



# UERRA Visualization

WEBSERVICES @ KNMI – UERRA GA 2016, TOULOUSE, FR

ADAGUC WEB-BASED VISUALIZATION

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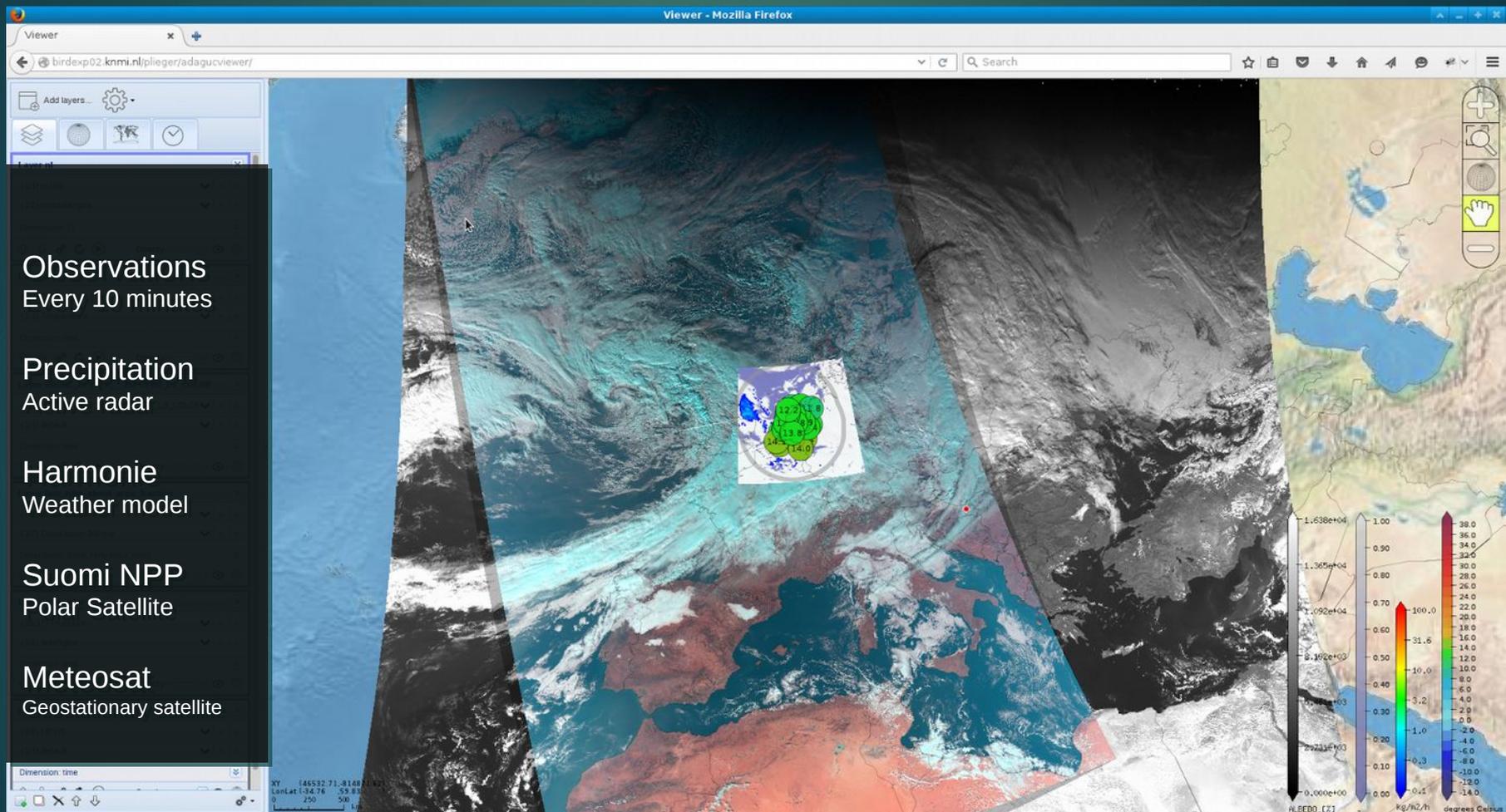


# Visualization - Web Map Services - ESGF

- ▶ Meteorological and climatological data
- ▶ ADAGUC
- ▶ WMS and WCS
- ▶ Combine data
- ▶ Data Formats and Styling
- ▶ ESGF
- ▶ Climate4Impact
- ▶ UERRA



# Satellite, radar, model & observation





# Tools for mapping □ ADAGUC

- ▶ ADAGUC – KNMI development since 2009
  - ▶ Serves OPeNDAP, WMS and WCS
  - ▶ Server (C++) and Viewer (JS) decoupled using WMS standard
  - ▶ Data in NetCDF format
  - ▶ AutoWMS mode – Automatic reading of new data
  - ▶ Combines multiple sources into a single WMS layer
  - ▶ Precipitation radar is publicly available as WMS, data since 2009, new data each 5 minutes, ~70000 timesteps, fast!



<http://adaguc.knmi.nl/>  
(open source + wiki)

