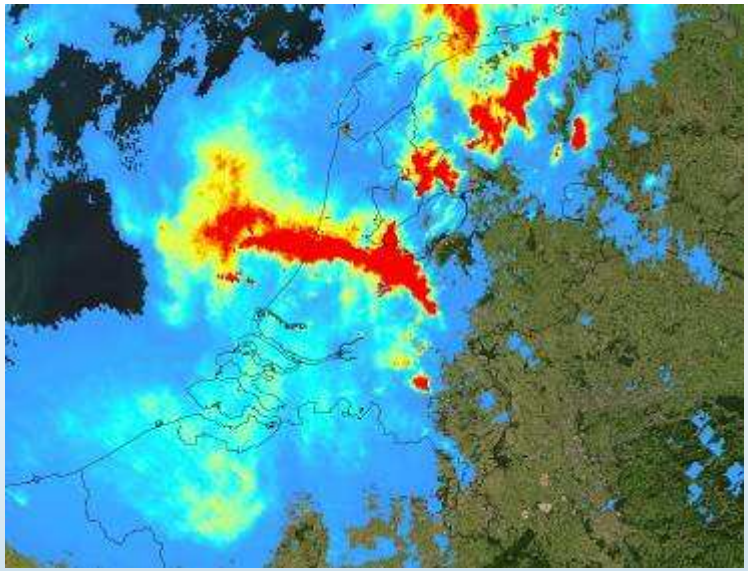

Using CF-NetCDF for OGC access to Atmospheric Data

M. Plieger[1], J. van de Vegte[1], R. Sluiter[1], W. Som de Cerff[1], E. de Vreede[1], H. Manders[1], R. M. van Hees[2], S. de Witte[2], R. de Jeu[3], N. de Reus[3]

[1)]Royal Netherlands Meteorological Institute
[2)]Netherlands Institute for Space Research
[3)]Vrije Universiteit Amsterdam, Faculty of Earth and Life Sciences

http://adaguc.knmi.nl

Introduction

- The ADAGUC project
- ADAGUC NetCDF4 file standard
- NetCDF4 data format
- Climate & Forecast (CF) conventions
- GDAL/OGR Drivers
- OGC Webservices WMS, WFS, WCS
- ADAGUC files in GIS

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ADAGUC

Atmospheric Data Access for the Geospatial User Community

- Bridging different sciences
- Atmospheric Datasets in GIS systems
- Standard data format for all data
- Open Standards → OGC
- Connect with GIS clients through OGC standards

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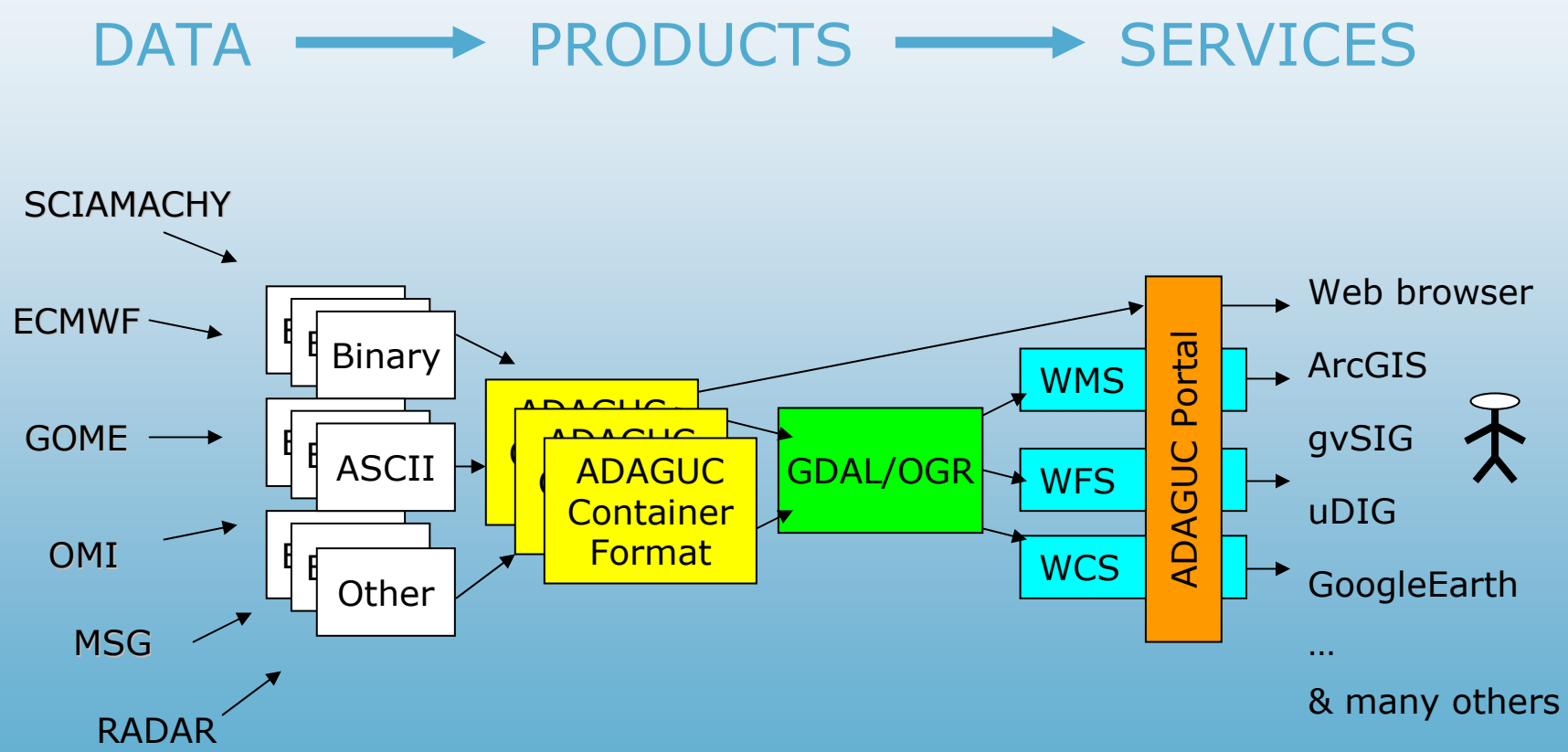
From bytes to services



