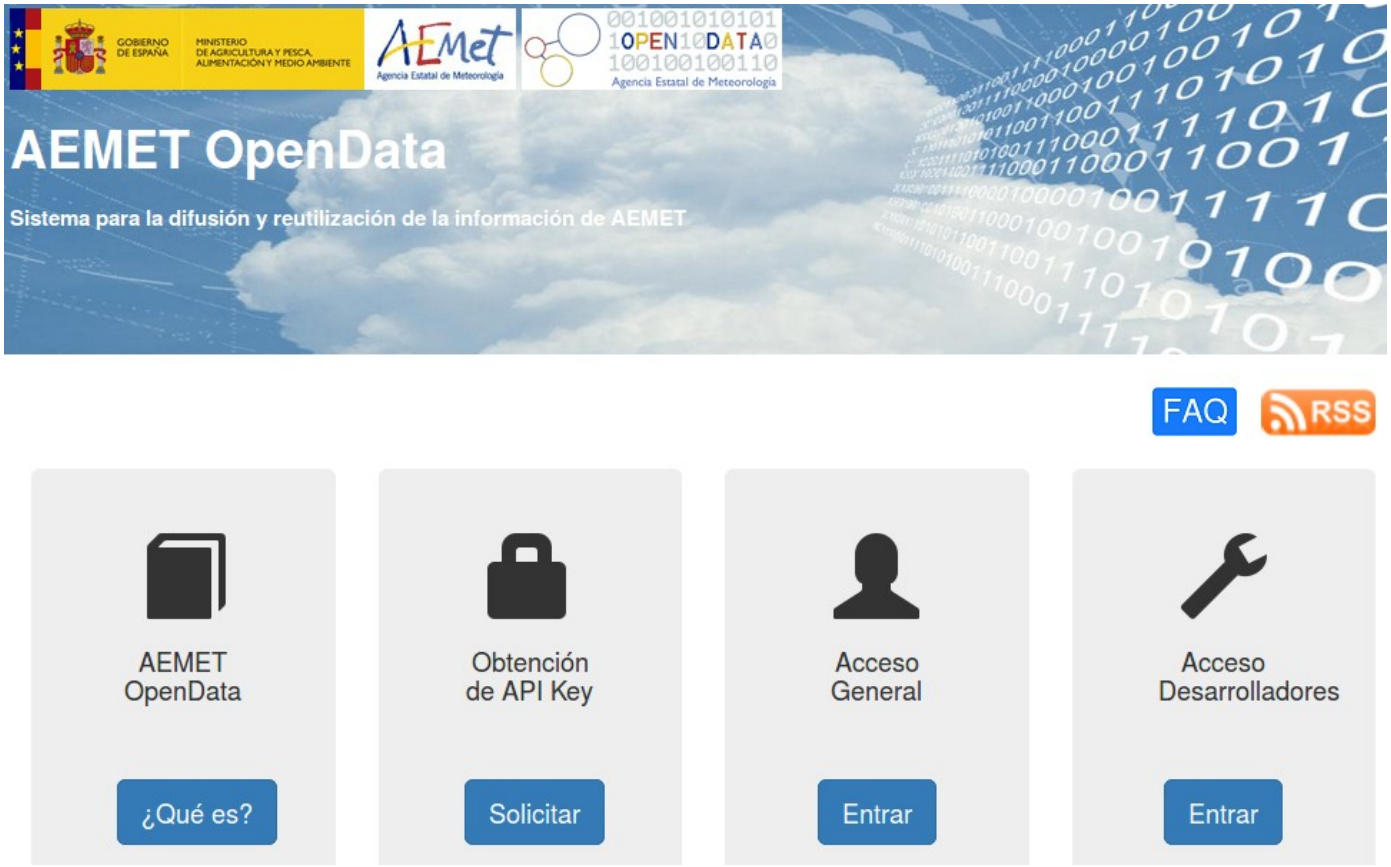

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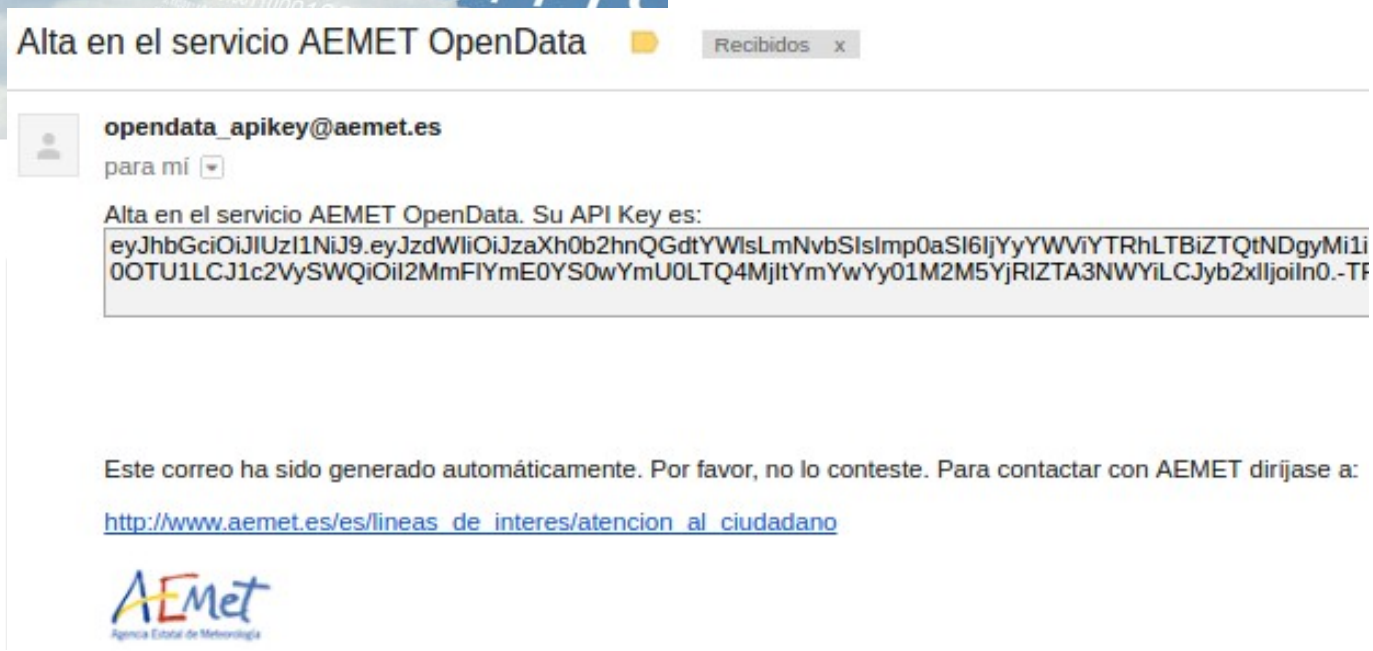

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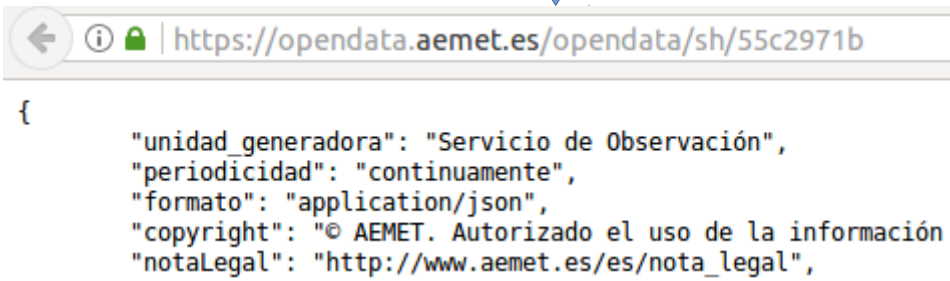

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BOLETÍN OFICIAL DEL ESTADO
Núm. 4 Martes 5 de enero de 2016 Sec. III. Pág. 659

ANEXO IV

Impresos de solicitud

IMPRESO DE SOLICITUD DE PRESTACIONES METEOROLÓGICAS PARA SOLICITUDES GENERALES (IMPRESO L1)

1. DATOS DEL SOLICITANTE

CIF//NIF:	Empresa (Nombre) // Particular (Nombre y Apellidos):		
Su referencia:	Sector de actividad (*):		
☐ Empresa Privada	☐ Empresa Pública	☐ Administración Pública	☐ Particular
Domicilio Fiscal	Código Postal:	Apdo. Correos:	
Localidad:	Provincia:	País:	
Teléfono:	Fax:	E-mail:	

(*) En caso de administración pública o enseñanza universitaria, rellenar el apartado 5 y cumplimentar (1) para obtener el descuento aplicable en el precio de la información y presentar documento original.

2. DATOS DE LA PERSONA DE CONTACTO (rellenar únicamente en caso de ser distintos que los del solicitante)

Persona de contacto (nombre y apellidos):

Teléfono: Fax: E-mail:

Dirección de contacto:

Observations

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https://www.ncdc.noaa.gov/data-access

- ECA&D: https://www.ecad.eu//dailydata/index.php

- AEMET-OpenData: http://www.aemet.es/es/datos_abiertos/AEMET_OpenData

BOLETÍN OFICIAL DEL ESTADO
Núm. 4 Martes 5 de enero de 2016 Sec. III. Pág. 659

ANEXO IV

icitud

TEOROLÓGICAS PARA SOLICITUDES
ESO L1)

ore y Apellidos):

Administración Pública ☐ Particular

Código Postal: Apdo. Correos:

```
Campos incluidos:
     Indicativo: Indicativo climatológico
     NOMBRE: Nombre estación
     ALTITUD: Altitud de la estación (metros)
     C_X: Coordenada X (Huso 30)
     C_Y: Coordenada Y (Huso 30)
     NOM_PROV: Provincia
     LONGITUD: Longitud geográfica
          (La última cifra indica la orientación: 1 para longitud E y 2 para W)
     LATITUD: Latitud geográfica

     P1: Precipitación día 1
     P31: Precipitación día 31

Unidades y valores especiales:

     Horas UTC (Tiempo Universal Coordinado)

     Precipitación en décimas de milímetro, medida de 07 a 07 (desde la 07 del día de la fecha hasta las 07 del día siguiente)
    Valores especiales de precipitación:
        -4: Precipitación acumulada
        -3: Precipitación inapreciable (inferior a 1 décima de mm)
```

Observations

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https://www.ncdc.noaa.gov/data-access

- ECA&D: https://www.ecad.eu//dailydata/index.php

- AEMET-OpenData: http://www.aemet.es/es/datos_abiertos/AEMET_OpenData

Any of the previous datasets includes all the ECVs?