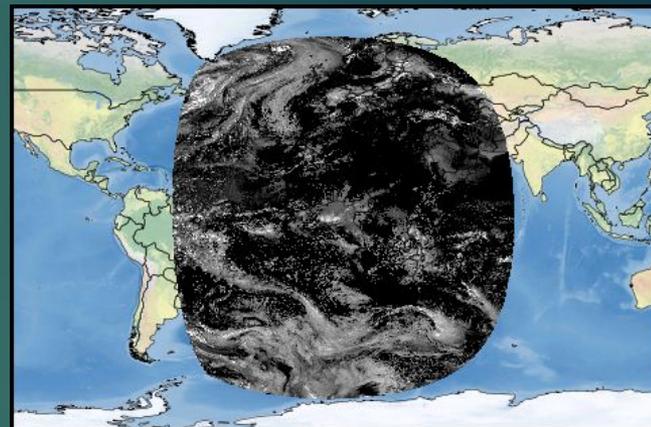
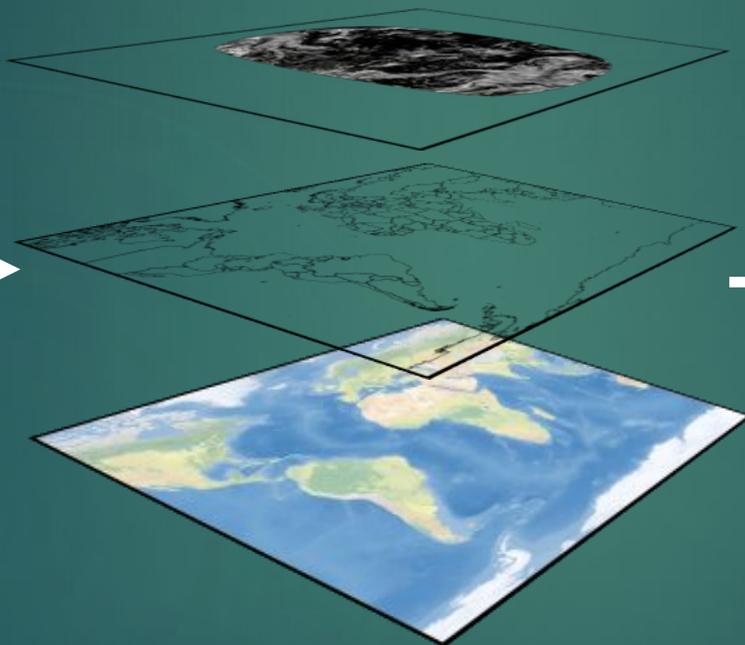
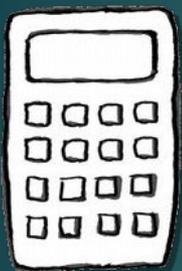


# Web Map Services

From data to image



+



NetCDF Data  
(big, 5.5Gb)

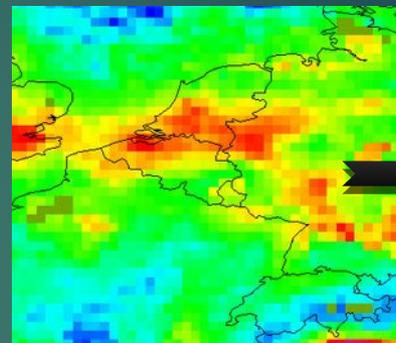
PNG images  
(small, 180Kb)

Combined  
geographically



# Web Coverage Services for data

- Download what you see
- Convert to ASCII, Geotiff
- Reproject and subset
- Use WCS directly in your script!
  - R
  - Python
  - Matlab
- Supports time, elevation, ...
- WCS client in viewer



83	51	68	50	67	68	58	51	55	74	72	60	10	75	65	50	14
24	25	16	52	51	61	15	11	36	16	16	51	52	55	72	38	38
13	10	52	56	43	65	39	35	37	15	16	13	35	41	32	34	43
61	51	54	77	81	61	39	34	54	51	54	40	17	24	35	34	9
61	55	43	39	40	40	31	17	19	16	39	41	27	7	3	15	22
41	46	50	54	41	17	30	29	47	40	50	57	77	27	27	27	27
33	11	51	70	72	38	36	33	33	73	11	36	40	57	51	10	35
63	17	36	48	15	37	15	17	11	12	35	36	27	33	42	38	33
15	41	36	44	43	35	41	47	43	42	40	31	43	47	43	42	33
33	44	32	43	52	52	52	48	35	41	31	23	26	33	35	36	33
33	36	32	34	34	35	48	42	32	25	21	30	39	16	32	45	45
17	10	44	47	40	41	19	27	27	22	22	26	47	67	70	35	29
36	40	40	41	40	40	44	47	44	42	29	41	20	34	29	27	27
28	38	11	37	11	11	30	38	11	6	33	38	10	51	16	35	28
47	42	44	43	42	34	31	37	36	41	35	33	44	47	47	46	46
17	30	26	31	40	31	23	30	32	43	48	44	45	41	23	26	40
33	40	44	39	36	39	26	36	46	46	50	44	30	31	32	27	20
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49	10	10	41	47	17	42	45	14	71	80	14	25	77	19	16	66
77	71	35	20	36	51	15	38	37	51	37	18	12	19	33	27	30
47	45	46	35	23	21	42	39	56	54	34	33	34	49	39	40	33
40	35	48	48	32	12	24	38	49	54	43	35	32	35	45	43	31

The screenshot shows the ADAGUC web viewer interface in Mozilla Firefox. The main content area displays metadata for a coverage service:

- Coverage:** atmosphere\_optical\_thickness\_due\_to\_cloud
- Title:** Cloud optical thickness (1)
- Description:** atmosphere\_optical\_thickness\_due\_to\_cloud
- Coordinate reference system:** NSDC Sea Ice Polar Stereographic North, NSDC Sea Ice Polar Stereographic South, Lambert azimuthal equal-area projection Europe, Mercator, EPSG:3395, EPSG:3396, EPSG:4258, WorldLat lon WGS84, EPSG:4326, EPSG:25831, EPSG:25832, EPSG:25892, EPSG:32661, EPSG:32660, EPSG:900913, Viewer window projection and area, EPSG:4326
- Area / Bounding box:** Top: 82, Bottom: -82, West: -80, East: 80
- Dimensions:** time: 2015-06-15T15:00Z
- Grid properties:** Cell size, X resolution: 0.0431034, Y resolution: 0.044181C, Plaster size
- Formats:** GeoTIFF, AAGRD, NetCDF3, NetCDF4