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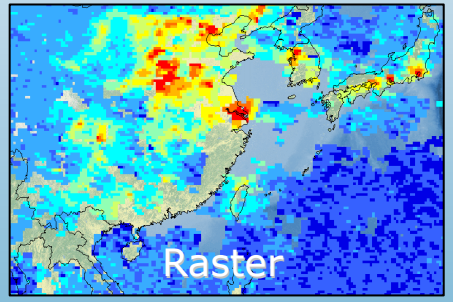
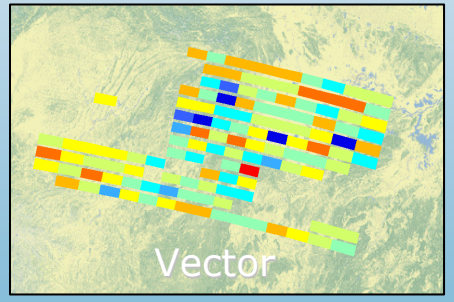
Datasets

- Instruments:
  - Sciamachy
  - GOME
  - OMI
  - AMSR
  - Precipitation radar
- Datasets:
  - Soil Moisture
  - FRESCO (clouds)
  - NO_2
  - CH_4
  - CO
  - O_3
  - Precipitation



- Current data types:
  - Raster
  - Vector



Goal: Store data in a generic format and provide access to the data by using standard OGC Services

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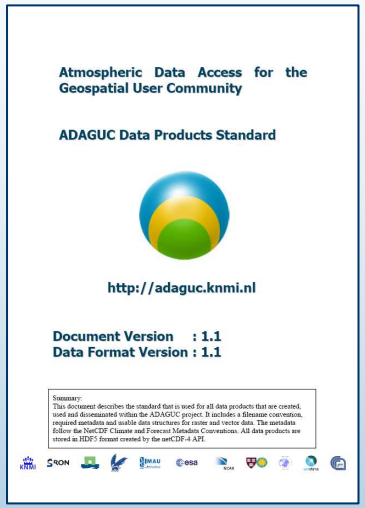
ADAGUC Data format

- NetCDF 4 data format
- Metadata conventions:
  - INSPIRE compliant: ISO-19115
  - Climate and Forecast metadata convention 1.4
  - NL kernset Metadata Standard
- Data and metadata reside in the same file
  - Self describing!

