Overview of available data and tools for monitoring of the climate system

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Outline

- ECA&D, ICA&D (LACA&D, SACA&D)
- Climate monitoring
- Climate explorer
- climate4impact: Climate platform for Copernicus

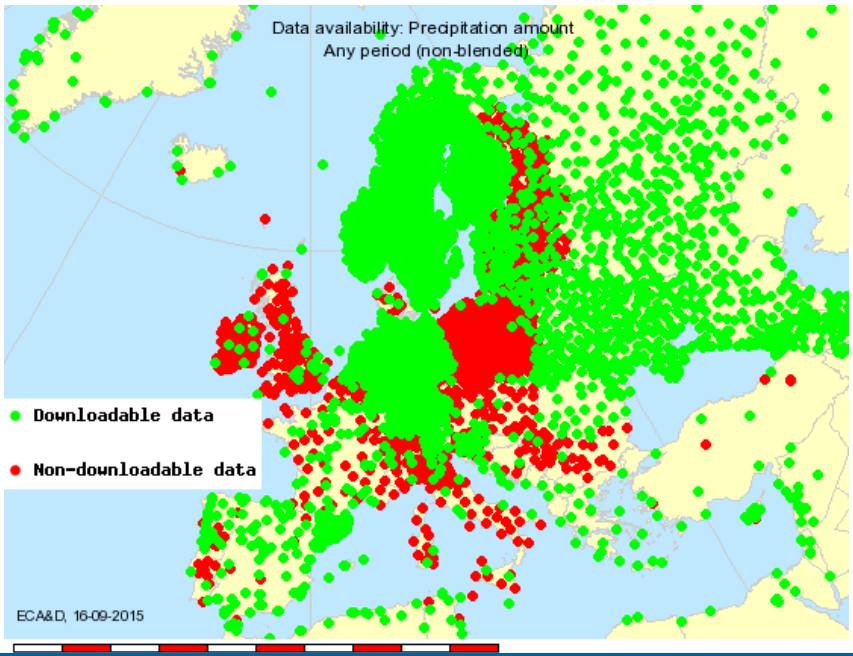
European Climate Assessment & Dataset

ECA&D introduction I

- ECA&D started in 1998 with few series
- Partly funded by EUMETNET until 2008
- Currently maintained by KNMI
- Regional Climate Center on Data for WMO Region VI

$\Rightarrow$ Objective:

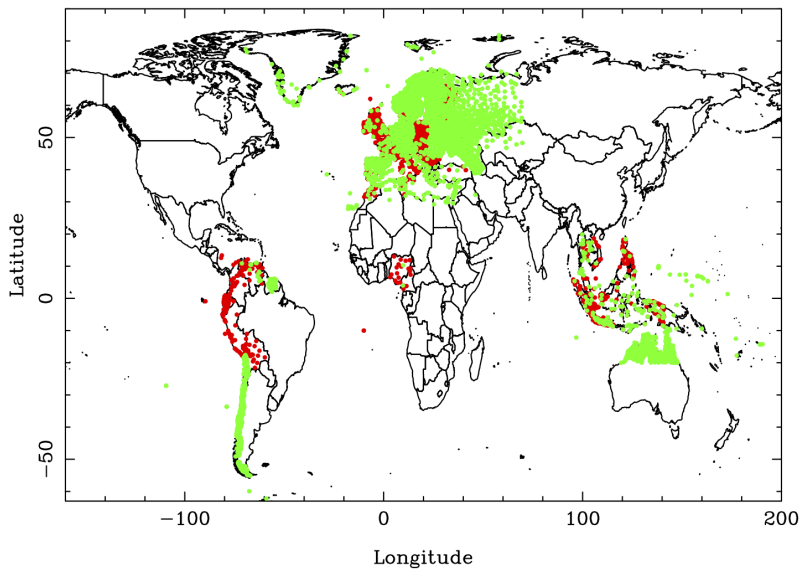
to analyze the climate of WMO region VI, with special focus on trends in climatic extremes observed at meteorological stations.



ECA&D

ICA&D

- Combines WMOs Expert Team on Climate Change Detection and Indices (ETCCDI) and WMOs Data Rescue (DARE) activities
- based on the concept developed for the ECA&D
- ICA&D combines the climate monitoring and assessment activities developed in ECA&D with DARE activities.
- New Products LACA&D (LACA-OBS), SACA&D (SACA-OBS)



LACA&D SACA&D ECA&D

ECA&D introduction II

- Today, ECA&D is receiving data:
  - 66 participants for 62 countries
  - ECA dataset contains 41600 series of observations for 12 elements at 10388 meteorological stations (RR, TN, TG, TX, PP, HU, SS, SD, FG, FX, DD, CC)
  - E-OBS gridded version (RR, TN, TG, TX, PP)
  - Europe and the Mediterranean
  - 77% of these daily series can be downloaded and used for non-commercial research and education.
  - Participation to ECA&D is open to anyone maintaining daily station data.
  - If you want to join please contact us. Data policy

ECA&D technical background

- Web-based information system
- Regional daily climate data
  - Recent data
  - Rescued digitized data
- Meta information
- Derived climate monitoring products
  - Indices of extremes
  - Maps with trends, anomalies, etc
- Historical perspectives integrated with monitoring of current climate

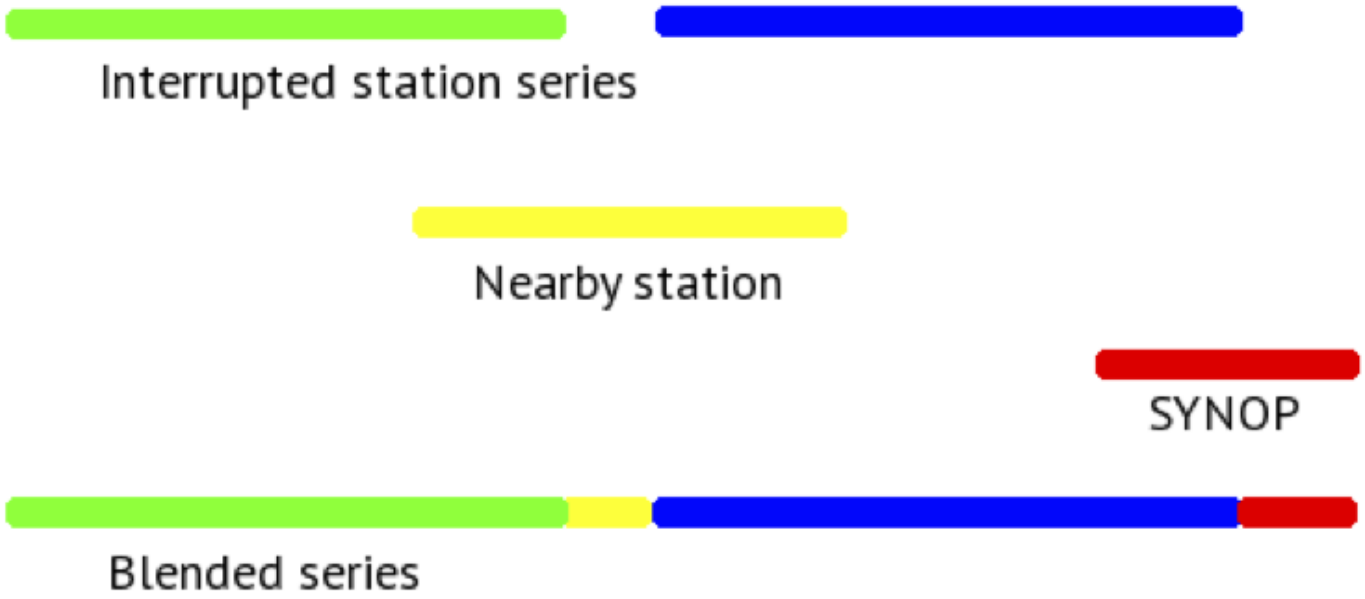
ECA&D technical background

Monthly updates:

- Including new data
- Quality control
- Blending with nearby stations
- Homogeneity check
- Indices calculation
- Climatology calculation
- Trend calculation

ECA&D Blending details

- Fill in and extend with other series, nearby stations and/or synop
- Nearby stations: within 25 km and 50m height difference