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- **AEMET-OpenData:** http://www.aemet.es/es/datos_abiertos/AEMET_OpenData

Gridded datasets:

- **Climate Research Unit (CRU): http://www.cru.uea.ac.uk/data/ → SPEI Dataset**
- **E-OBS:** https://www.ecad.eu//download/ensembles/ensembles.php
  https://surfobs.climate.copernicus.eu/dataaccess/access_eobs.php
- **Iberian01:** http://hdl.handle.net/10261/183071
- **Spain02:** http://meteo.unican.es/en/datasets/spain02
- **MOPREDAS and MOTEDAS (Universidad de Zaragoza) - Monthly**

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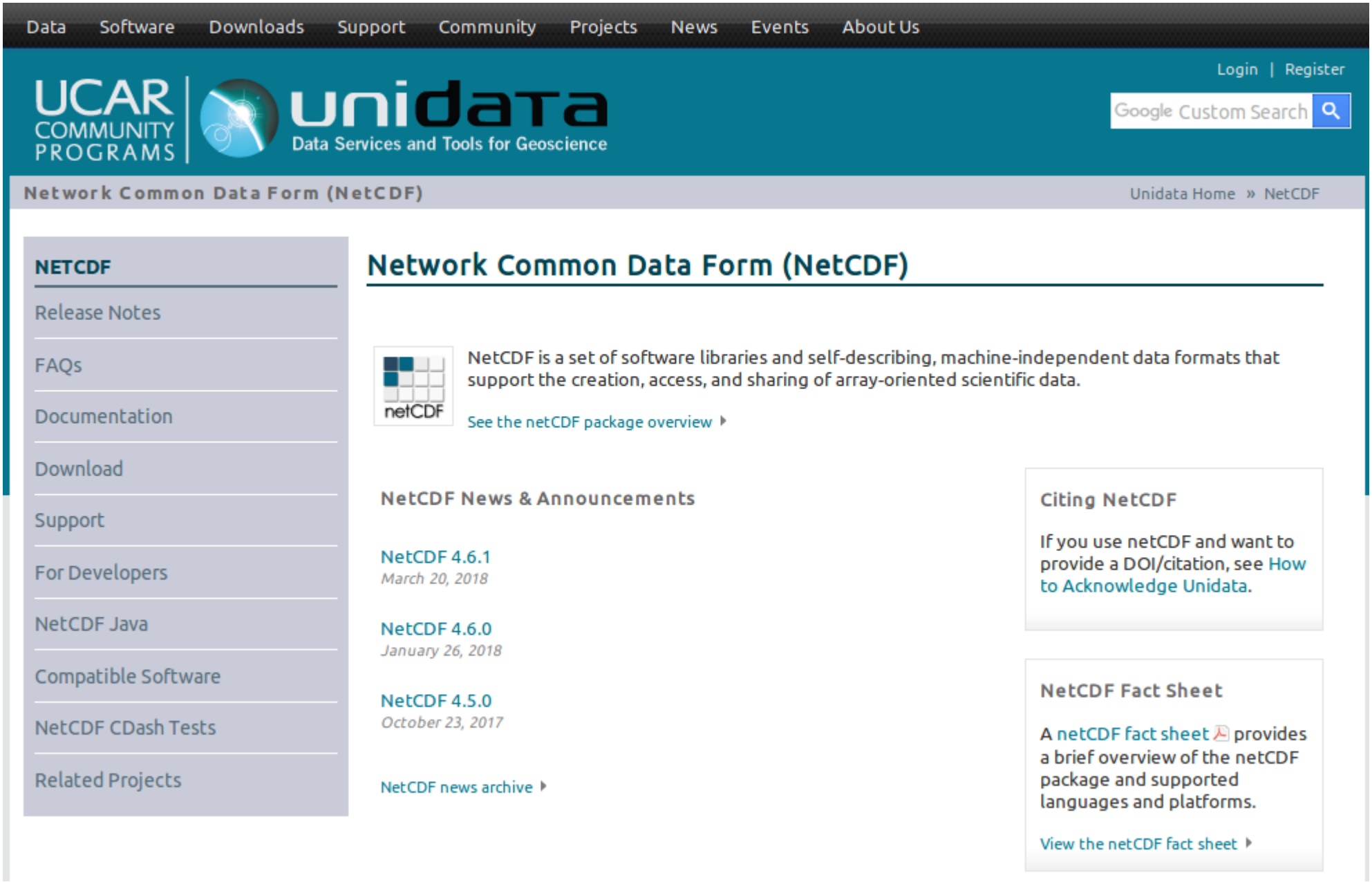