At the bottom, there is a "GetCoverage request link" with a URL: [http://mscapp-zac.nsltime.knmi.nl/mscapp/38SEPVICE/38C28FQUEST/GetCoverage?COVERAGE=atmosphere\\_optical\\_thickness\\_due\\_to\\_cloud&CPS=EPSG:34432&FORMAT=AAGRD&BOX=-80,82,80,82&PCS=0.0431034,0.044181C&TIME=2015-06-15T15:00Z](http://mscapp-zac.nsltime.knmi.nl/mscapp/38SEPVICE/38C28FQUEST/GetCoverage?COVERAGE=atmosphere_optical_thickness_due_to_cloud&CPS=EPSG:34432&FORMAT=AAGRD&BOX=-80,82,80,82&PCS=0.0431034,0.044181C&TIME=2015-06-15T15:00Z)



# Combine different sources

Share research results

Share data via internal network

Web Map Services on all workstations

Experiment with data without interfering operational systems

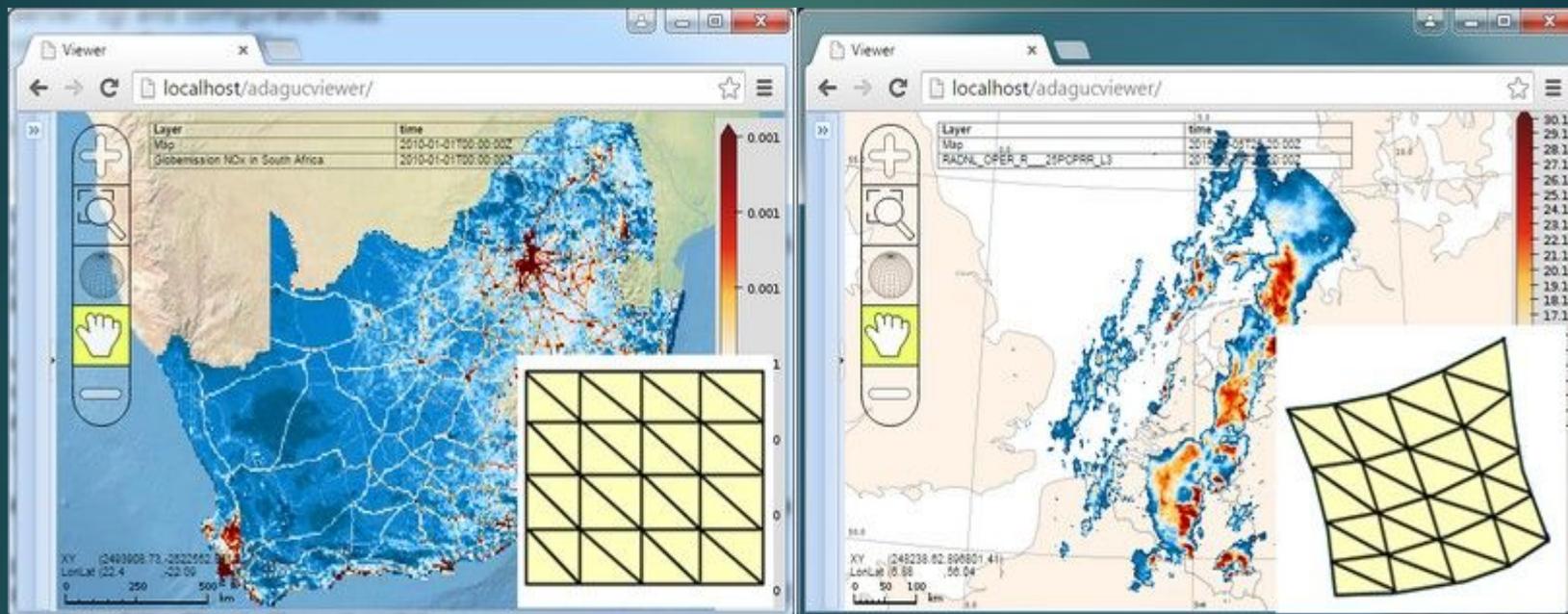
Precipitation radar  
Every 5 minutes



Observations  
Every 10 minutes



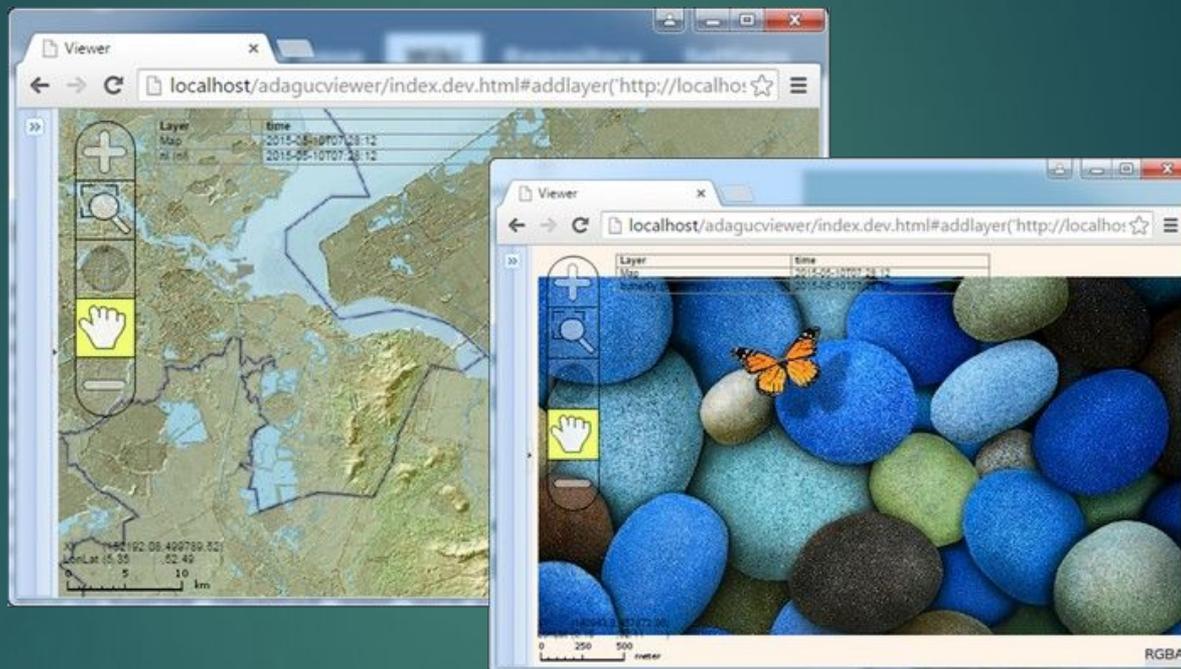
# Data : structured grids



- ▶ Structured grids - Model/satellite/radar
  - ▶ Lat/lon and projected data
  - ▶ Regular grids