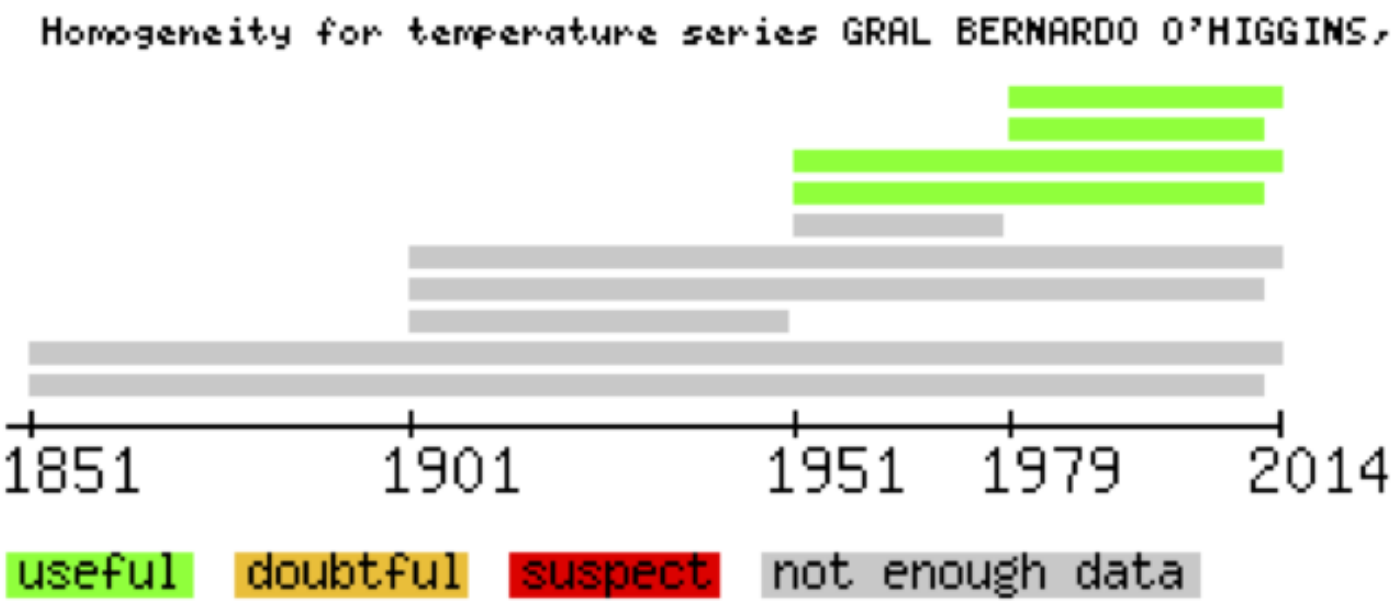


ECA&D Homogeneity details I

- 80% non-missing in period
- 4 test (Wijngaard et al. 2003):
  - Standard Normal Homogeneity Test (SNH, Alexandersson (1986))
  - Buishand Range test (BHR, Buishand (1982))
  - Pettitt test (PET, Pettitt (1979))
  - Von Neumann Ratio test (VON, von Neumann (1941))
- First 3 give year of break

ECA&D Homogeneity details: II

Homogeneity results



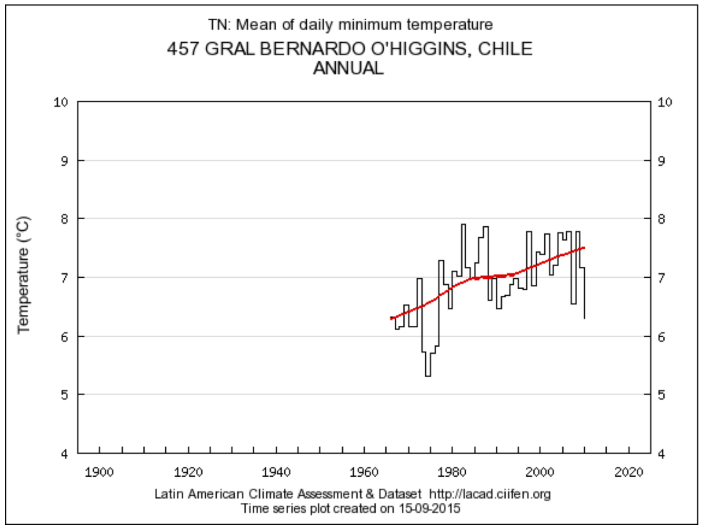
- Useful: 0 or 1 tests detect break
- Doubtful: 2 tests detect break
- Suspect: 3 or 4 detect break

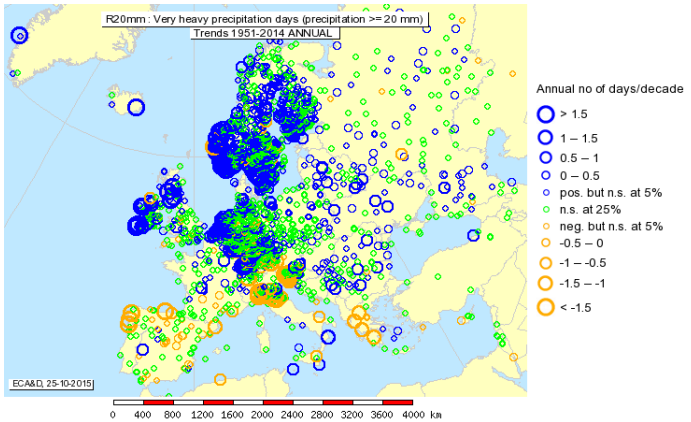
$\Rightarrow$ Useful & Doubtful used in ECA&D monitoring

ECA&D Climate monitoring

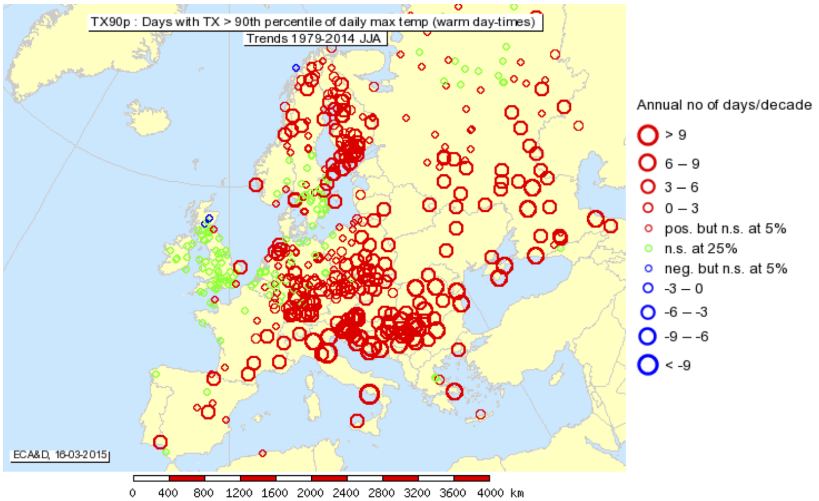
Indices of extremes - Climate impact indices (ETCCDI , eca indices)

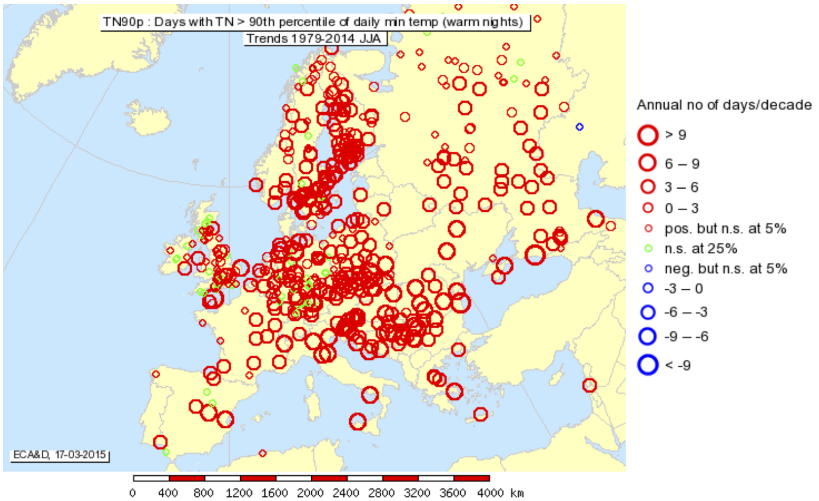
- Indices dictionary
- Time series plots
- Trend/anomaly/climatology maps





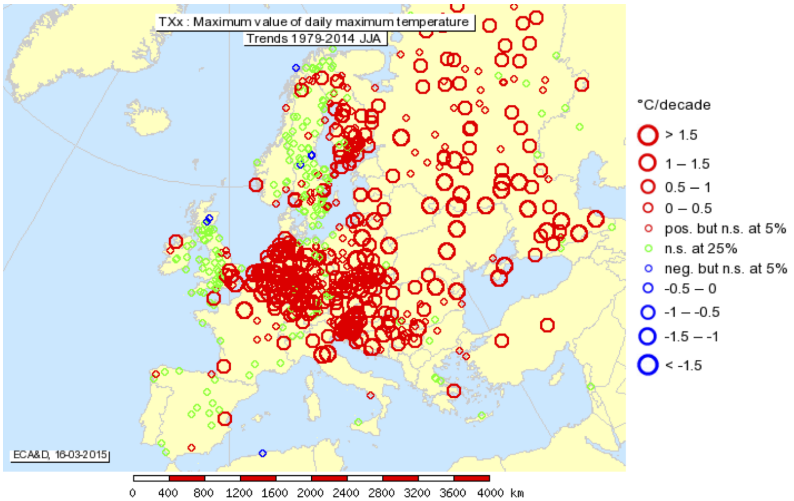
Trends - Some interesting aspects

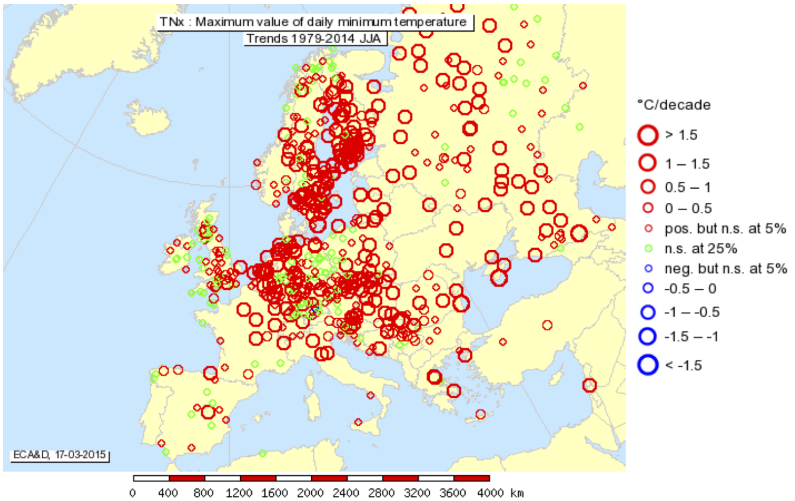




Trend (1979-2014) in number of warm day-times vs. warm nights (JJA)