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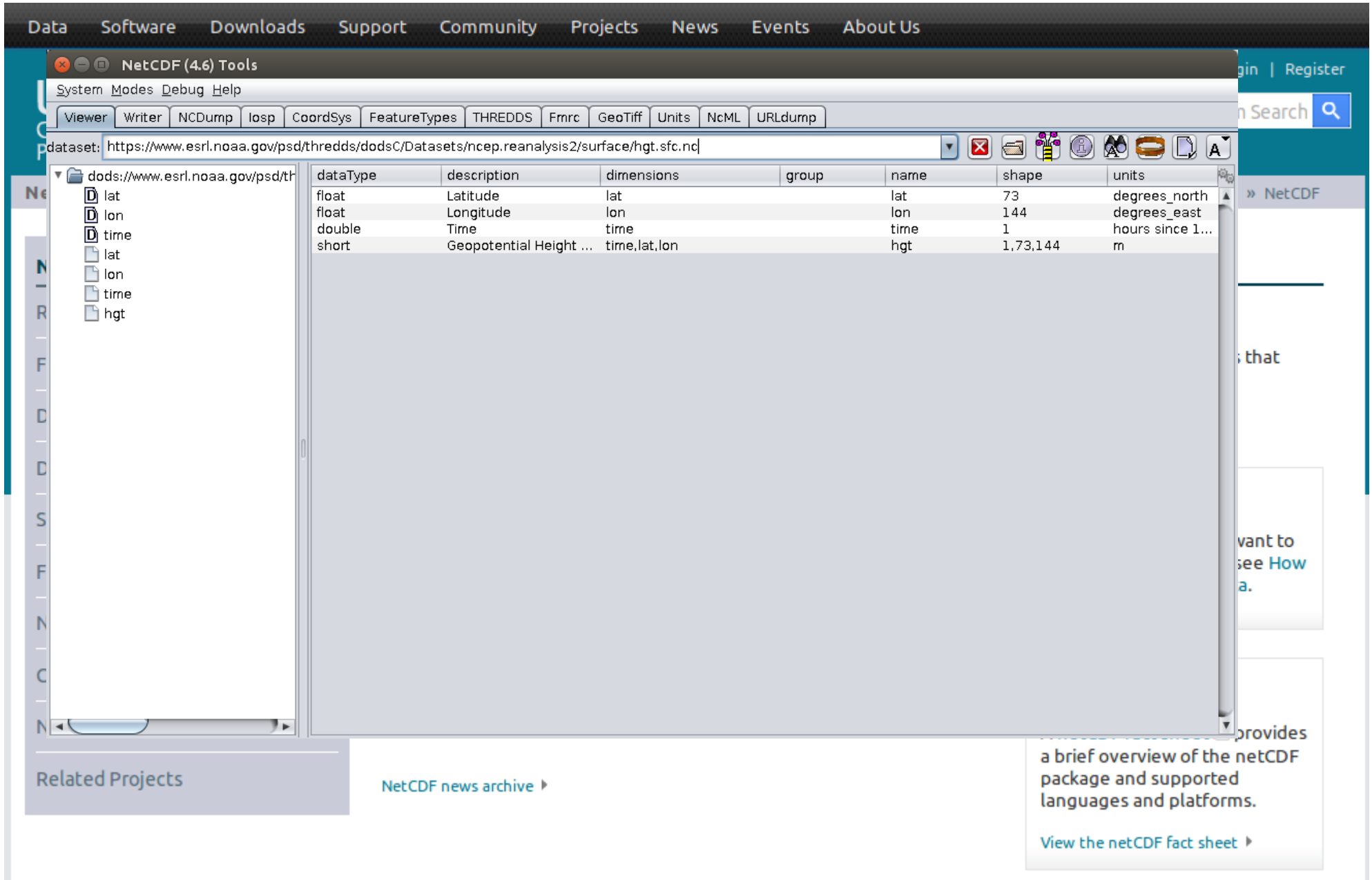
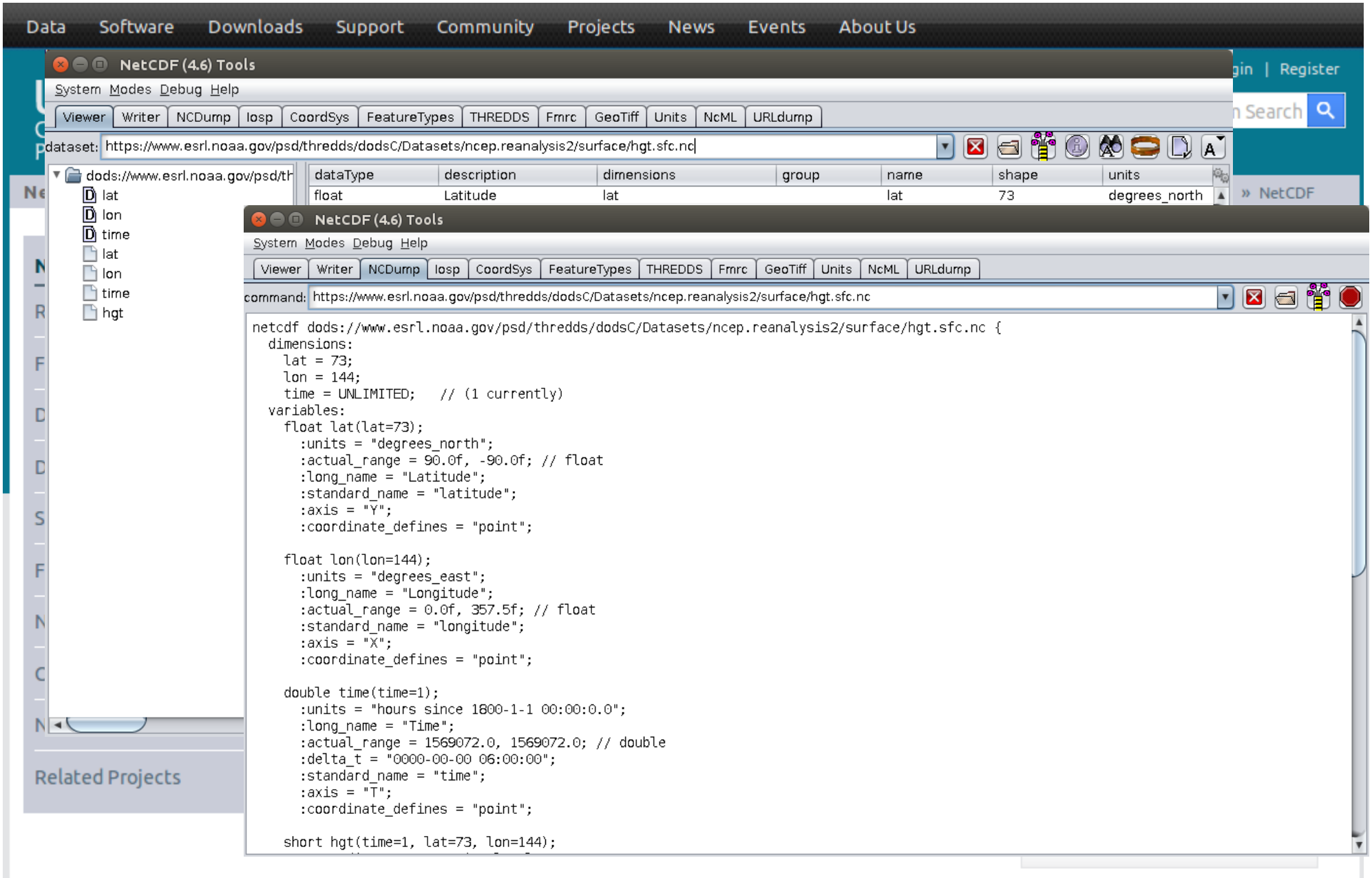
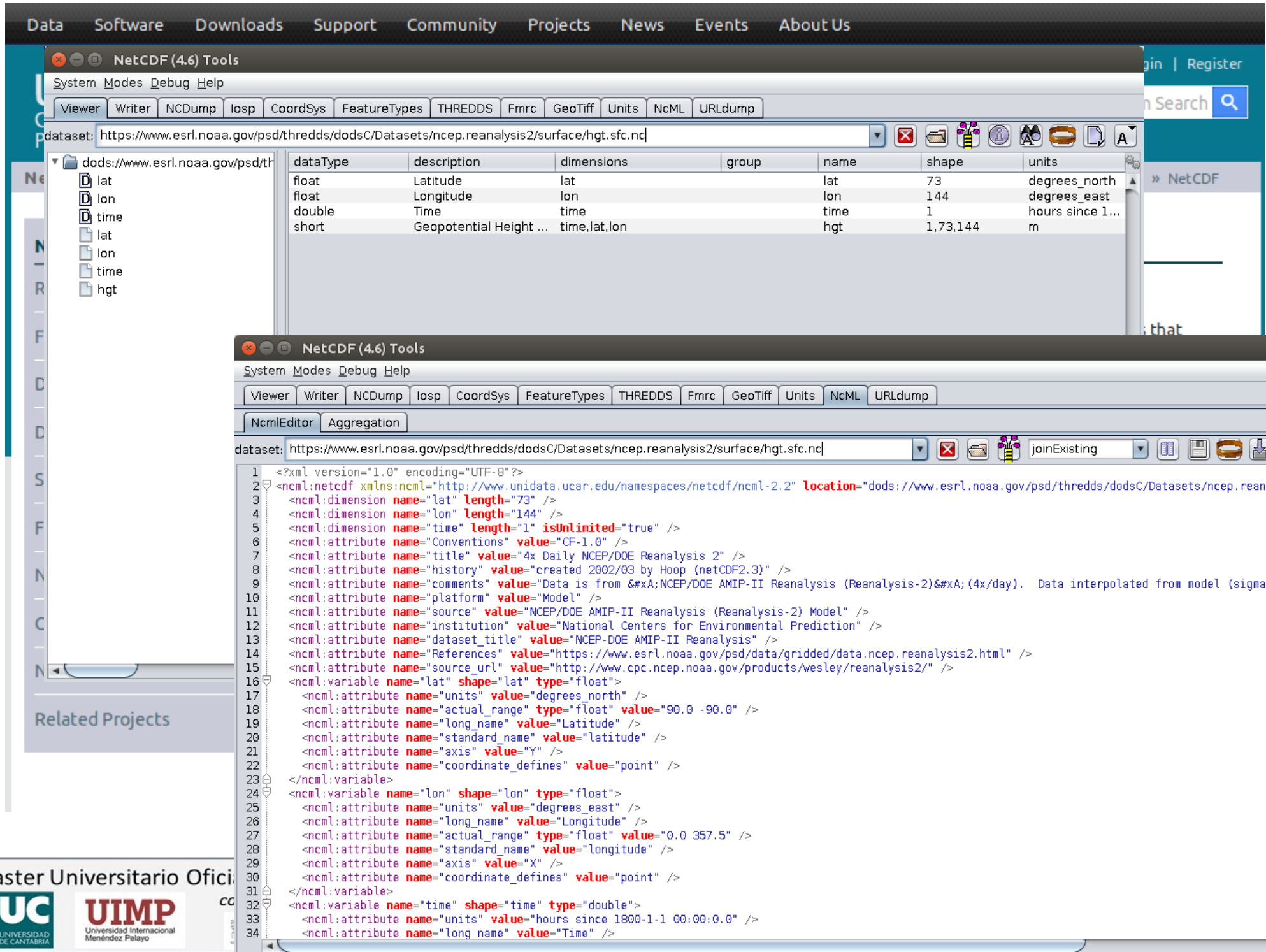


https://www.unidata.ucar.edu/software/netcdf/



https://www.unidata.ucar.edu/software/netcdf/


Data Software Downloads Support Community Projects News Events About Us
NetCDF (4.6) Tools
System Modes Debug Help
Viewer Writer NCDump Iosp CoordSys FeatureTypes THREDDS Fmrc GeoTiff Units NcML URLdump
dataset: https://www.esrl.noaa.gov/psd/thredds/dodsC/Datasets/ncep.reanalysis2/surface/hgt.sfc.nc
dods://www.esrl.noaa.gov/psd/th
lat
lon
time
lat
lon
time
hgt
dataType description dimensions group name shape units
float Latitude lat lat 73 degrees_north
float Longitude lon lon 144 degrees_east
double Time time time 1 hours since 1...
short Geopotential Height ... time,lat,lon hgt 1,73,144 m
NetCDF (4.6) Tools
System Modes Debug Help
Viewer Writer NCDump Iosp CoordSys FeatureTypes THREDDS Fmrc GeoTiff Units NcML URLdump
NcmlEditor Aggregation
dataset: https://www.esrl.noaa.gov/psd/thredds/dodsC/Datasets/ncep.reanalysis2/surface/hgt.sfc.nc
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2 <ncml:netcdf xmlns:ncml="http://www.unidata.ucar.edu/namespaces/netcdf/ncml-2.2" location="dods://www.esrl.noaa.gov/psd/thredds/dodsC/Datasets/ncep.reanalys
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8 <ncml:attribute name="history" value="created 2002/03 by Hoop (netCDF2.3)" />
9 <ncml:attribute name="comments" value="Data is from
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(4x/day). Data interpolated from model (sigma) su
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27 <ncml:attribute name="actual_range" type="float" value="0.0 357.5" />
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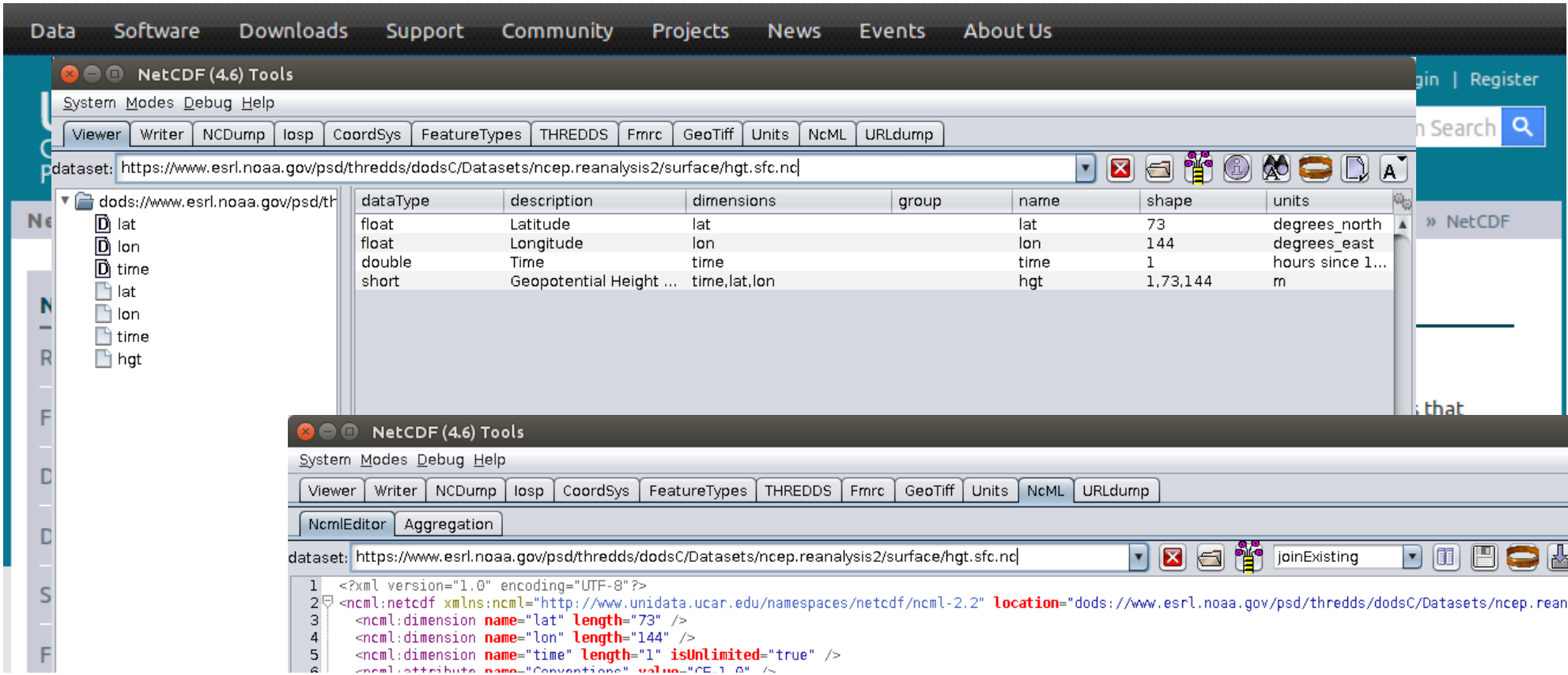
33 <ncml:attribute name="units" value="hours since 1800-1-1 00:00:0.0" />
34 <ncml:attribute name="long_name" value="Time" />
Related Projects
Master Universitario Ofici
UC UNIVERSIDAD DE CANTABRIA
UIMP Universidad Internacional Menéndez Pelayo