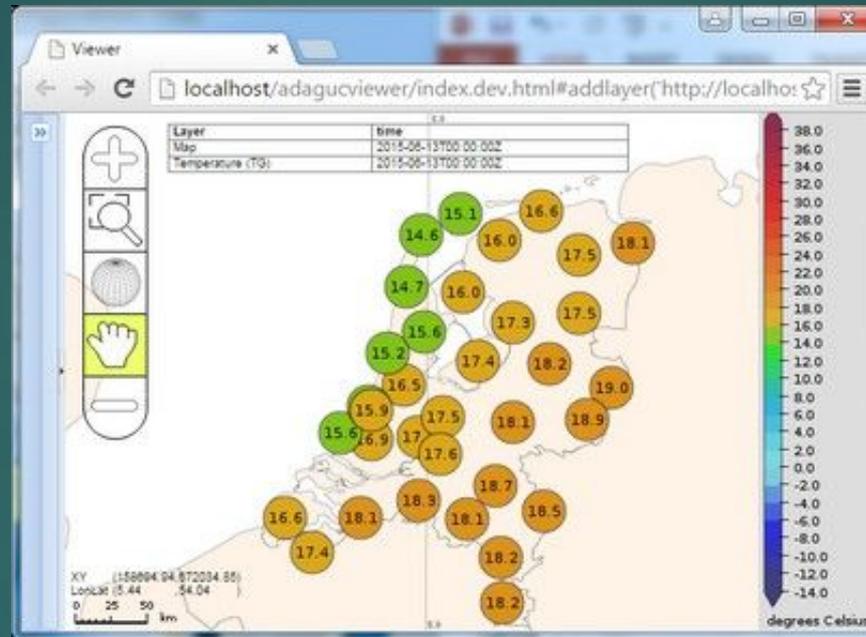
# Data : Georeferenced Pictures



- ▶ True color data (RGBA)
  - ▶ Background maps, meteorological maps, composites,
  - ▶ 4 channels, red, green, blue and alpha – 8 bits per channel = 32bits pp



# Data : Point measurements / observations

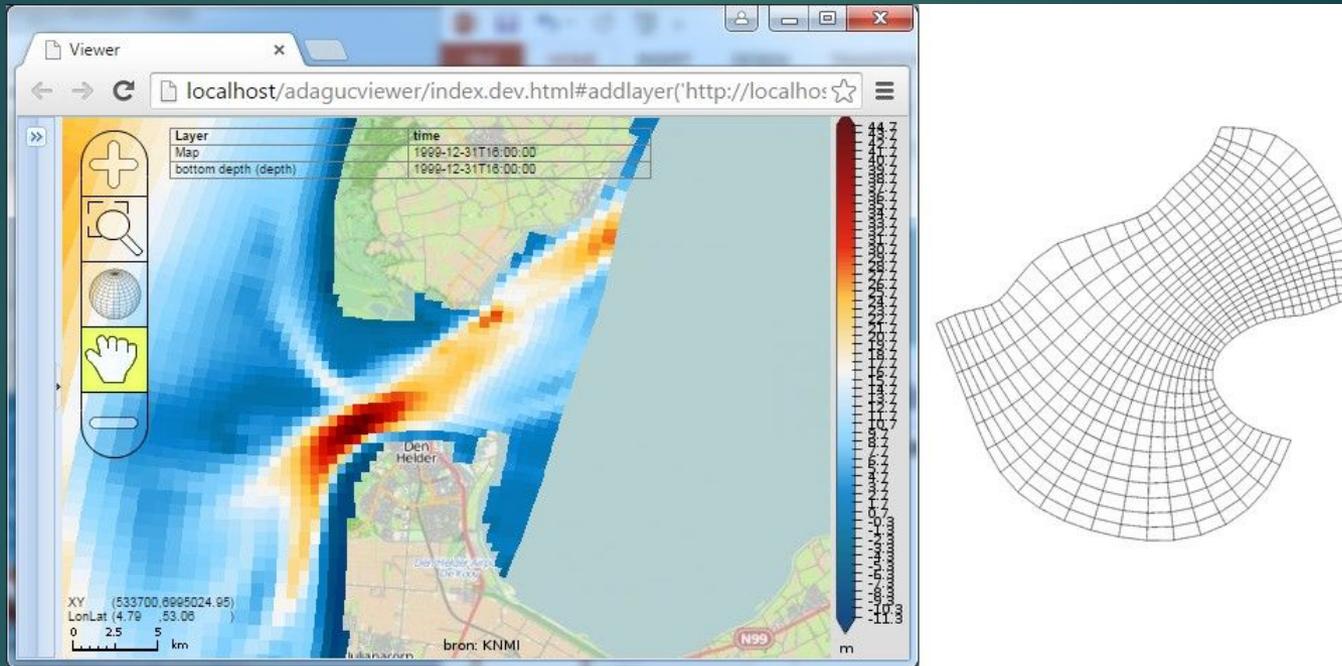


## ► Point data / timeseries

- Measurements from automated weather stations, timeseries
- Seismological measurements