Trends - Some interesting aspects

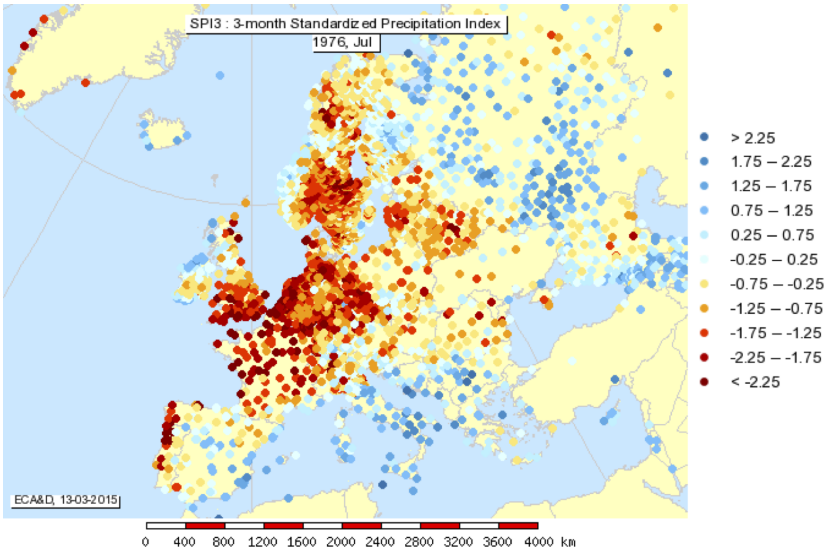


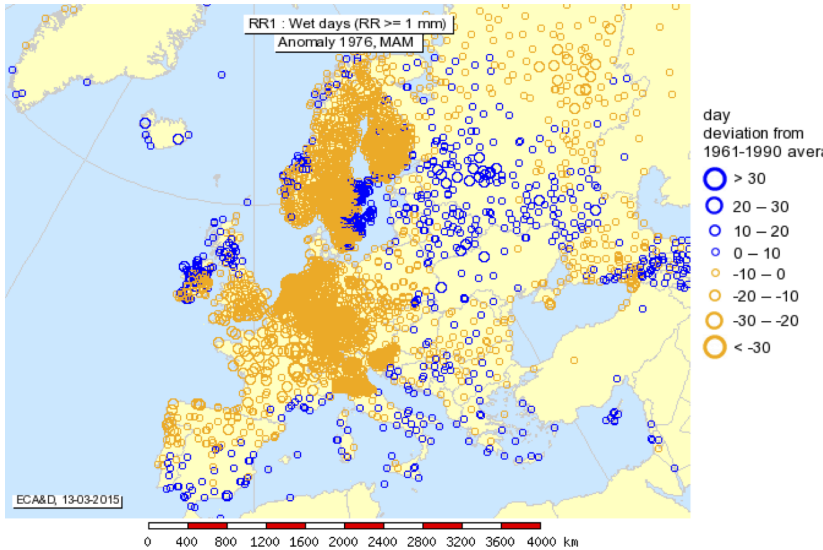


Trend (1979-2014) in maximum of daily maximum and minimum temperature (JJA)

ECA&D example on SPI & RR1mm anomaly

Descriptions of droughts, eg. 1976

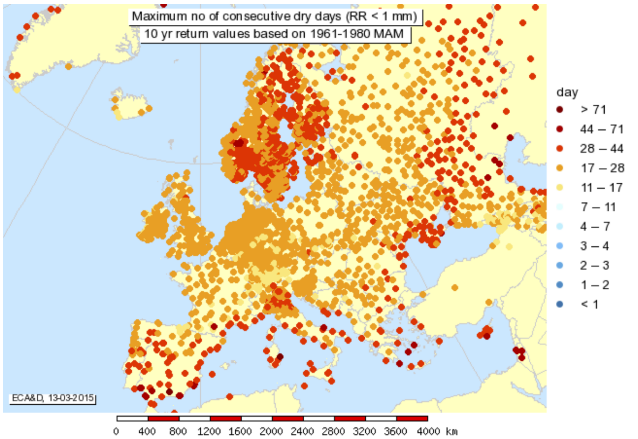




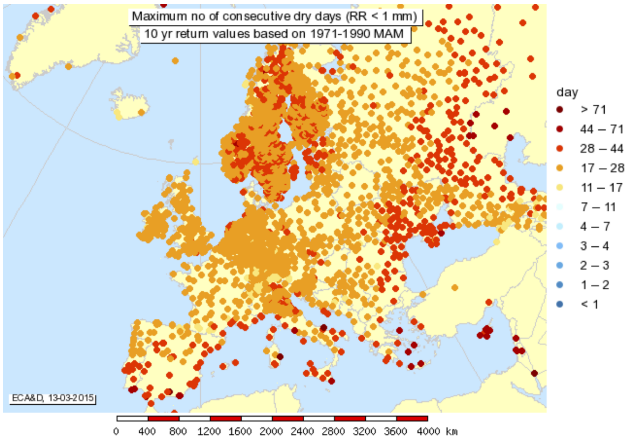
Combination of SPI-3 and anomalous number of rainy days (RR1)