https://www.unidata.ucar.edu/software/thredds/current/tds/tutorial/NcMLExamples.html
https://www.unidata.ucar.edu/software/thredds/current/tds/tutorial/NcMLAggExamples.html
https://www.unidata.ucar.edu/software/thredds/current/netcdf-java/ncml/Tutorial.html

Data Software Downloads Support Community Projects News Events About Us

NetCDF (4.6) Tools

System Modes Debug Help

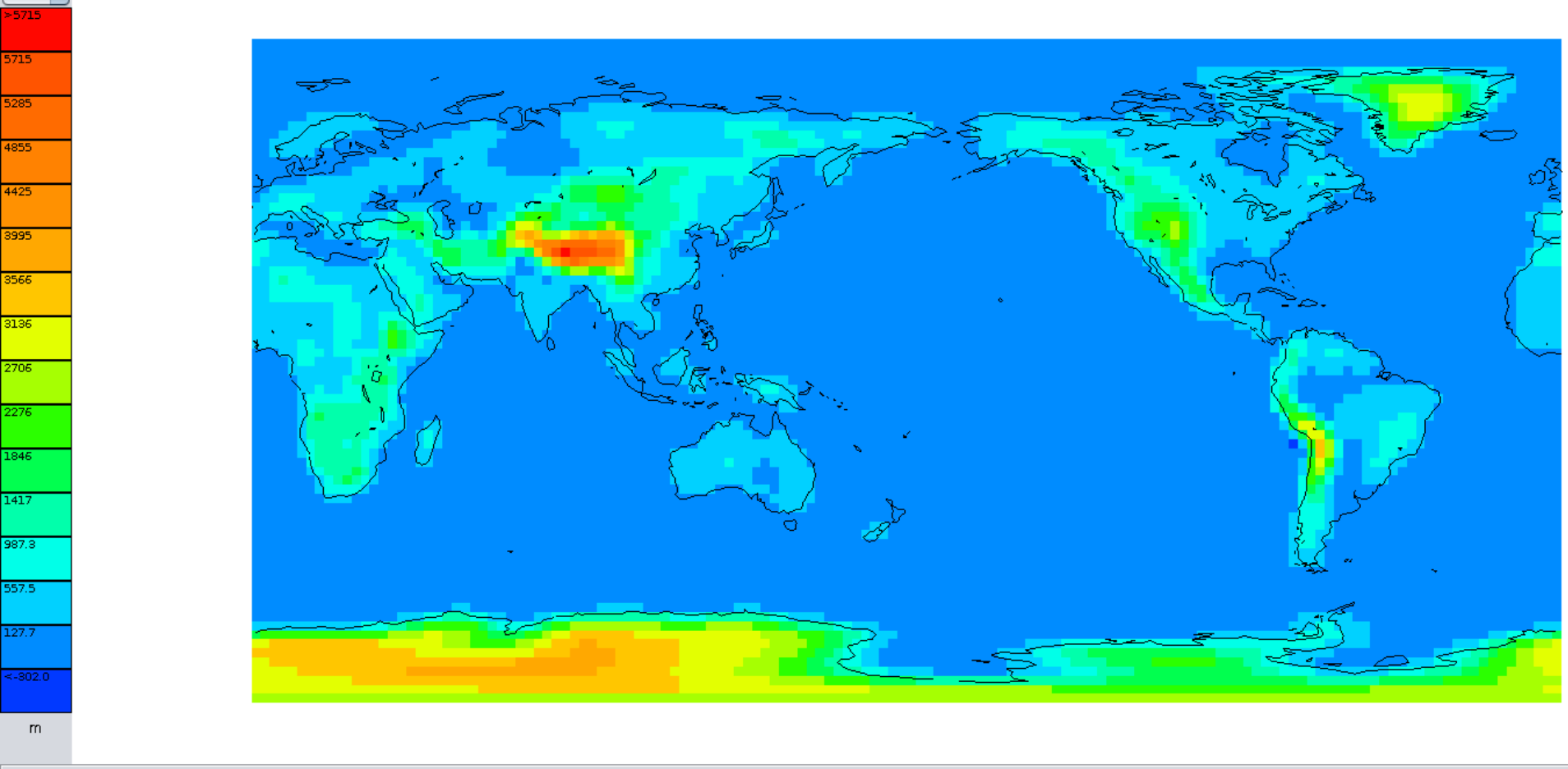
Viewer | Writer | NCDump | Iosp | CoordSys | FeatureTypes | THREDDS | Fmrc | GeoTiff | Units | NcML | URLdump

Grid Viewer

Dataset: dods://www.esrl.noaa.gov/psd/thredds/dodsC/Datasets/ncep.reanalysis2/surface/hgt.sfc.nc

Dataset Configure Controls | hgt == Geopotential Height at the Surface | 1979-01-01 00:00:00Z | 1

horiz



27.280N 41.178W .0 m @ 27.5N 40.0W

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26      <ncml:attribute name="long_name" value="Longitude" />
27      <ncml:attribute name="actual_range" type="float" value="0.0 357.5" />
28      <ncml:attribute name="standard_name" value="longitude" />
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34      <ncml:attribute name="long_name" value="Time" />
```

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  https://surfobs.climate.copernicus.eu/dataaccess/access_eobs.php
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Gridded datasets (reanalysis calibration):

- **WATCH Datasets:** http://www.eu-watch.org/data_availability
- **EWEMBI:**
  http://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:1809891
- **WFDE5:** https://cds.climate.copernicus.eu/cdsapp#!/search
- **SAFRAN (Spain):** http://meteo.unican.es/en/node/73339
- **AEMET 5 km:** http://www.aemet.es/es/serviciosclimaticos
- **Regional Reanalysis: UERRA Project (http://www.uerra.eu/)**

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- **WFDE5:** https://cds.climate.copernicus.eu/cdsapp#!/search
- **SAFRAN (Spain):** http://meteo.unican.es/en/node/73339
- **AEMET 5 km:** http://www.aemet.es/es/serviciosclimaticos
- **Regional Reanalysis: UERRA Project (http://www.uerra.eu/)**

Reanalysis

- NCEP/NCAR:

https://www.ncdc.noaa.gov/data-access

https://www.esrl.noaa.gov/psd/thredds/catalog.html

- ECMWF:

https://www.ecmwf.int/, http://apps.ecmwf.int/datasets/

- API: https://software.ecmwf.int/wiki/display/WEBAPI/

Reanalysis

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https://www.ncdc.noaa.gov/data-access

https://www.esrl.noaa.gov/psd/thredds/catalog.html

- ECMWF:

https://www.ecmwf.int/, http://apps.ecmwf.int/datasets/

- API: https://software.ecmwf.int/wiki/display/WEBAPI/