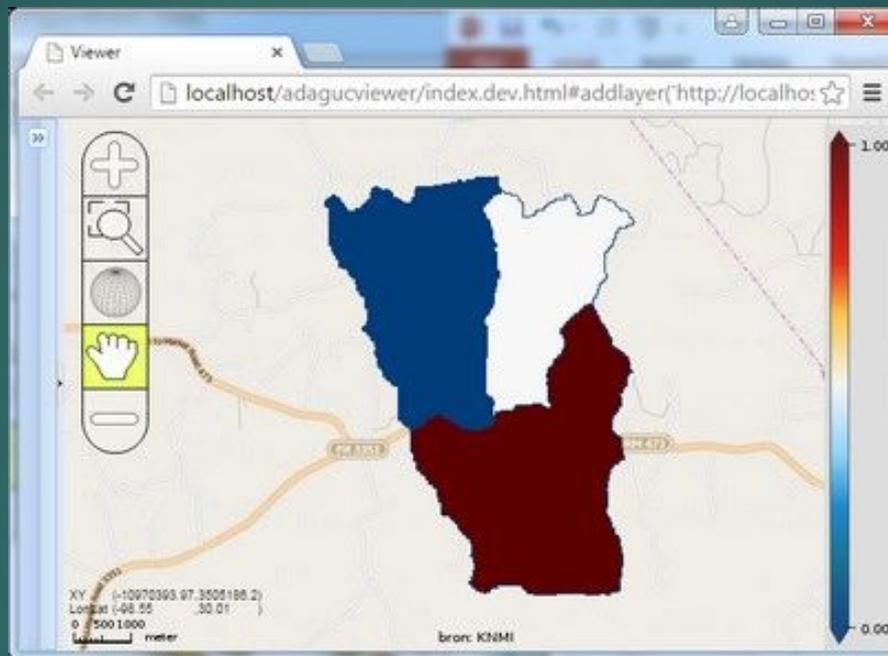
# Data : Curvilinear data



- ▶ Curvilinear data – Models
  - ▶ Fluid mechanics
  - ▶ Quads are linked with irregular shape and size



# Data : Unstructured grids – UGRID

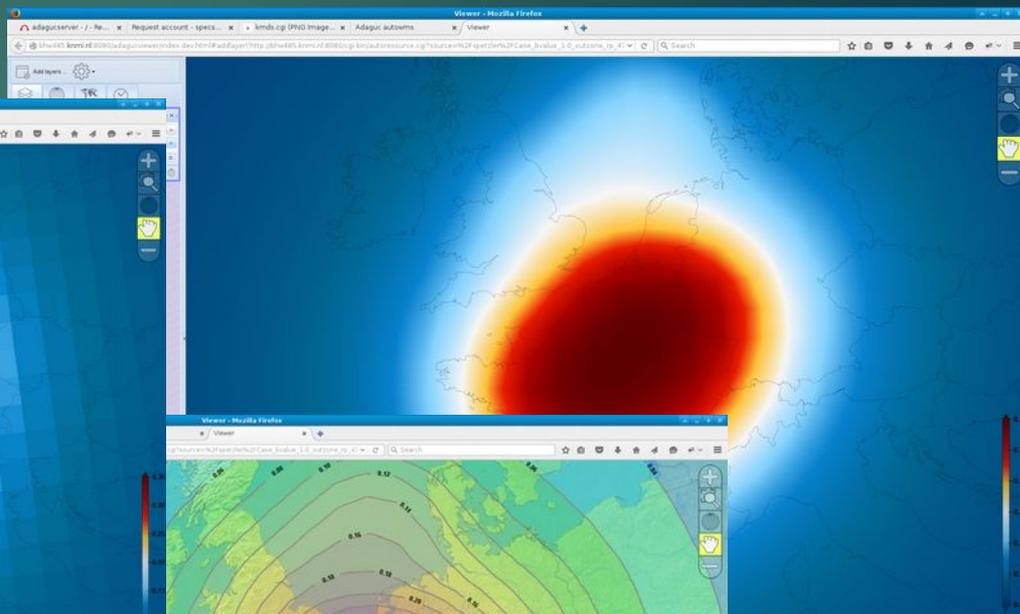
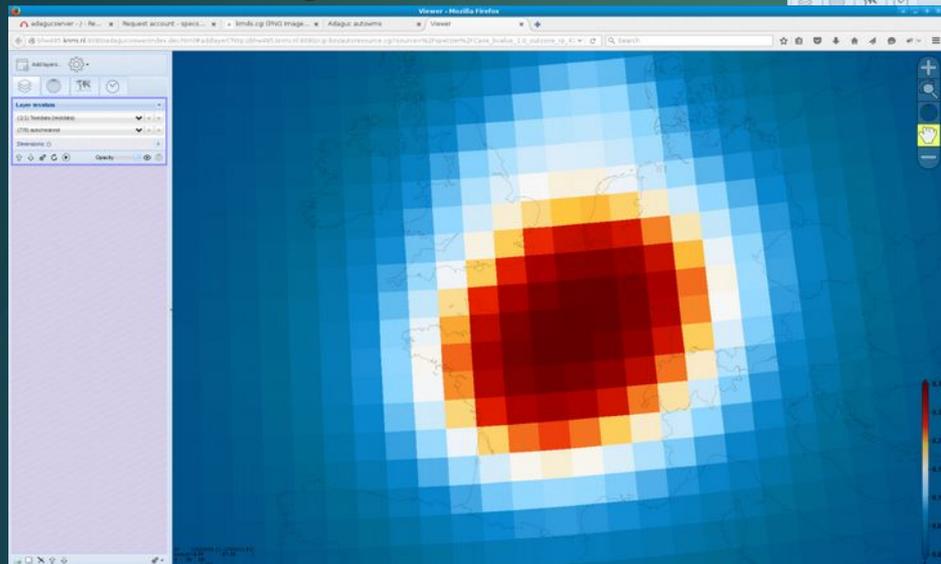


- ▶ Unstructured grids according the UGRID convention
  - ▶ Land boundaries, river catchments, masks,
  - ▶ Data stored as mesh: lines and polygons