ECA&D - return values

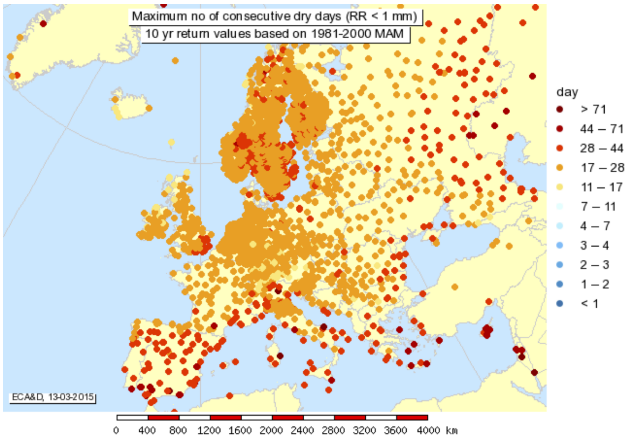
61-80



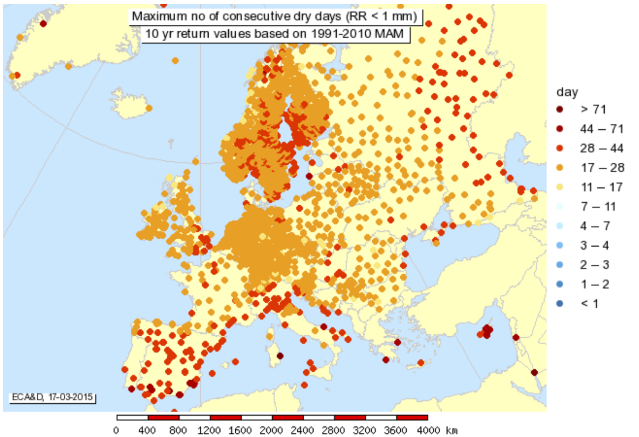
71-90



81-00



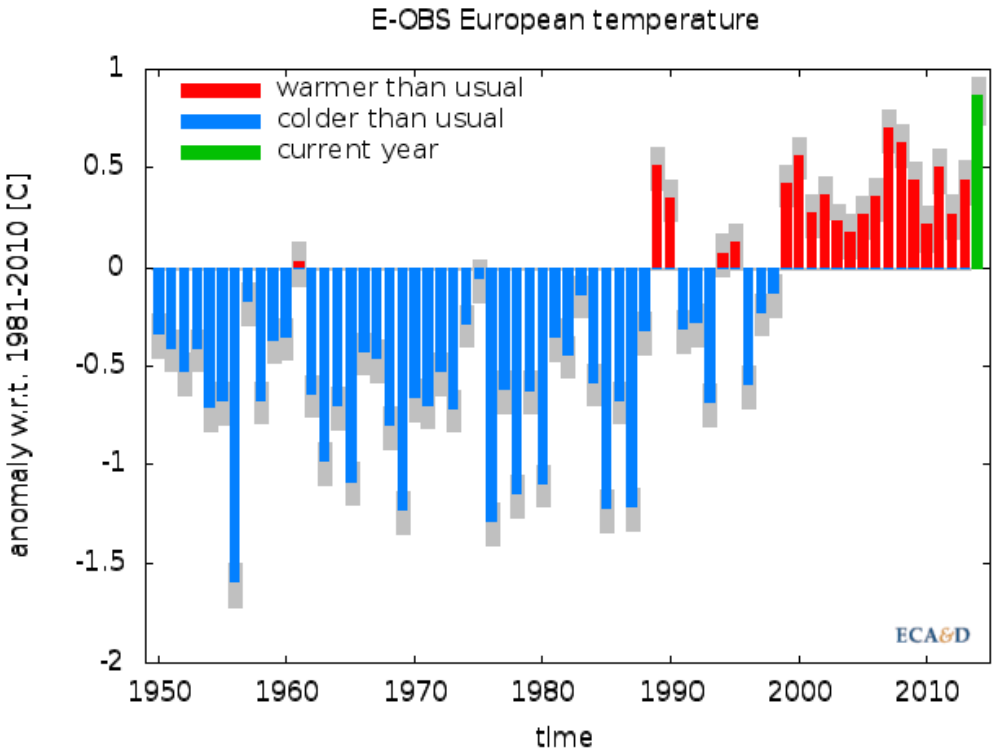
91-10



Changes in 10-yr return values for CDD in Spring

Climate Indicator Bulletins I

European average temperature

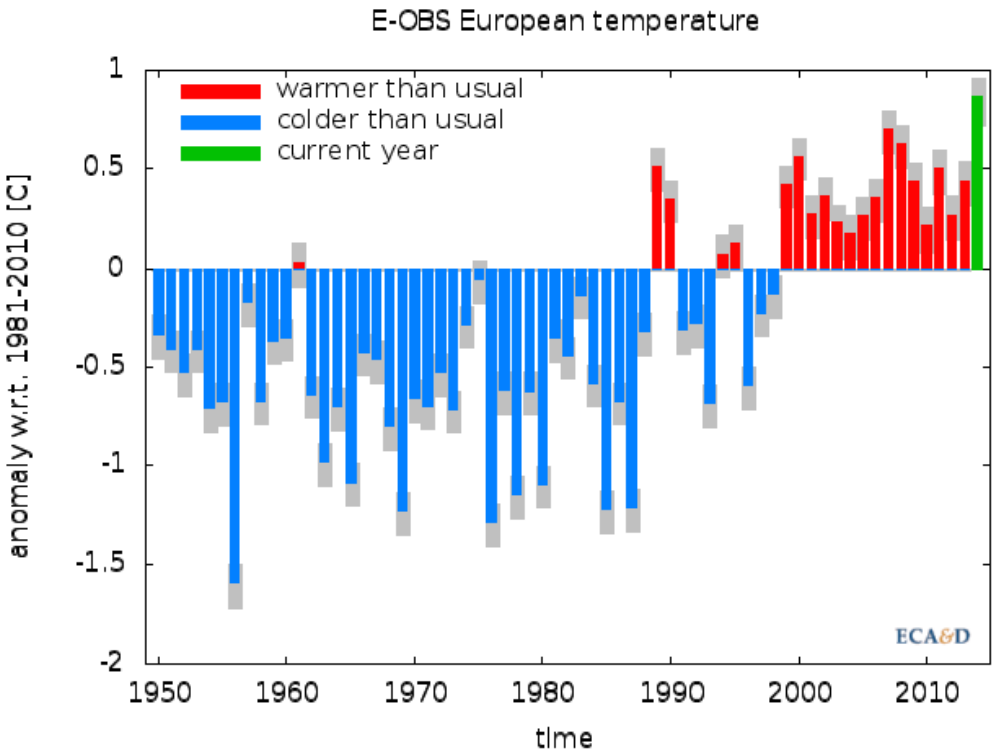


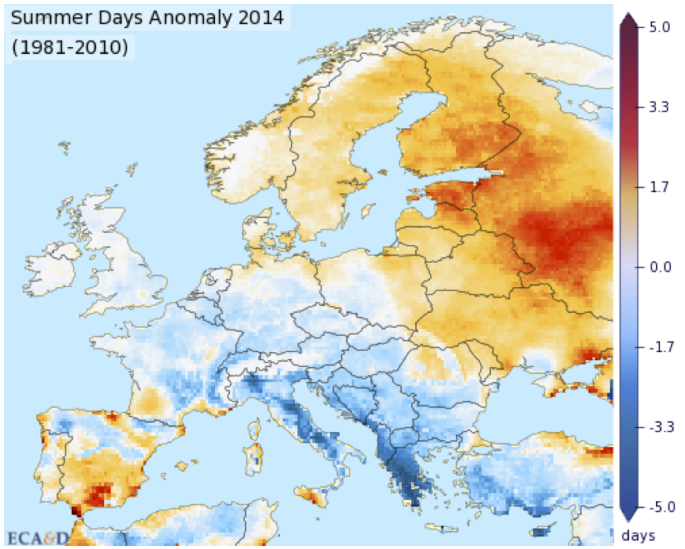
- 2014 warmest year on record
- *not* exceptional in terms of extremes

http://cib.knmi.nl, EURO4m

Climate Indicator Bulletins II

European average temperature



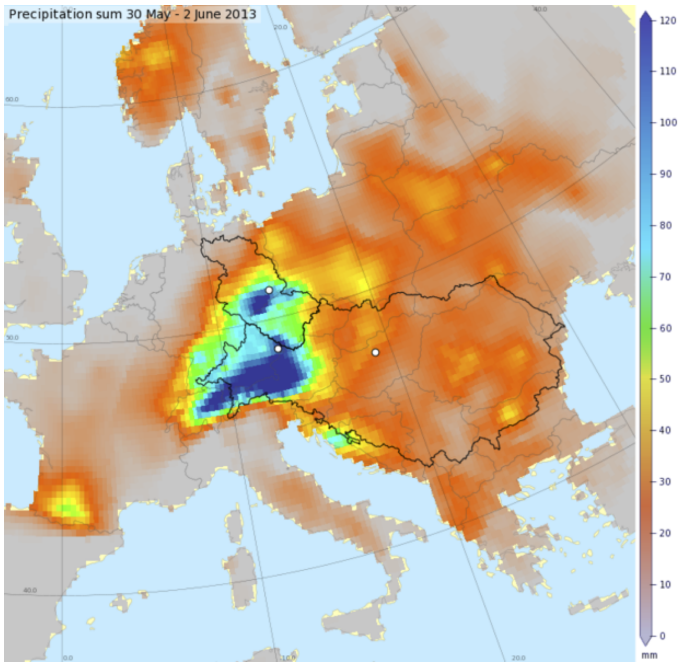


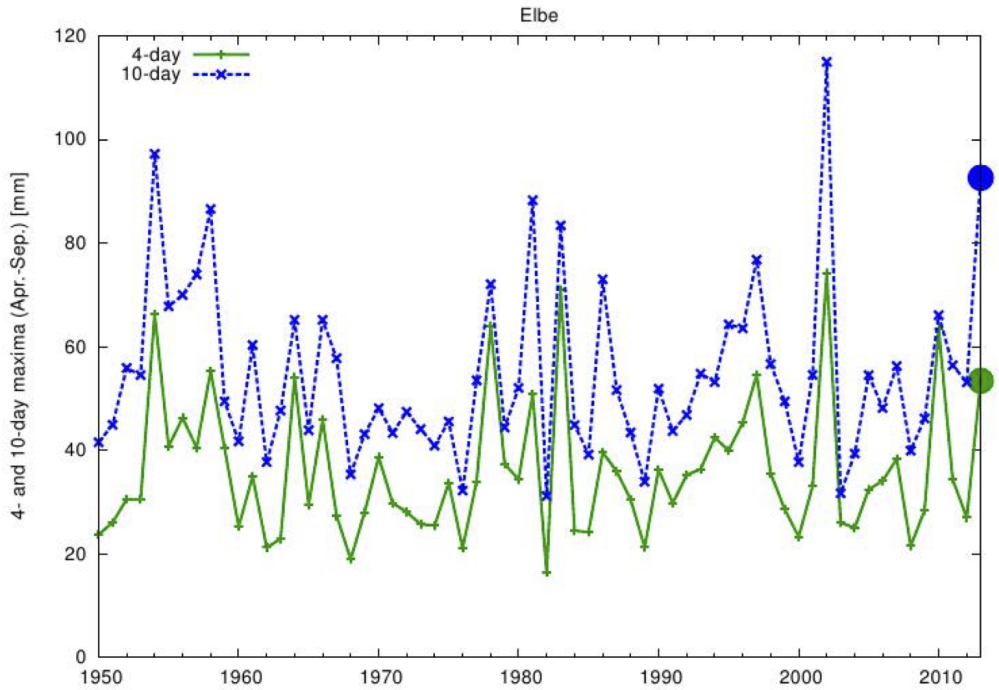
Number of Summer days (TX $\geq$ 25°C) *lower than usual*