```
#!/usr/bin/env python
from ecmwfapi import ECMWFDataServer
server = ECMWFDataServer()
server.retrieve({
    'stream'   : "oper",
    'levtype'  : "sfc",
    'param'    : "228.128",
    'dataset'  : "interim",
    'step'     : "0",
    'grid'     : "0.75/0.75",
    'time'     : "00/06/12/18",
    'date'     : "2004-01-01/to/2017-07-31",
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    'format'   : "netcdf",
    'target'   : "interim_2004-01-01to2017-07-31_00061218_166.128.nc"
})
```

Reanalysis

- NCEP/NCAR:

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https://www.esrl.noaa.gov/psd/thredds/catalog.html

- ECMWF:

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    'dataset'  : "interim",
    'step'     : "0",
    'grid'     : "0.75/0.75",
    'time'     : "00/06/12/18",
    'date'     : "2004-01-01/to/2017-07-31",
    'type'     : "an",
    'class'    : "ei",
    'format'   : "netcdf",
    'target'   : "interim_2004-01-01to2017-07-31_00061218_166.128.nc"
})
```

chmod +x script.py # Execute permission for the user

python script.py # Execute the script

Reanalysis

- NCEP/NCAR:

https://www.ncdc.noaa.gov/data-access

https://www.esrl.noaa.gov/psd/thredds/catalog.html

- ECMWF:

https://www.ecmwf.int/, http://apps.ecmwf.int/datasets/

- API: https://software.ecmwf.int/wiki/display/WEBAPI/

- Copernicus CDS: https://cds.climate.copernicus.eu/cdsapp#!/home

Reanalysis

- NCEP/NCAR:

https://www.ncdc.noaa.gov/data-access

https://www.esrl.noaa.gov/psd/thredds/catalog.html

- ECMWF:

https://www.ecmwf.int/, http://apps.ecmwf.int/datasets/

- API: https://software.ecmwf.int/wiki/display/WEBAPI/

- Copernicus CDS: https://cds.climate.copernicus.eu/cdsapp#!/home

If possible, explore the CDS App and define the request to download the surface ECVs for the ERA5 Reanalysis considering any month, year, etc...

Reanalysis

- NCEP/NCAR:

https://www.ncdc.noaa.gov/data-access

https://www.esrl.noaa.gov/psd/thredds/catalog.html

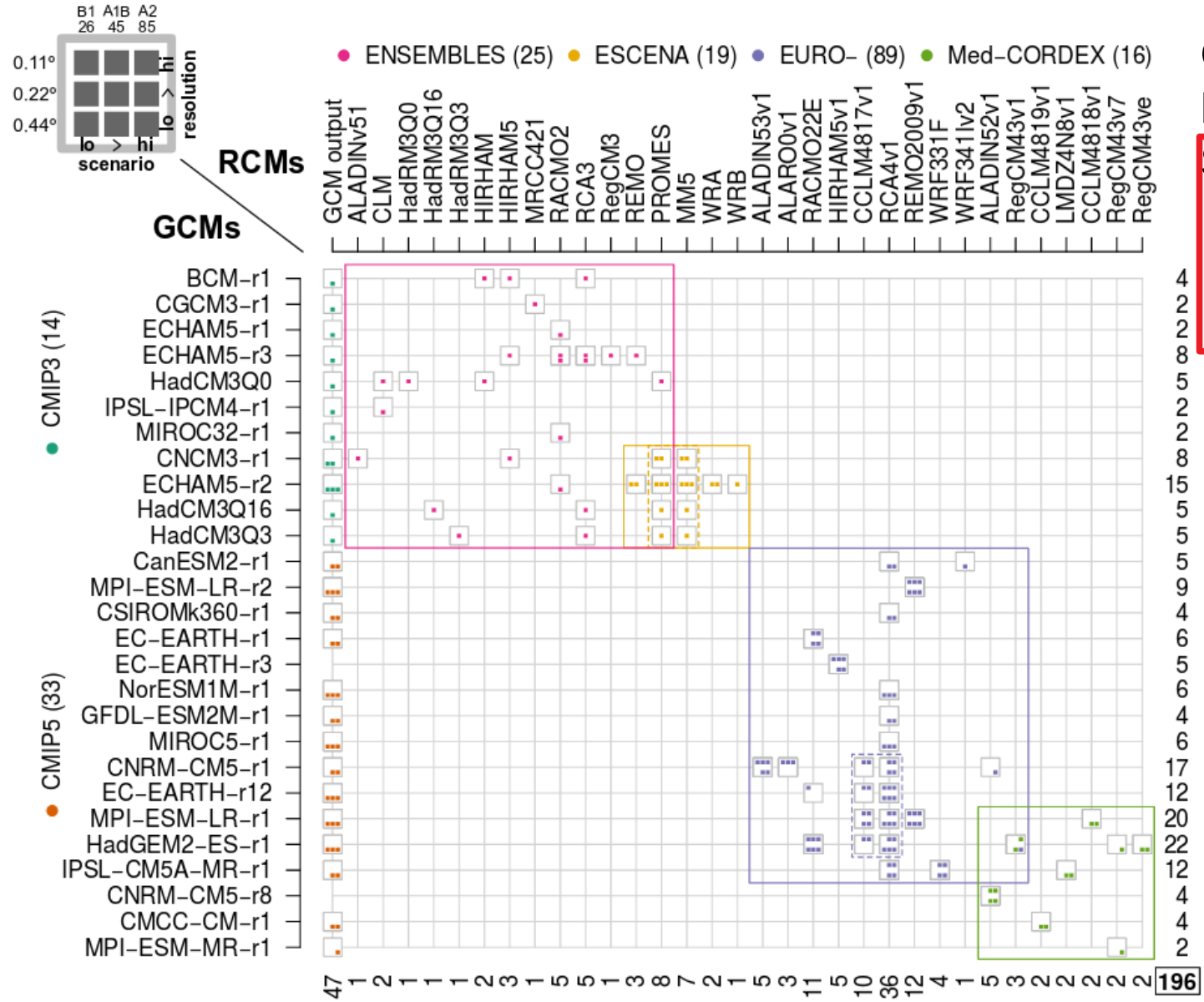
- ECMWF:

https://www.ecmwf.int/, http://apps.ecmwf.int/datasets/

- **API:** https://software.ecmwf.int/wiki/display/WEBAPI/
- **Copernicus CDS:** https://cds.climate.copernicus.eu/cdsapp#!/home

- JRA-55: http://jra.kishou.go.jp/JRA-55/index_en.html

- **API:** http://jra.kishou.go.jp/comm/application_en.html



Observations

Reanalysis

Seasonal Forecast:

- Member
- Initialization
- …

Petabytes → Exabytes!!!

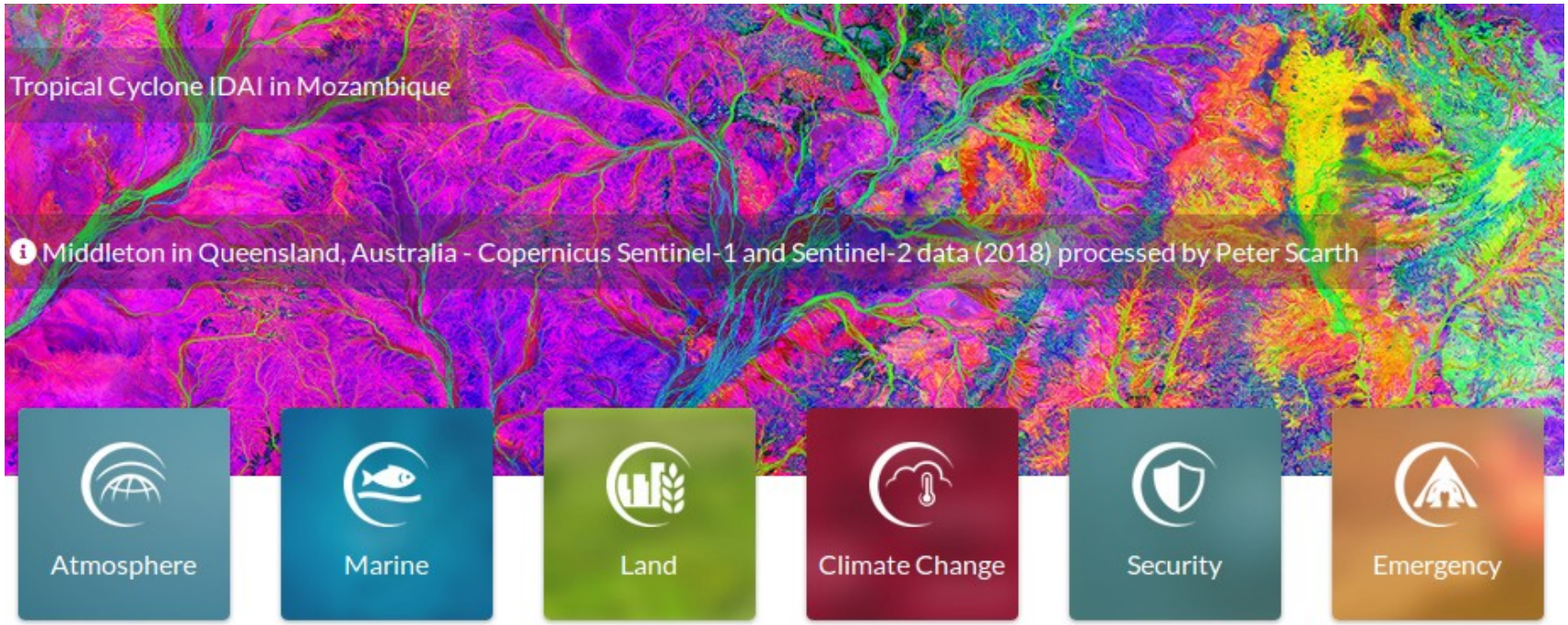
Source: Fernández, J. et al. 2018, Consistency of climate change projections from multiple global and regional model intercomparison projects. Climate Dynamics. Doi:10.1007/s00382-018-4181-8

Satellite: ~12 Sentinels in the following 10 years (**ESA**, **EUMETSAT 6**)

Local observations (In situ):

- Sensors in the shore of the rivers
- Ocean buoys
- Meteorological globes
- Non-static radars (ships, airplane, etc.)
- ….