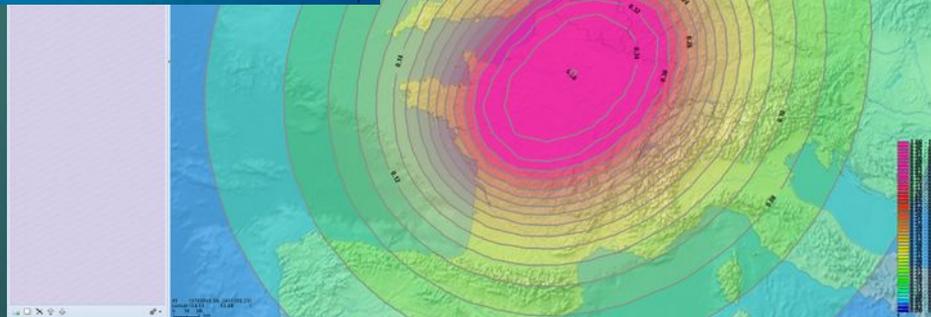
# Nearest neighbor, bilinear and contour

Nearest neighbour



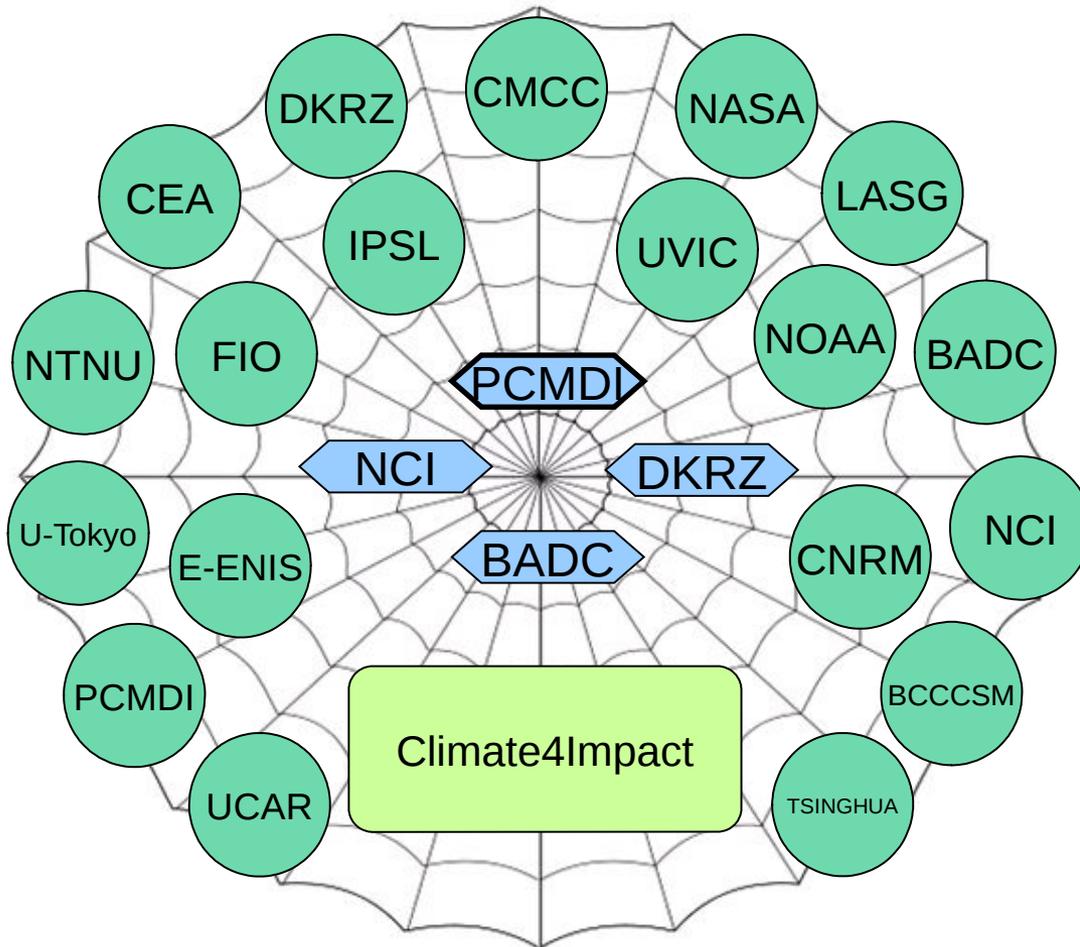
Bilinear

Shading + Contours





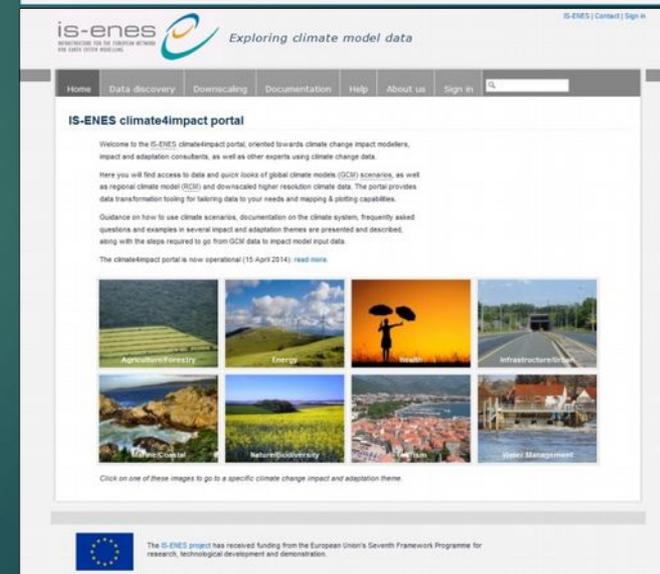
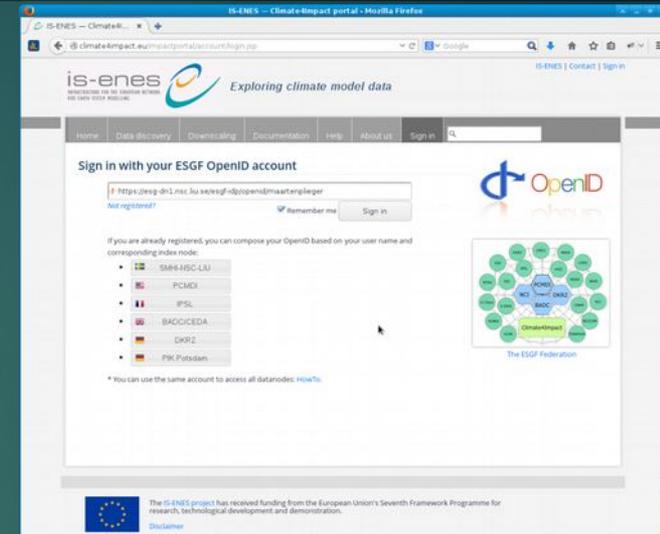
# Earth System Grid Federation