http://cib.knmi.nl, EURO4m

Climate Indicator Bulletins III

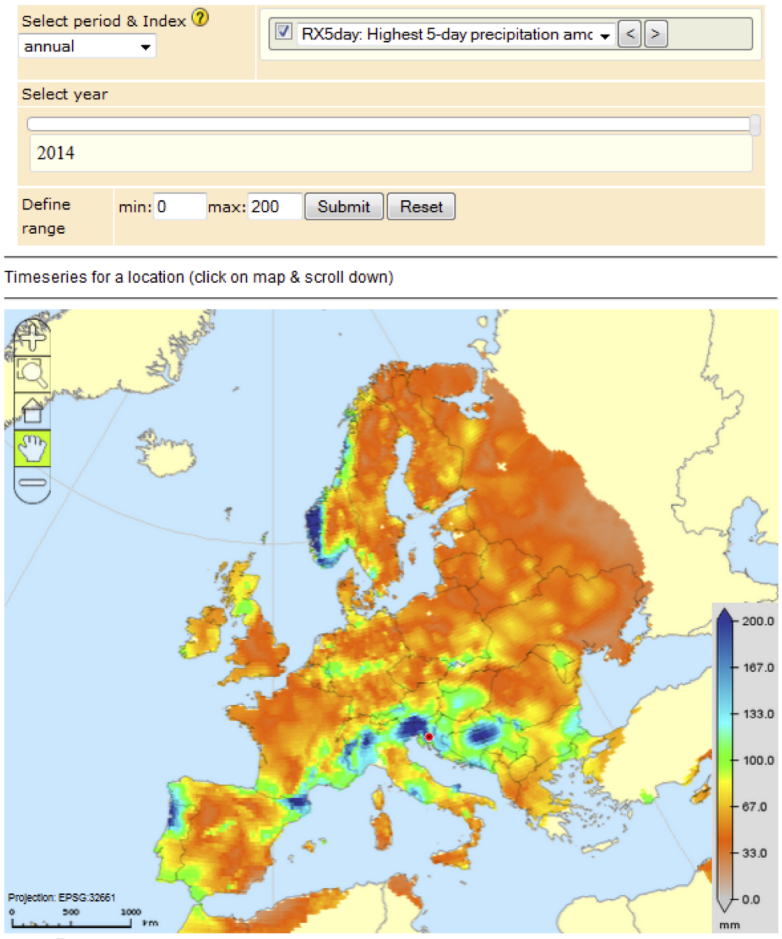
Central European flooding of 2013

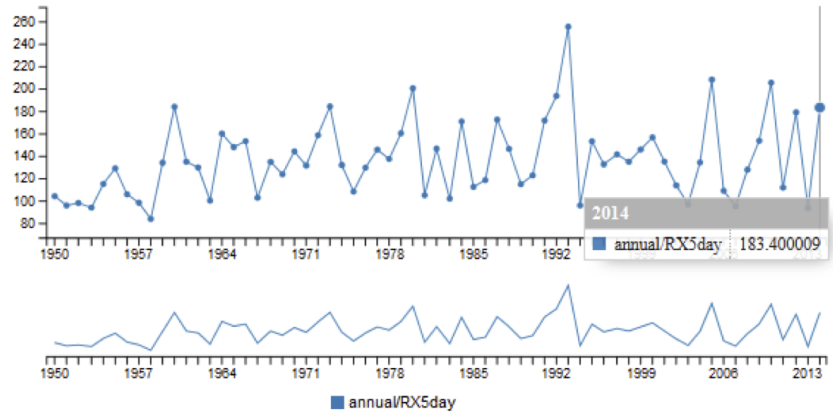




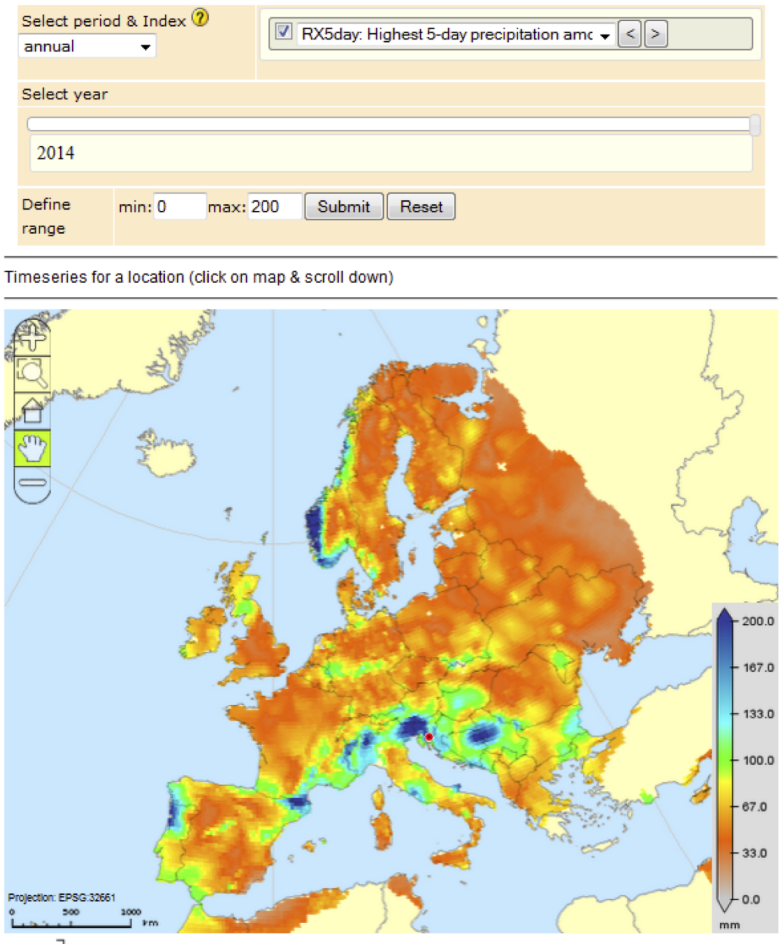
http://cib.knmi.nl

E-OBS v11.0 climate impact indices (CII)



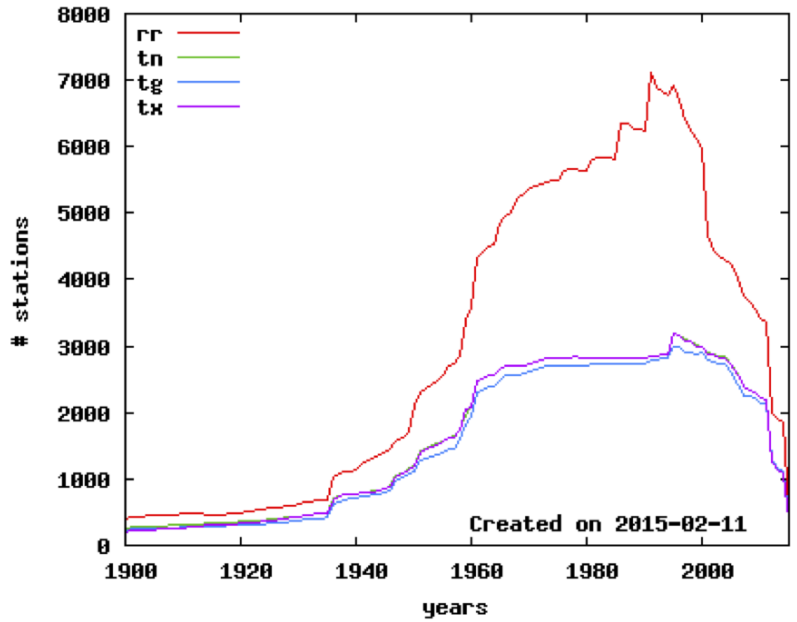


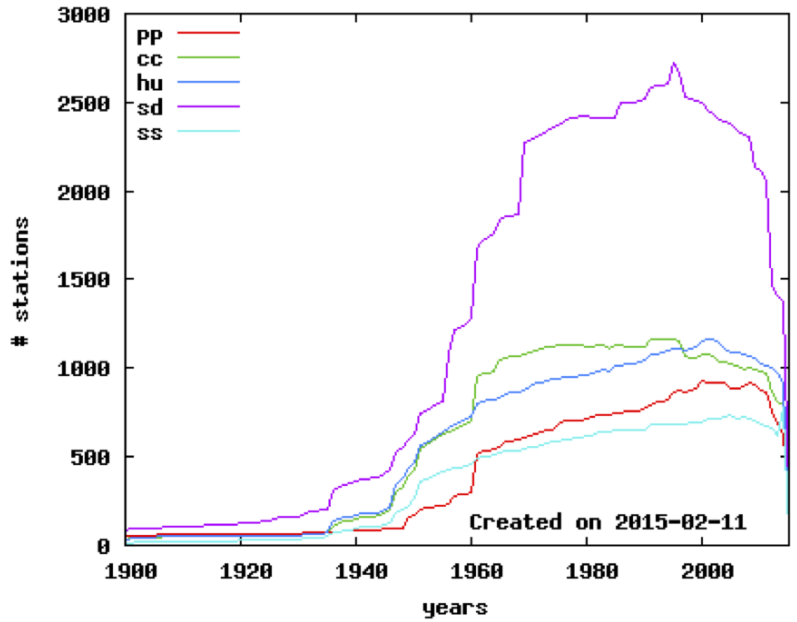
E-OBS v11.0 climate impact indices (CII)



- CII developed within EUPORIAS
- Extensive contribution together with MeteoSwiss to R packages climdex.pcic & climdex.pcic.ncdf developed by PCIC
- CII calculated using seasonal forecast
- Introducing uncertainties into the CII visualization