Local observations are needed to calibrate the data provided by the satellite.



https://www.copernicus.eu/en

https://cds.climate.copernicus.eu/

Home Search Datasets Applications Your requests Toolbox Help & support

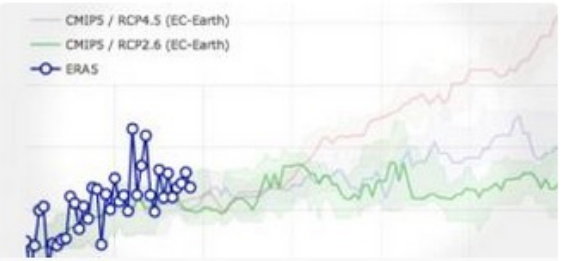
Welcome to the Climate Data Store

Dive into this wealth of information about the Earth's past, present and future climate.

It is freely available and functions as a one-stop shop to explore climate data. Register for free to obtain access to the CDS and its Toolbox.

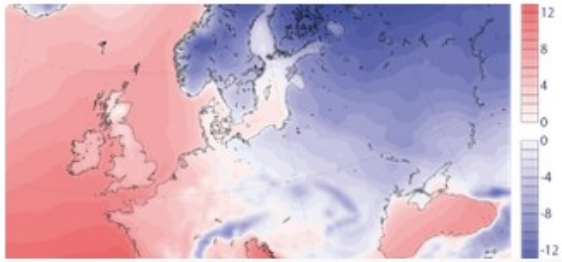
We are constantly improving the services and adding new datasets. For more information, please consult the catalogue and our FAQ.

Enter search term(s) | All | Search



Climate Data Store **Toolbox**

Climate Data Store **API**



Access **climate reanalysis (ERA5)**

Home Search Datasets Applications Your requests Toolbox Help & support

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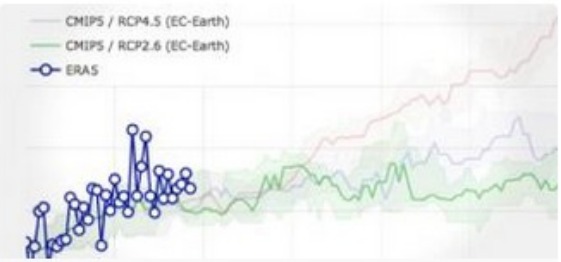
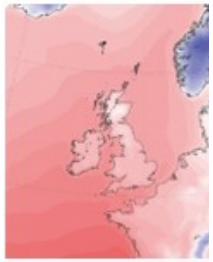


Climate Data Store **Toolbox**

Climate Data Store **API**



Access c

Product type

- Climate projections (5)
- Reanalysis (8)
- Satellite observations (12)
- Seasonal forecasts (6)
- Sectoral climate indices (2)

Variable domain

- Atmosphere (composition) (3)
- Atmosphere (surface) (5)
- Atmosphere (upper air) (7)
- Land (biosphere) (1)
- Land (cryosphere) (2)
- Land (hydrology) (4)
- Ocean (physics) (5)

Spatial coverage

- Europe (6)
- Global (23)

Temporal coverage

- Future (13)
- Past (31)
- Present (4)

Originating centre

- [ ] ECMWF
- [x] DWD
- [ ] UK Met Office
- [ ] CMCC
- [ ] Météo France

Select all Clear all

System

- [x] 2
- [ ] 3
- [ ] 4
- [ ] 5
- [ ] 6
- [ ] 12
- [ ] 13

Select all Clear all

Variable

- [ ] 10m u-component of wind
- [ ] 10m v-component of wind
- [ ] 10m wind gust since previous post-processing
- [ ] 2m dewpoint temperature
- [x] 2m temperature
- [ ] Eastward turbulent surface stress
- [ ] Evaporation
- [ ] Land-sea mask
- [ ] Maximum 2m temperature in the last 24 hours
- [ ] Mean sea level pressure
- [ ] Minimum 2m temperature in the last 24 hours
- [ ] Northward turbulent surface stress
- [ ] Orography
- [ ] Runoff
- [ ] Sea surface temperature
- [ ] Sea-ice cover
- [ ] Snow density
- [ ] Snow depth
- [ ] Snowfall
- [ ] Soil temperature level 1
- [ ] Surface latent heat flux
- [ ] Surface net solar radiation
- [ ] Surface net thermal radiation
- [ ] Surface sensible heat flux
- [ ] Surface solar radiation downwards
- [ ] Surface thermal radiation downwards
- [ ] TOA incident solar radiation
- [ ] Top net solar radiation
- [ ] Top net thermal radiation
- [ ] Total cloud cover
- [ ] Total precipitation

Product type

- [ ] Climate projections (5)
- [ ] Reanalysis (8)
- [ ] Satellite observations (12)
- [ ] Seasonal forecasts (6)
- [ ] Sectoral climate indices (2)

Variable domain

- [ ] Atmosphere (composition) (3)
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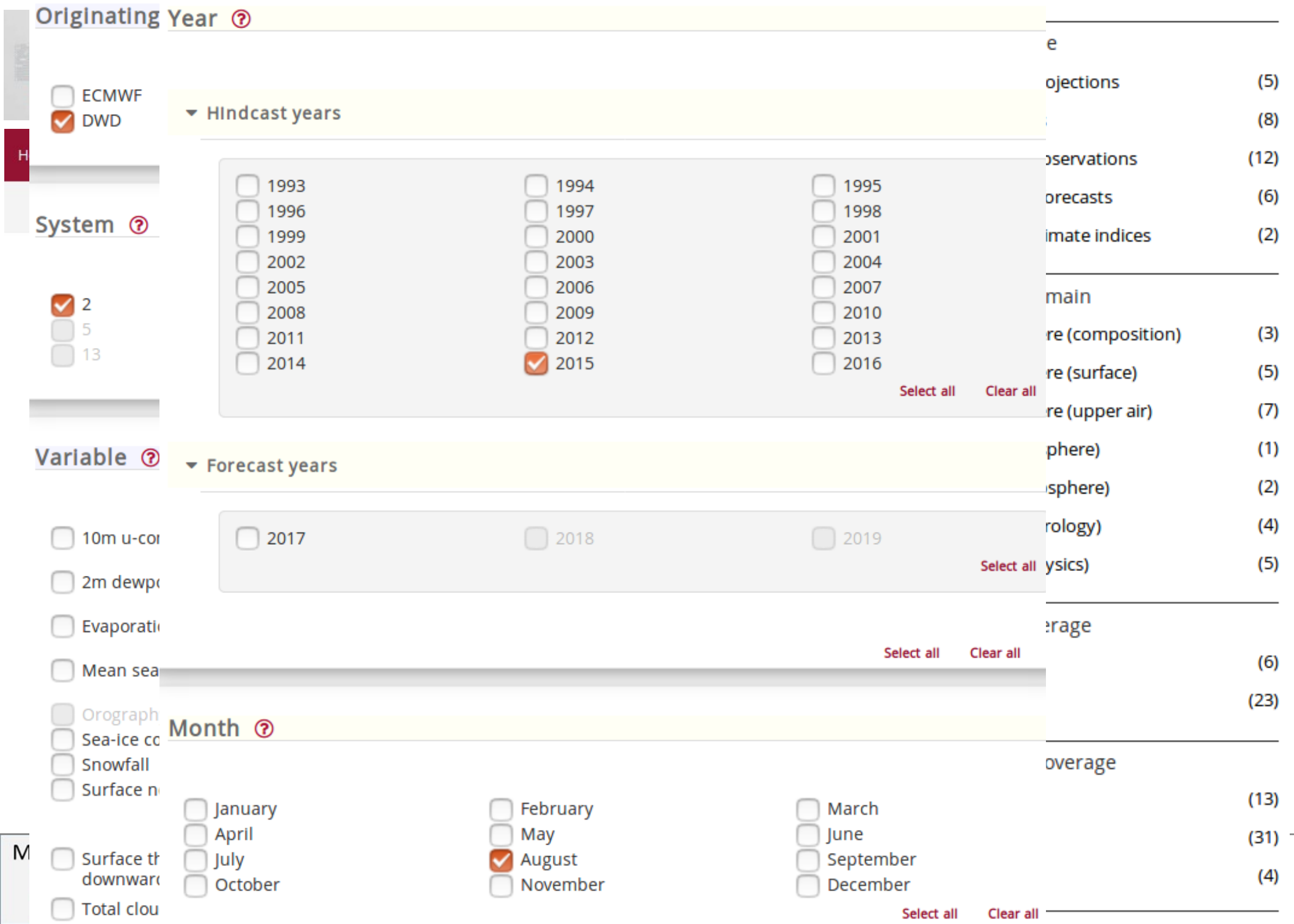
- [ ] Ocean (physics) (5)

Spatial coverage

- [ ] Europe (6)
- [ ] Global (23)