- Robust and distributed
- Global Climate Model Data (CMIP5)
- Regional Climate Model Data (CORDEX)
- ~3 Petabyte of data
- **Search API**
- **OpenDAP data access**
- **THREDDS Catalogs**
  
- Climate4Impact builds on and contributes to this global infrastructure
- KNMI is installing a data node for UERRA



- ▶ Platform for impact researchers to explore climate data and perform analysis
- ▶ Searches ESGF using search API
- ▶ Visualizes ESGF data using OpenDAP
- ▶ Uses ADAGUC WMS visualization
- ▶ Perform calculations
  - ▶ Climate indices calculation, data reduction
  - ▶ Personal store for processing outcomes
  - ▶ Upload and store your own data





# For UERRA datasets



- ▶ KNMI can help setting up visualization services
  - ▶ Serve your data via OpenDAP – Install THREDDS
  - ▶ Install ADAGUC server at institute
  - ▶ Make your data available through ESGF
    - ▶ fixed data format and conform to strict standard
- ▶ KNMI is installing an ESGF data node for UERRA
  - ▶ Available June 2016
- ▶ Climate4Impact uses ESGF
  - ▶ Visualizes OpenDAP resources and WMS services
- ▶ Automatic WMS on files is available
  - ▶ <http://euro4mvis.knmi.nl/>

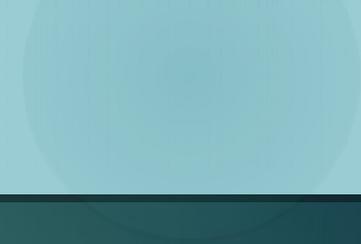


# Thanks for listening!!!

- ▶ <http://euro4mvis.knmi.nl/>
- ▶ <http://adaguc.knmi.nl/>
- ▶ <https://climate4impact.eu/>



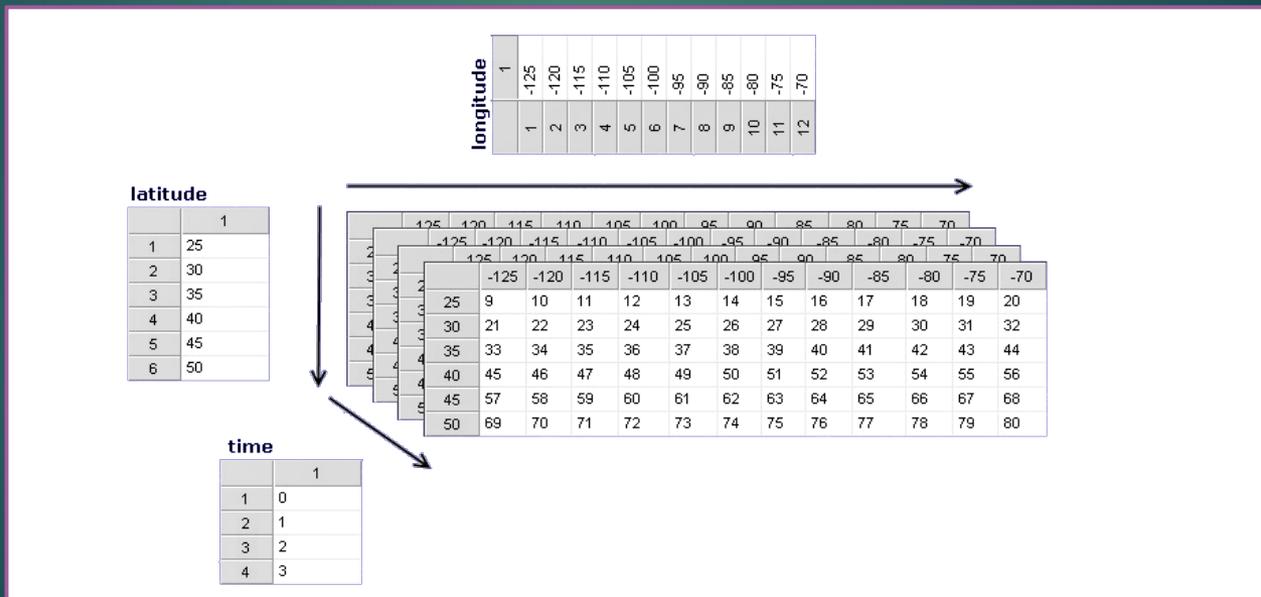
- ▶ For any questions:
  - ▶ Else van den Besselaar: [besselaar@knmi.nl](mailto:besselaar@knmi.nl)
  - ▶ Maarten Plieger: [maarten.plieger@knmi.nl](mailto:maarten.plieger@knmi.nl)





# Data format: NetCDF-CF

- ▶ NetCDF4 with Climate and Forecast conventions
- ▶ Standard names and units
- ▶ Identify and compare
- ▶ Dimensions, variables and attributes





# Drill down search results using available filters

**Selected filters:**  
none

**Filters:**

Project (5) Parameter (645) Frequency (8) RCP/Experiment (100) Model (75) > more...