Monitoring requires access to data





- Monthly updates from cz, de, si, se, fi, ie, lu, no, ch, nl, pt
- Data updates are sometimes hard to get
- Although a trend towards a more liberal data policy is present, some countries provide a (very) small part of their network
- *Access to data and Getting it right are the hard parts*

New data contributions

- Meteorological Service of Catalonia - updates for 2015 and revised series for snow depth
- Sogrape S.A. (Portugal) now contributes data
- number of NMSs contributing monthly updates increases
  (cz, de, si, se, fi, ie, lu, no, ch, nl, pt)
- contacts with regional weather services in Italy
  (ARPA-SIMC, ARPA Valle d'Aosta)

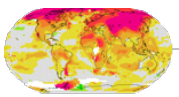
New developments

- start with homogenizing *daily* data in ECA&D
  EU-FP7 EUSTACE project
- daily updates of E-OBS on the basis of data from GTS
  provides input for near real-time attribution of extreme events (KNMI, University of Oxford, University of Melbourne and Australia National University)
- coupling of E-OBS to ECMWF seasonal forecast (EUPORIAS)
- 'continuous' updates of climate indices
- NMSs use ECA&D for providing ECMWF with daily & sub-daily monthly deliveries to be used for their forecast verification program.
- development of existing griding techniques to improve the high resolution of E-OBS and make it more suitable for high resolution model validation, important for hydrological impact studies (EUPORIAS, UERRA)

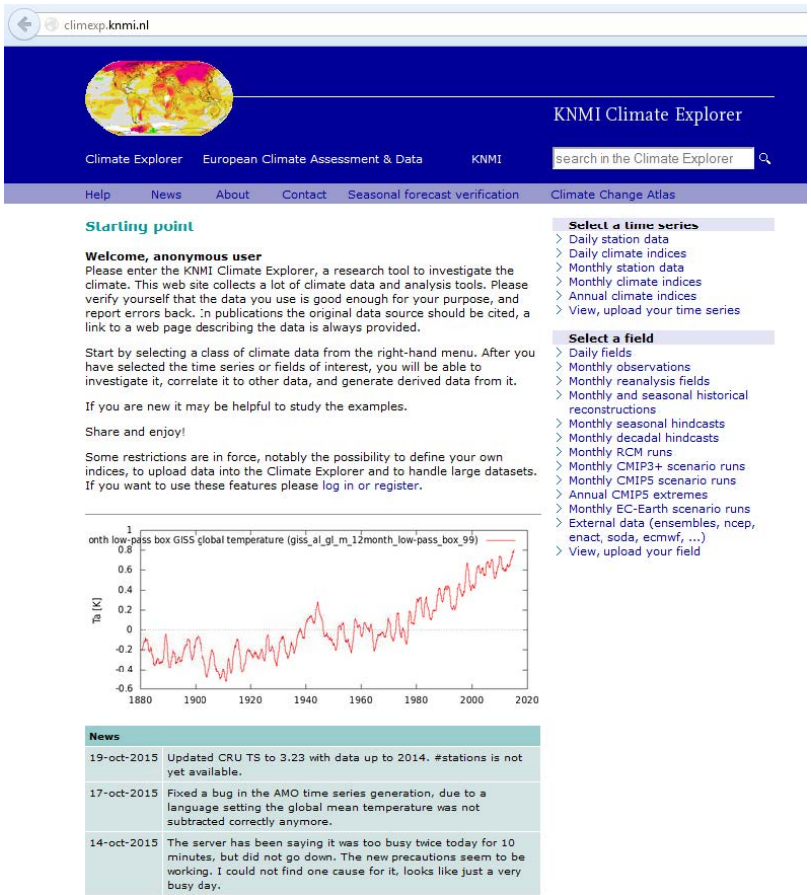
Climate explorer

Climate Explorer

- Developed and maintained by Geert Jan van Oldenborgh at KNMI.
- Setup in the late 1990s to analyse the teleconnections from the big El Niño event in 1997-98
- Essentially a website with a lot of data & progrmas for statistical analysis behind it:
  - hosts data for easy access to user
  - allows users to search for a given dataset and download direct from source
- designed to make sense of all data



Climate Explorer



- Upload your own time series / fields.
- Make EOFs.
- Calculate extremes
- Download data in different formats (inc netCDF) for your analysis
- Create and download your own figures (.png, .eps)
- a tool for seasonal predictions and skill scores
- email support...also for reporting bugs!
- hands-on tutorial by Jonathan Eden

climate4impact.eu

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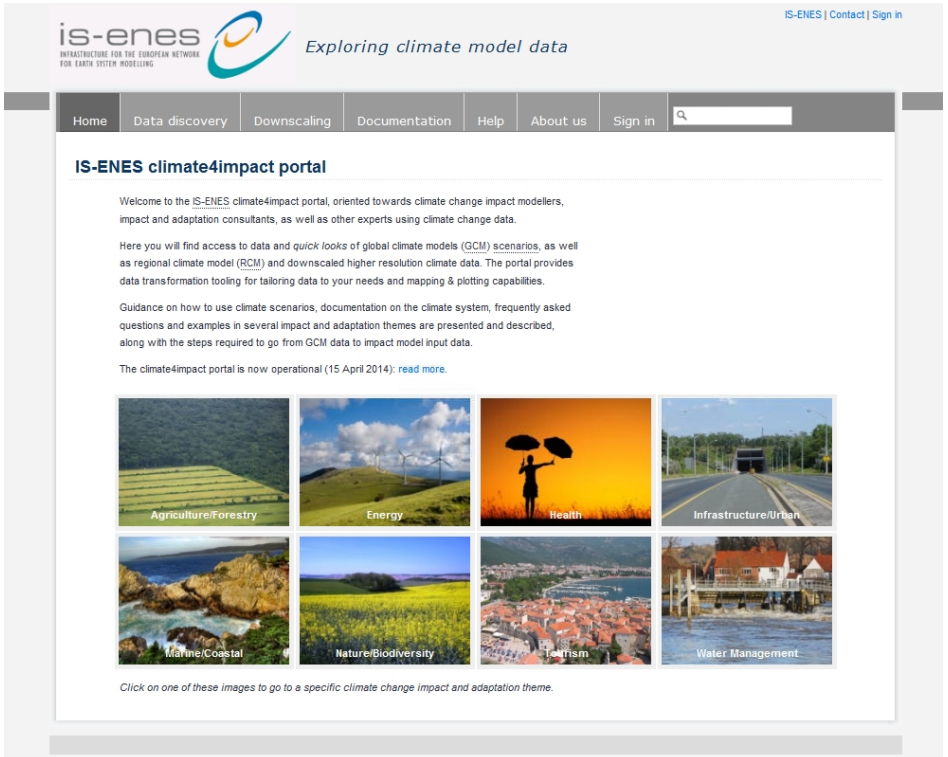
- Climate Information Platform for Copernicus
- Bridging CMIP5 and CORDEX data infrastructure to impact users
- CERFACS, KNMI, University of Cantabria, SMHI, Wageningen University, CMCC, STFC, IPSL
- Platform for impact researchers to explore climate data and perform analysis
- Current phase in IS-ENES2 project: Implementing real use cases from impact researchers
- requires registration



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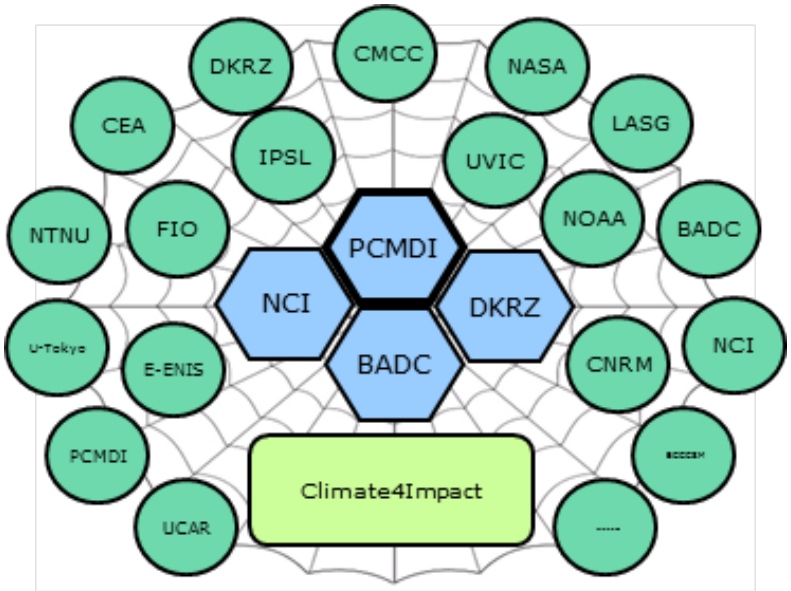
- Search ESGF infrastr. (CMIP5 / CORDEX) climate4impact builds on and contributes to this global infrastructure
- Visualize ESGF data -using ADAGUC Web Map Services
- Downscaling - University of Cantabria



- Perform calculations / process data:
  PyWPS & ICCLIM
  Climate indices calculation and data reduction
  Personal store for processing outcomes