Temporal coverage

- [ ] Future (13)
- [ ] Past (31)
- [ ] Present (4)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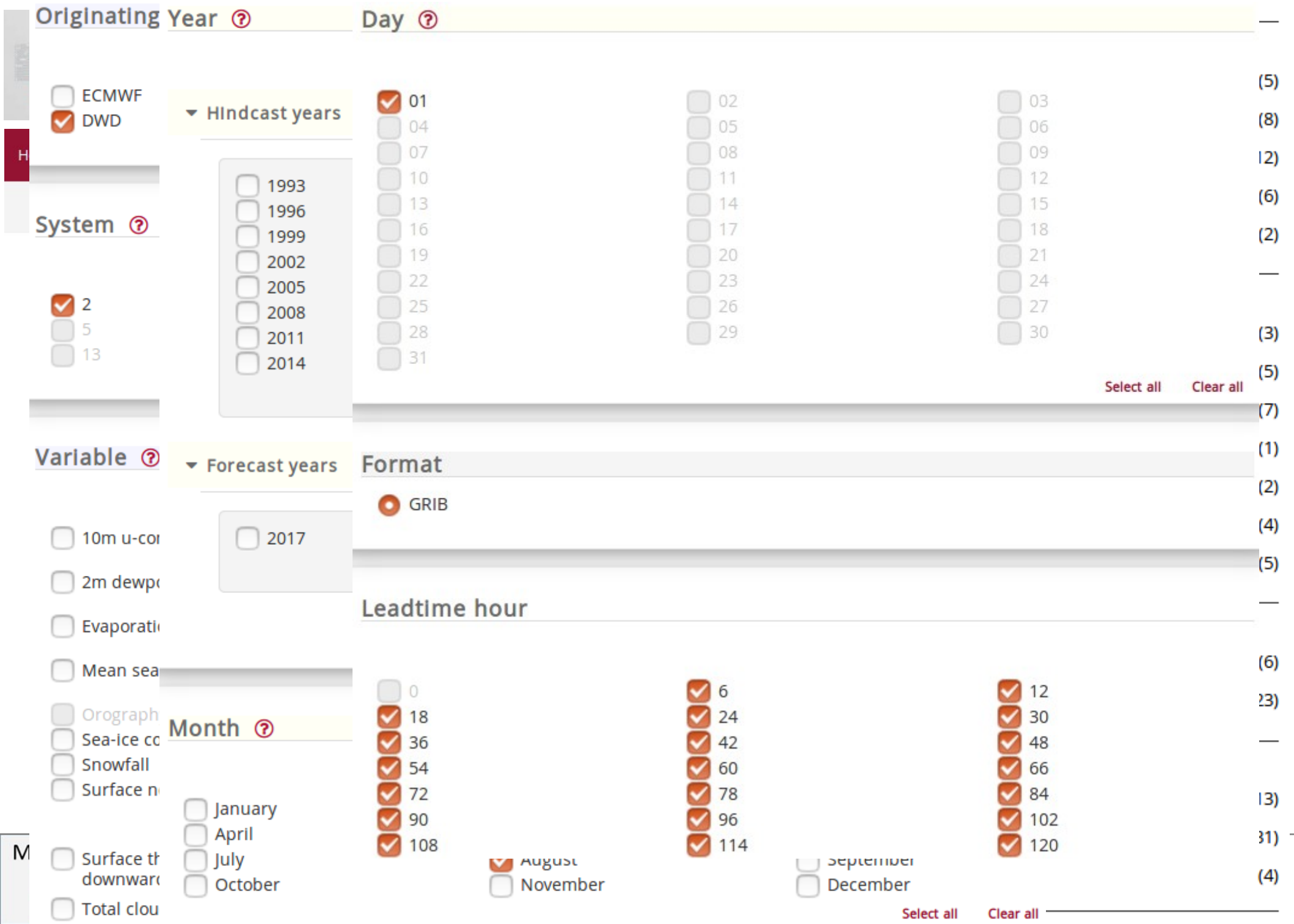
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78
96
114
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30
48
66
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120
September
December
Select all
Clear all

Originating Year Day

Hide API request | Not yet toolbox compatible | Submit Form

ECMWF
DWD

Please go to the documentation page for information as to how to use the CDS API.

```
import cdsapi

c = cdsapi.Client()

c.retrieve(
    'seasonal-original-single-levels',
    {
        'originating_centre':'dwd',
        'system':'2',
        'variable':'2m_temperature',
        'year':'2015',
        'month':'08',
        'day':'01',
        'format':'grib',
        'leadtime_hour':[
            '6','12','18',
            '24','30','36',
            '42','48','54',
            '60','66','72',
            '78','84','90',
            '96','102','108',
            '114','120','126',
            '132','138','144',
            '150','156','162'
```

System

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Show API request | Not yet toolbox compatible | Submit Form

Originating Year Day

Hide API request | Not yet toolbox compatible | Submit Form

ECMWF
DWD

Please go to the documentation page for information as to how to use the CDS API.

```
import cdsapi

c = cdsapi.Client()

c.retrieve(
    'seasonal-original-single-levels',
    {
        'originating_centre':'dwd',
        'system':'2',
```

System

2
5

Seasonal forecast daily data on single levels from 2017 to present	2019-04-01 14:01:26	1:39:44	Queued	☐
Seasonal forecast daily data on single levels from 2017 to present	2019-04-01 14:01:09	1:40:01	Queued	☐
Seasonal forecast daily data on single levels from 2017 to present	2019-04-01 14:00:44	1:40:26	Queued	☐
Seasonal forecast daily data on single levels from 2017 to present	2019-04-01 14:00:25	1:40:46	Queued	☐
Seasonal forecast daily data on single levels from 2017 to present	2019-04-01 14:00:01	1:41:09	In progress	☐

```
            '150', '156', '162'
```

Mean sea

Orograph
Sea-ice co
Snowfall
Surface n

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downward
Total clou

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Select all Clear all

Observations

- **ECA&D:** https://www.ecad.eu//dailydata/index.php
- **WATCH Datasets:** http://www.eu-watch.org/data_availability
- **EWEMBI:** http://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:1809891
- **Spain02:** http://meteo.unican.es/en/datasets/spain02
- **AEMET-OpenData:** http://www.aemet.es/es/datos_abiertos/AEMET_OpenData

Reanalysis

- **NCEP/NCAR:** https://www.ncdc.noaa.gov/data-access https://www.esrl.noaa.gov/psd/thredds/catalog.html
- **ECMWF:** https://www.ecmwf.int/, http://apps.ecmwf.int/datasets/
  - **API:** https://software.ecmwf.int/wiki/display/WEBAPI/
- **JRA-55:** http://jra.kishou.go.jp/JRA-55/index_en.html
  - **API:** http://jra.kishou.go.jp/comm/application_en.html

Climatic Change:

- **ESGF:** https://esgf.llnl.gov/index.html

User Information	
User Name	M1980 *[5 to 30 characters, letters, digits and @/./-/_ only. Please note that the username is used to build a unique OpenID that you will use to login. If your chosen username is not available, you will be automatically assigned a similar one.]*
First Name	Meteo
Last Name	DataLab
Email	sixtohg@gmail.com
Password	•••••••••• *[At least 8 characters, including one lower case letter, one upper case letter, one number, and one special symbol. All characters are allowed EXCEPT for ( ) " .]* Password score: strong. Estimated time to crack password: 4 years
Confirm Password	•••••••••• *[Must match the password above.]*
Institution	University of Cantabria
Department	Applied Mathematics and Computer Science
City	Santander
State	
Country	SPAIN
Interest Keywords	downscaling, climate change [A short list of science fields you are involved with (60 characters maximum). Example: Software Engineering, Grid Computing, Climate Change.]
Interest Statement	Regional climate change scenarios. [A short paragraph describing your professional interests (1000 characters maximum).]
Subscribe to COG Email List?	☐ *['cog_info', low traffic list]*

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First Name	Meteo
Last Name	DataLab
Email	sixtohg@gmail.com
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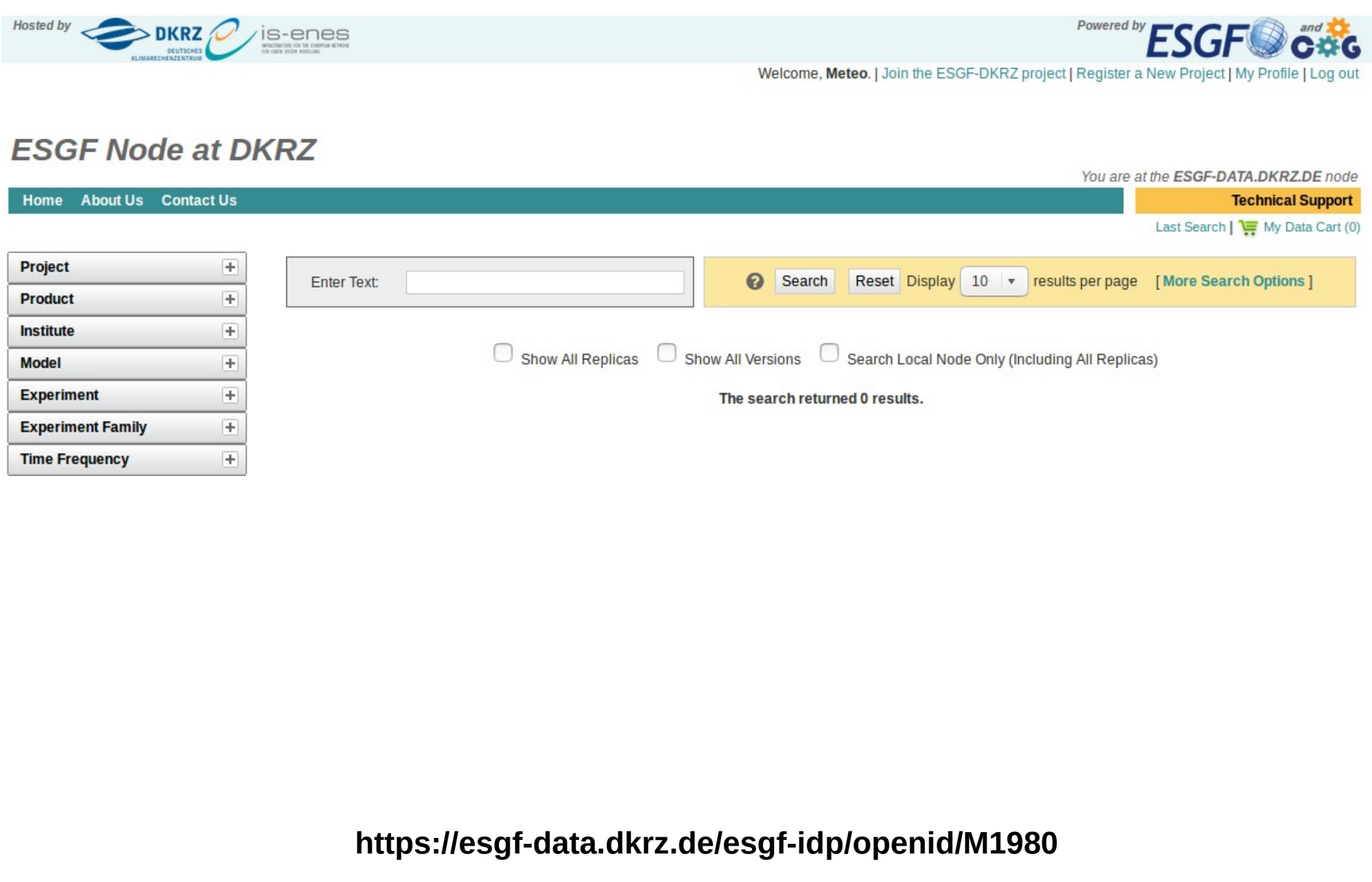
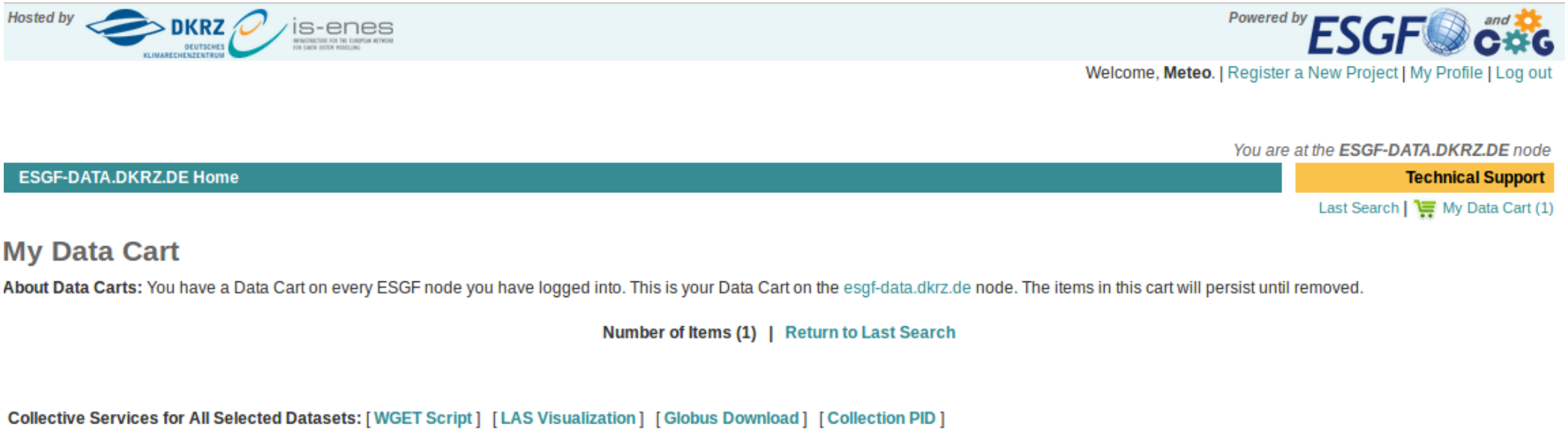
https://esgf-data.dkrz.de/esgf-idp/openid/M1980