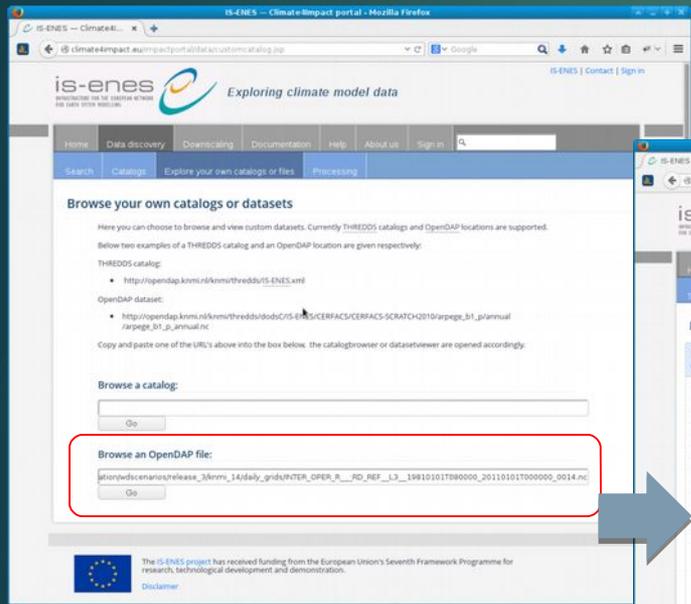
Quick select All variable properties (645)

Temperature	Precipitation	Humidity	Wind
<input type="checkbox"/> Temperature (tas) <input type="checkbox"/> Min. Temperature (tasmin) <input type="checkbox"/> Max. Temperature (tasmax) <input type="checkbox"/> Air Temperature (ta)	<input type="checkbox"/> Rain (pr) <input type="checkbox"/> Conv. Precip. (prc) <input type="checkbox"/> Snow (prsn)	<input type="checkbox"/> Specific Humidity (huss) <input type="checkbox"/> Rel. Humidity (hurs) <input type="checkbox"/> Spec. Humidity (hus) <input type="checkbox"/> Rel. Humidity (hur) <input type="checkbox"/> Rel. Humidity (rhs) <input type="checkbox"/> Max. Rel. Humidity <input type="checkbox"/> Min. Rel. Humidity (rhsmin)	<input type="checkbox"/> Wind (sfcWind) <input type="checkbox"/> Max. Wind (sfcWindmax) <input type="checkbox"/> E. Wind (uas) <input type="checkbox"/> N. Wind (vas)
	<b>Radiation</b> <input type="checkbox"/> SW Radiation (rsds) <input type="checkbox"/> SW Up Radiation (rsus) <input type="checkbox"/> LW Radiation (rlds) <input type="checkbox"/> LW Up Radiation (rlus) <input type="checkbox"/> Diff. Radiation (rsdsdiff) <input type="checkbox"/> Clouds (clt)	<b>Pressure</b> <input type="checkbox"/> Pressure (ps) <input type="checkbox"/> SL Pressure (psl) <input type="checkbox"/> Evaporation (evspsbl) <input type="checkbox"/> <del>Pot. Evaporation</del>	

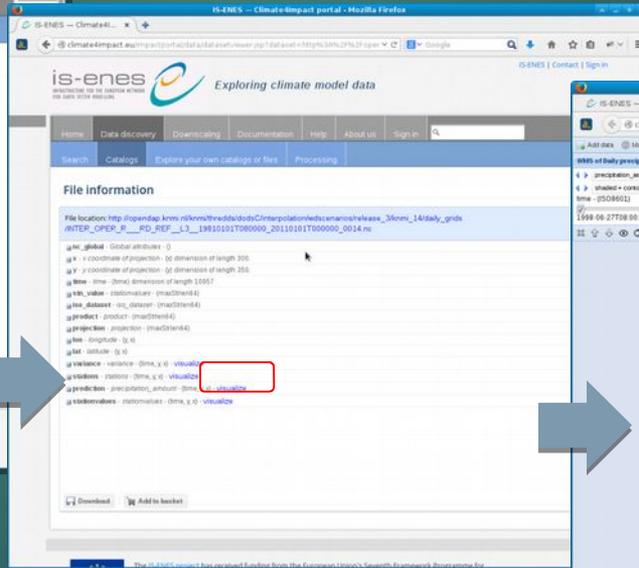


# OpenDAP Web Map

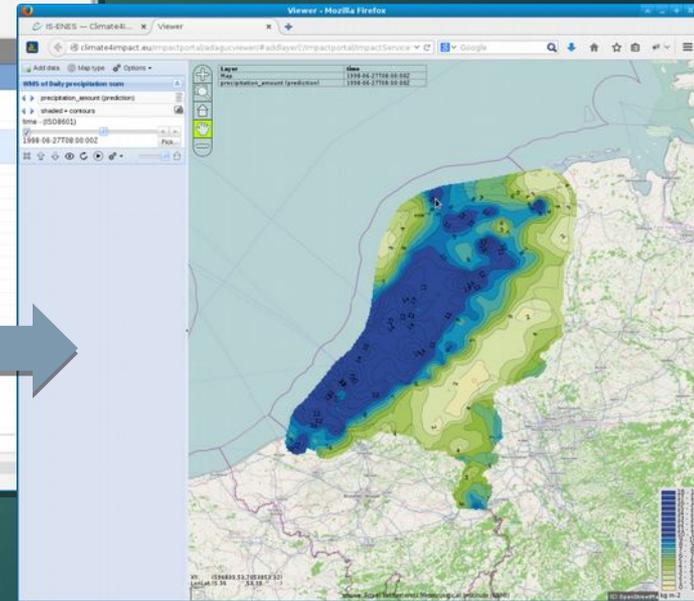
## Automatic visualization of remote data



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



File Metadata



ADAGUC viewer WMS

ADAGUC WEB-based visualization