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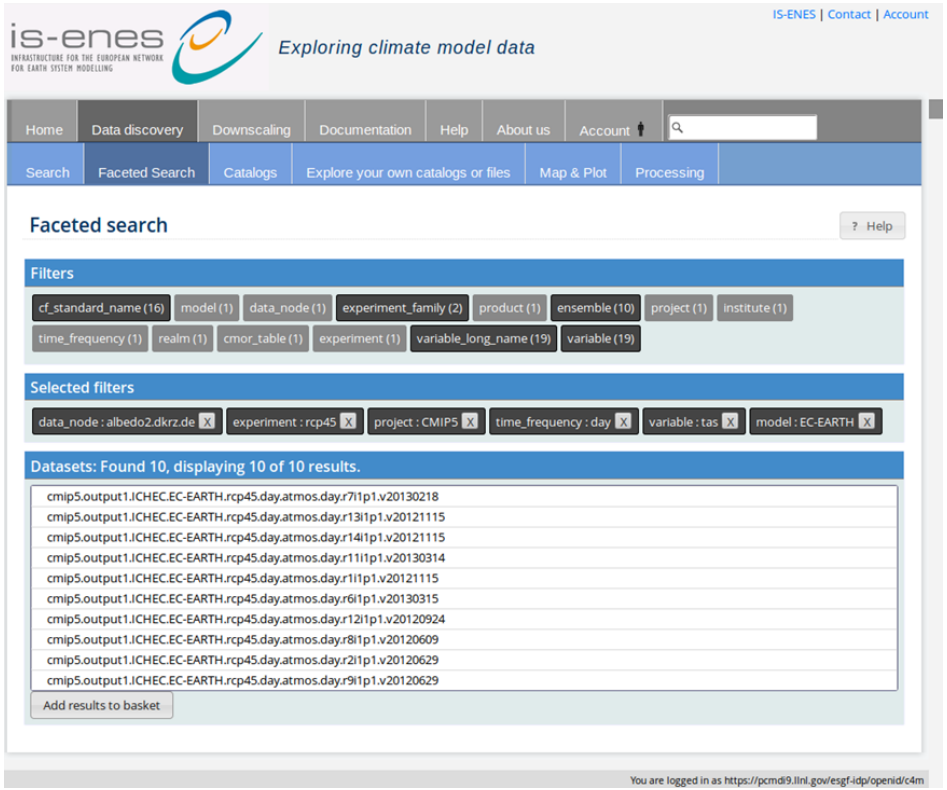
- New faceted search
- Faceted search allows to drill down search results using available filters in the federation
- Results from a search query are treated as a new dataset



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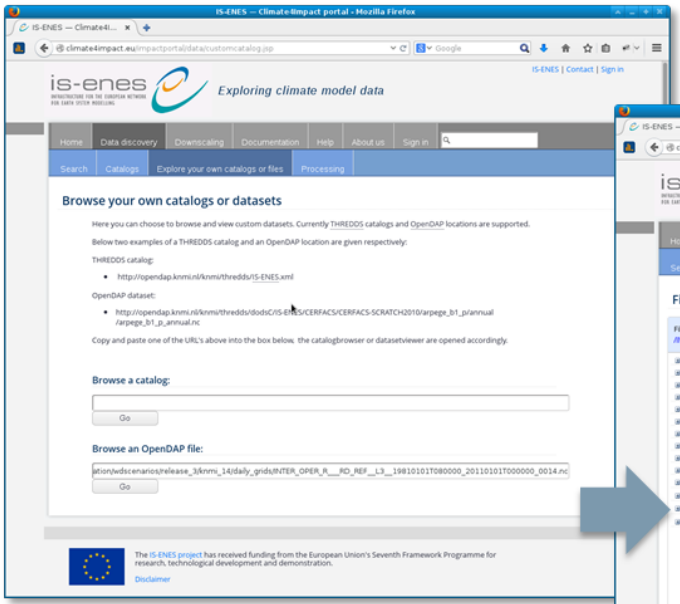
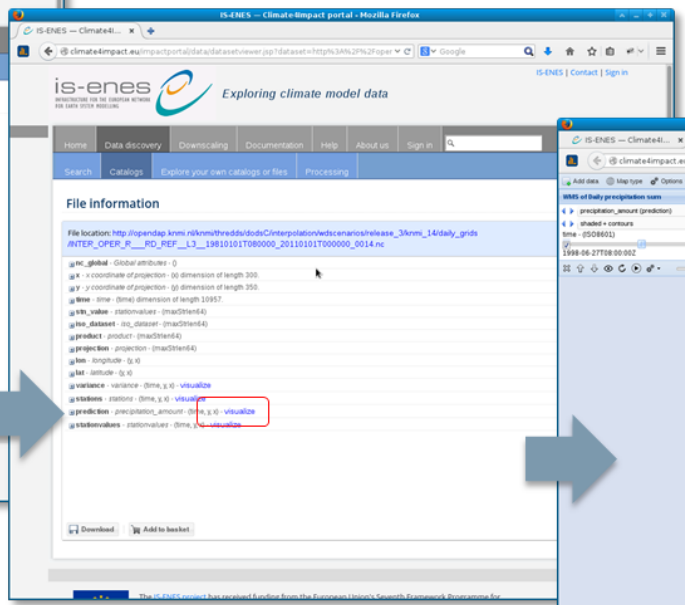
Web Map Services based on OPENDAP resources

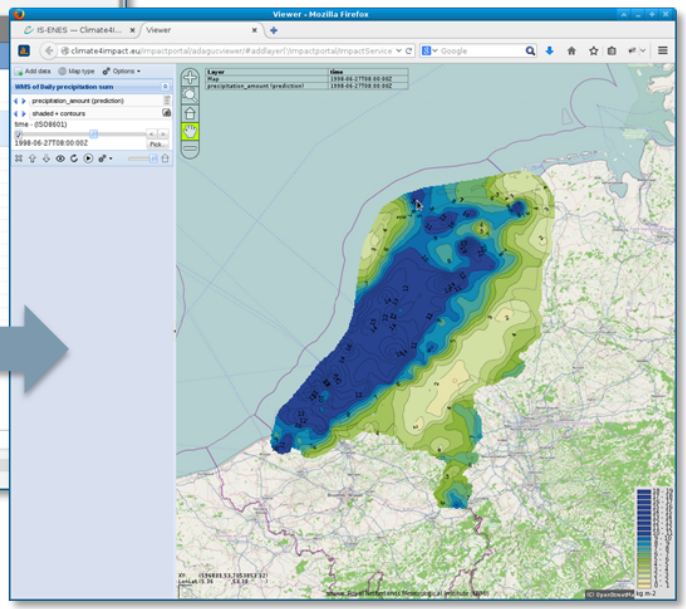
climate4impact.eu allows for creation of WMS visualizations on OPENDAP endpoints:



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



Metadata with variables to be visualized is displayed



ADAGUC viewer displaying the WMS

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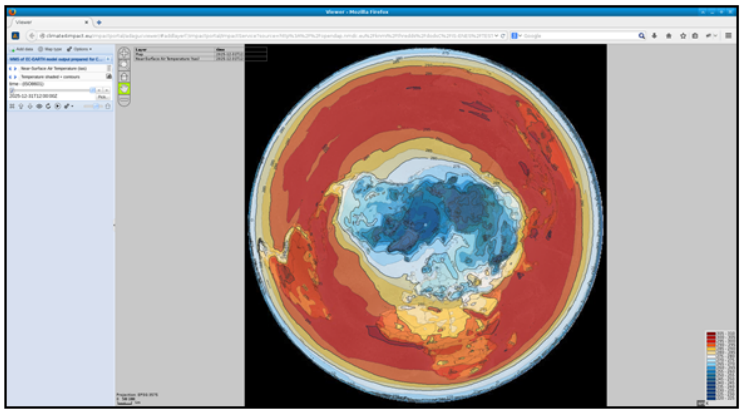
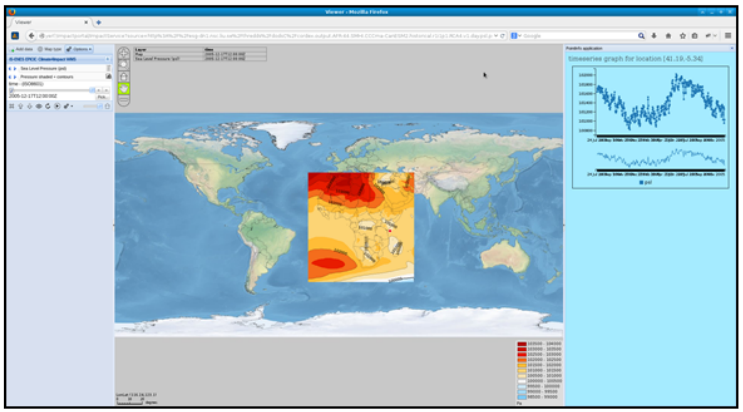
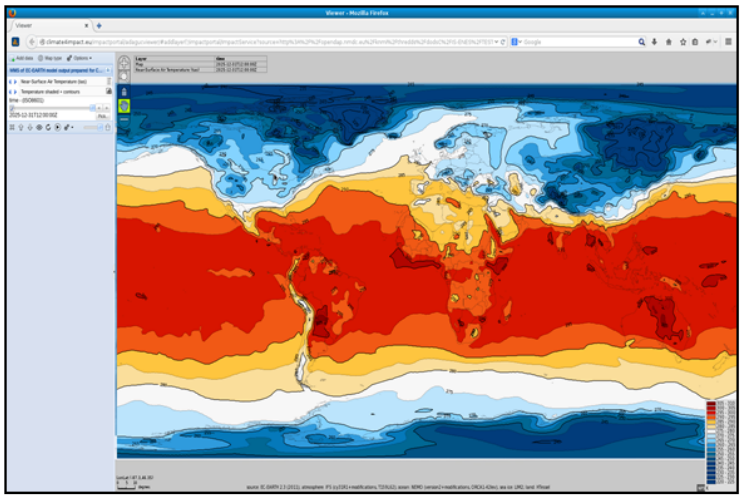
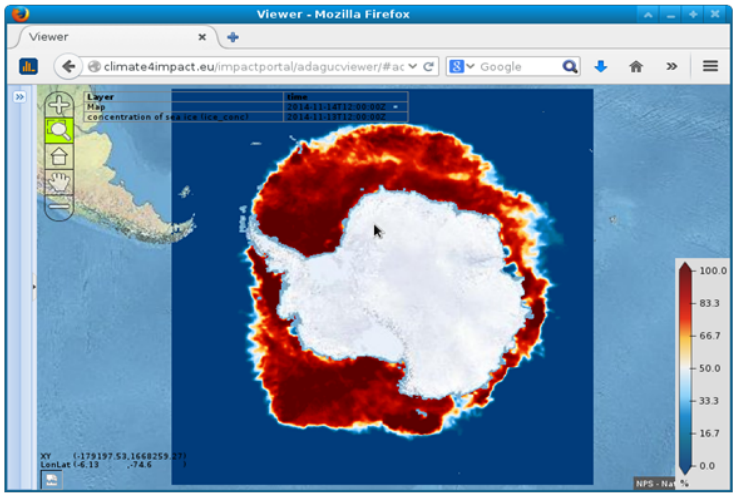
is-enes
INFRASTRUCTURE FOR THE EUROPEAN NETWORK FOR EARTH SYSTEM MODELLING