https://esgf-data.dkrz.de/esgf-idp/openid/M1980



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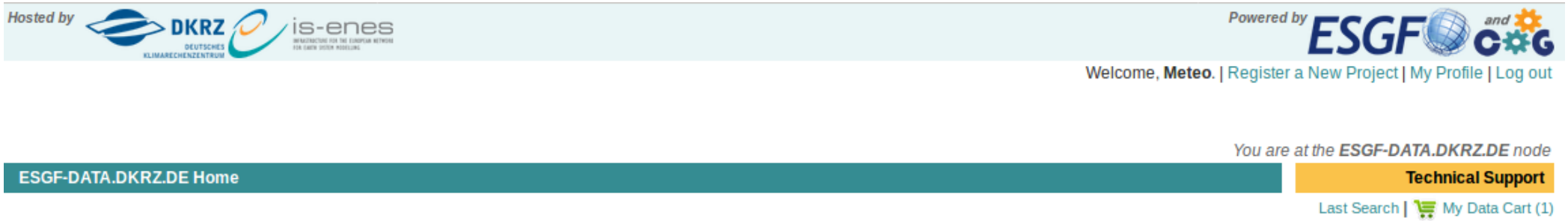

chmod +x wget-YYYYMMDDHHMMSS.sh # Execute permission for the user

./wget-YYYYMMDDHHMMSS.sh # Execute the script

If the script doesn't find the credentials, it requests them to the user

https://esgf-data.dkrz.de/esgf-idp/openid/M1980

Research

UC UNIVERSIDAD DE CANTABRIA — MG METEOROLOGY GROUP — CSIC

Statistical Downscaling Portal

MOSAICC

http://www.fao.org/climatechange/mosaicc

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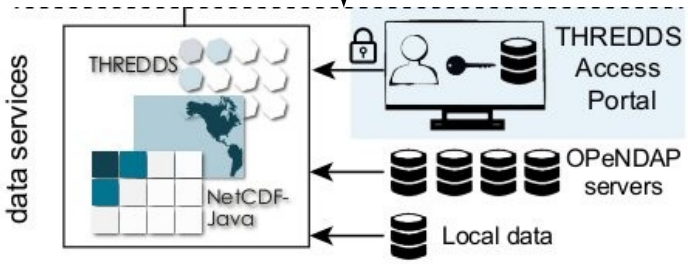
Welcome to IS-ENES Climate4Impact

https://climate4impact.eu

User Data Gateway



ESGF Node

ESGF Earth System Grid Federation

ECLISEA

ERA4CS European Research Area for Climate Services

WATER

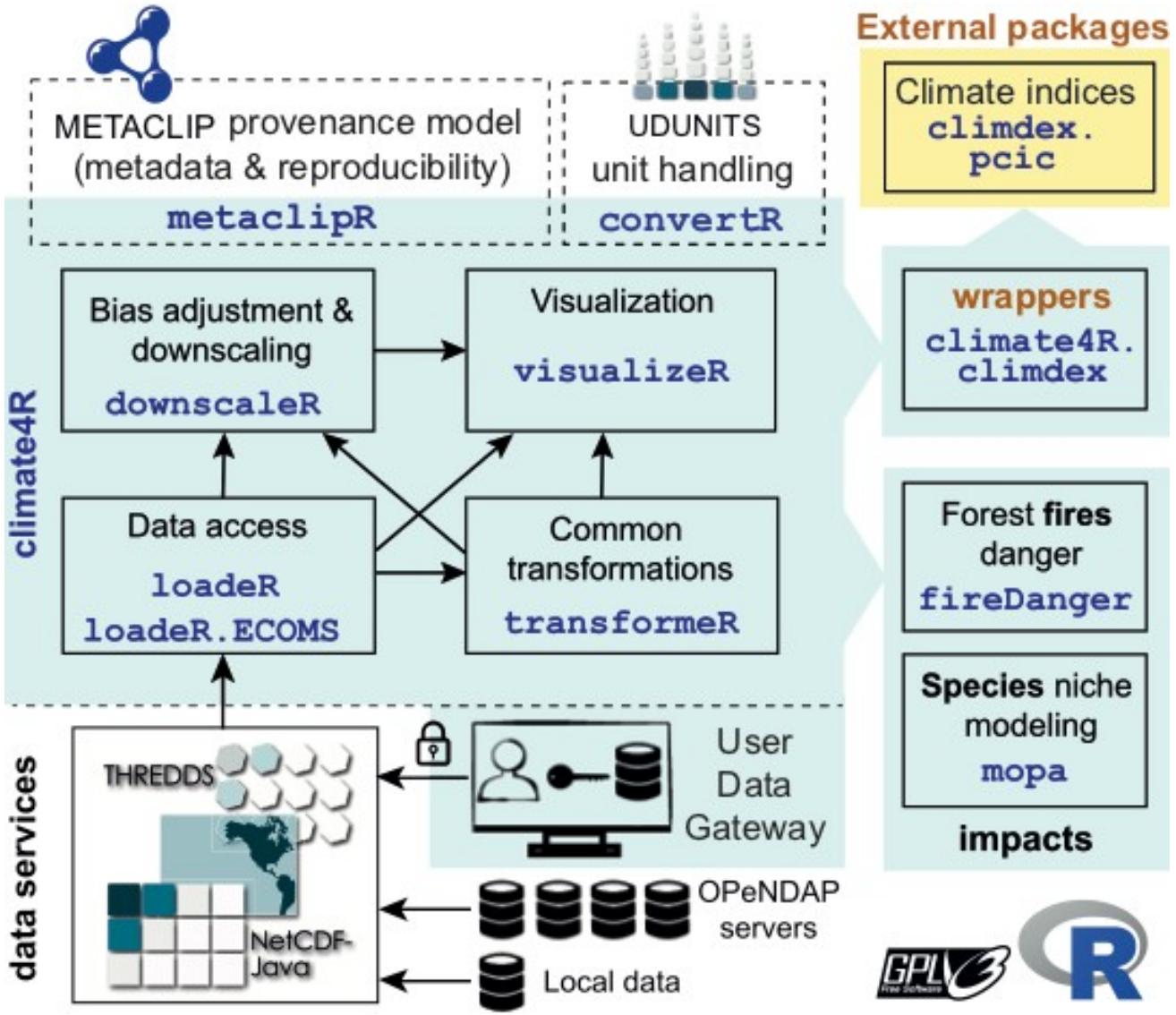
AfriCultuReS

HORIZON 2020

VALUE

cost

UDG: http://meteo.unican.es/udg-tap/home
UDG-Public Data:
http://www.meteo.unican.es/tds5/catalogs/public.html



UDG: http://meteo.unican.es/udg-tap/home
UDG-Public Data:
http://www.meteo.unican.es/tds5/catalogs/public.html

Task: Follow the instructions and complete the registration on the User Data Gateway. All the details are included in the Santander MetGroup Trac: https://meteo.unican.es/trac/wiki/udg