Visualization of remote and local resources









CMIP5 - global climate models

CORDEX - regional climate models

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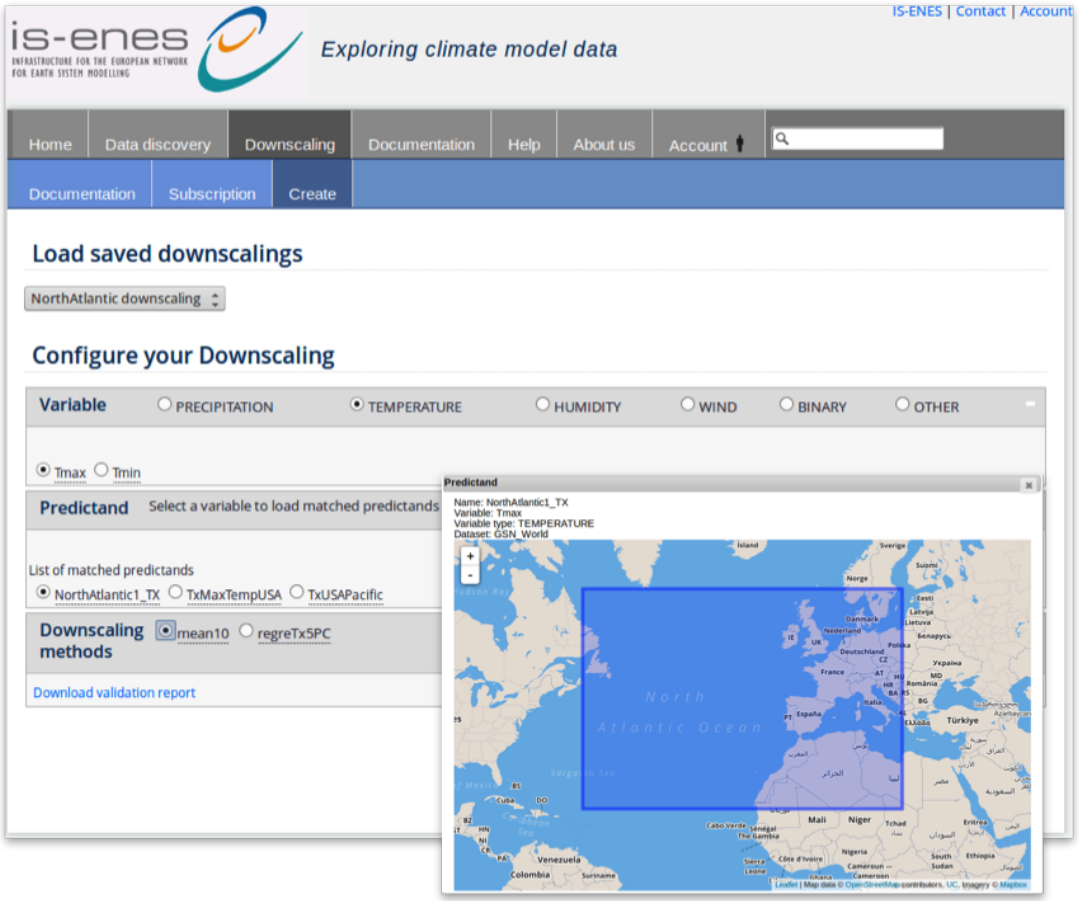
On-demand calculations: statistical downscaling & climate indices

- C4I Statistical downscaling
  - Services provided by Uni. of Cantabria serves
  - Friendly user interface on C4II
- C4I Climate indices
  - All ETCCDI indices & simple statistics available
  - High performance icclim software (fully validated against climdex.pcic)
  - Currently expanded to climate indicators as well (CLIPC)



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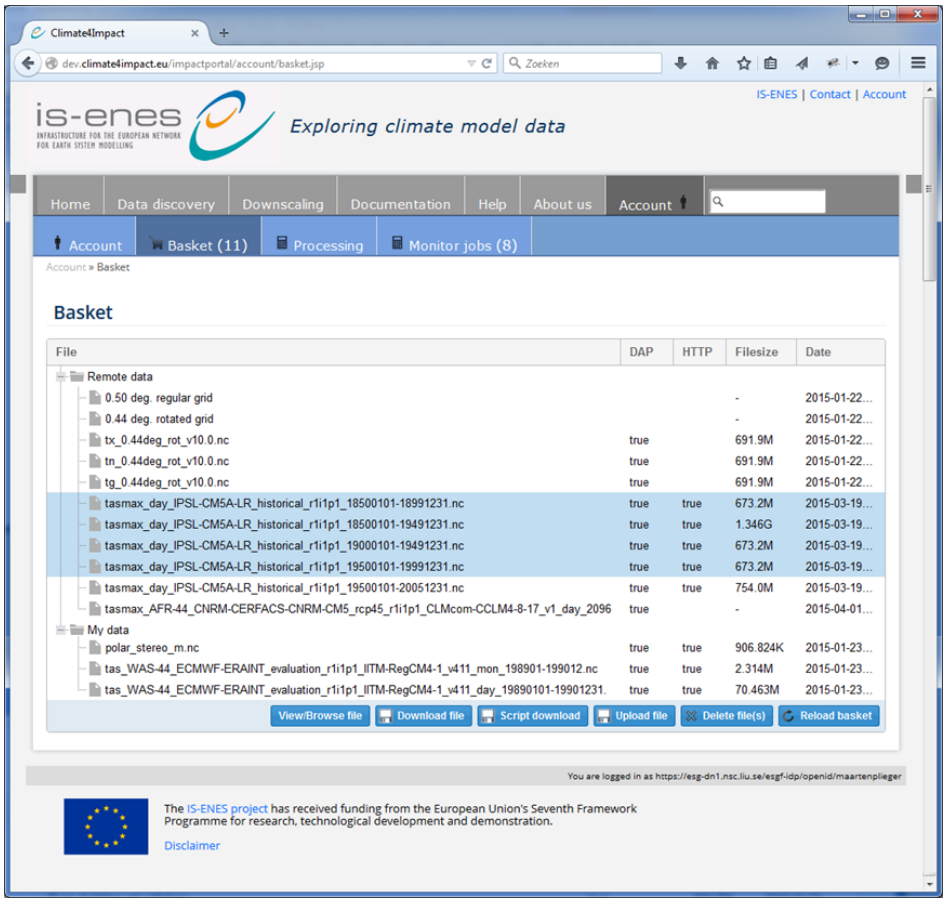
Download

- By default the basket contains
  - “Remote”data for links
  - “My data”for your own data
- Script for downloading & selecting multiple files
- Client certificate (x509) is embedded in download script
  - no need for MyProxy login
  - no need for firewall changes
- The basket allows for uploading your own files
  - can be used in processing or visualization



Info

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LACA&D:
http://lacad.ciifen.org, laca@ciifen.org

SACA&D:
http://sacad.database.bmkg.go.id/, sacad.database@bmkg.go.id

ICA&D:
http://www.ecad.eu/icad.php

Climate explorer
climexp.knmi.nl

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