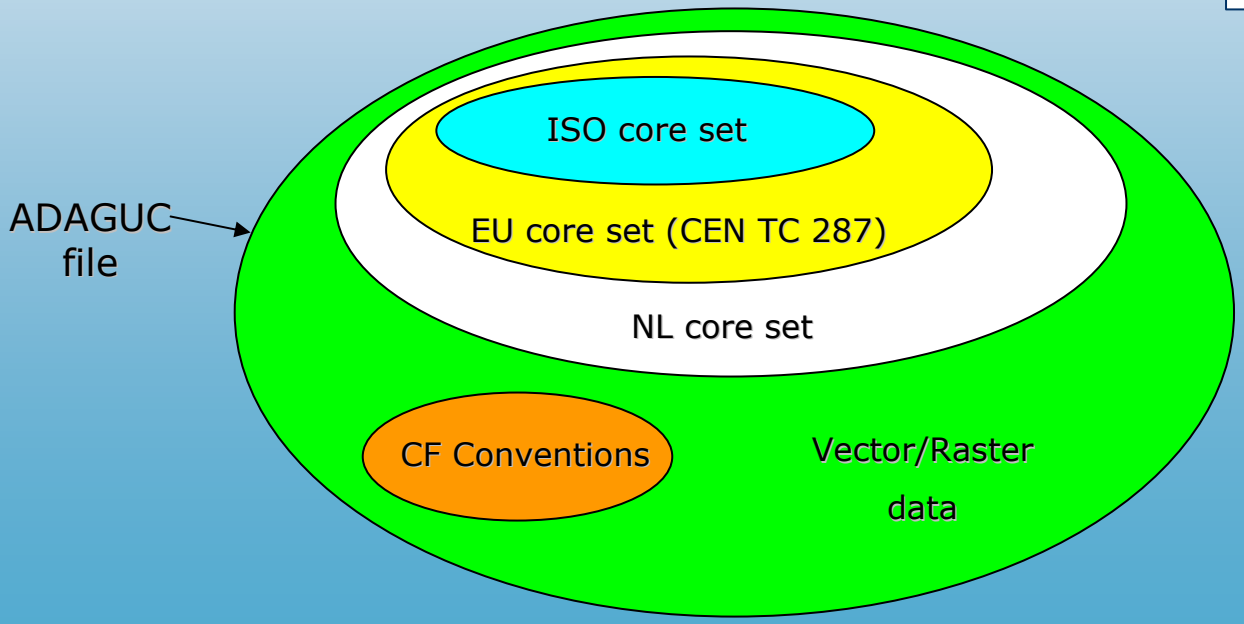

Atmospheric Data Access for the Geospatial User Community

ADAGUC Data Products Standard

http://adaguc.knmi.nl

Document Version : 1.1
Data Format Version : 1.1

Summary:
This document describes the standard that is used for all data products that are created, used and disseminated within the ADAGUC project. It includes a filename convention, required metadata and usable data structures for raster and vector data. The metadata follow the NetCDF Climate and Forecast Metadata Conventions. All data products are stored in HDF5 format created by the netCDF-4 API.



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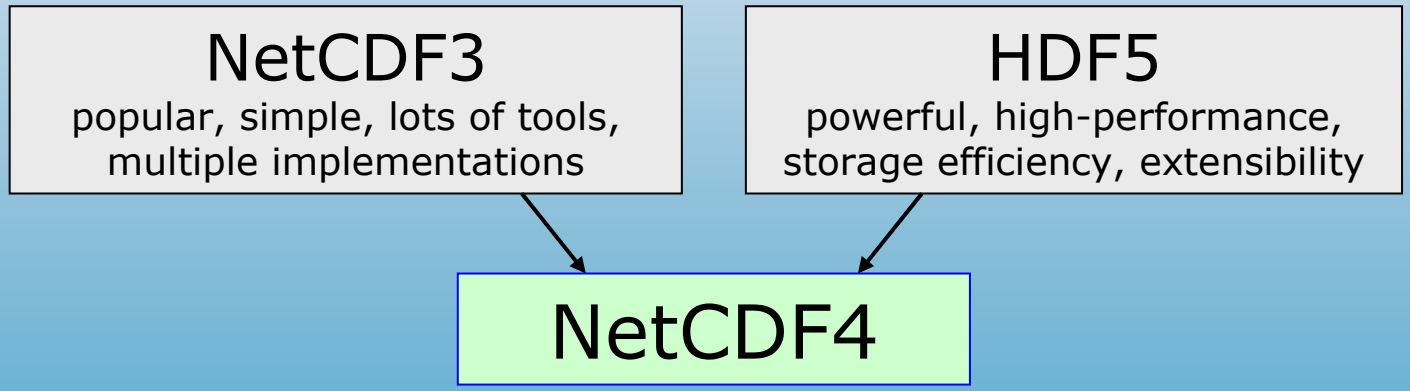
Network Common Data Form 4 (netCDF 4)

- Joint project between Unidata and HDF Group
- NetCDF 4 uses HDF5 as the storage layer of NetCDF
- Programming interfaces are backward compatible with the netCDF3 programming interface



Best of both formats combined!

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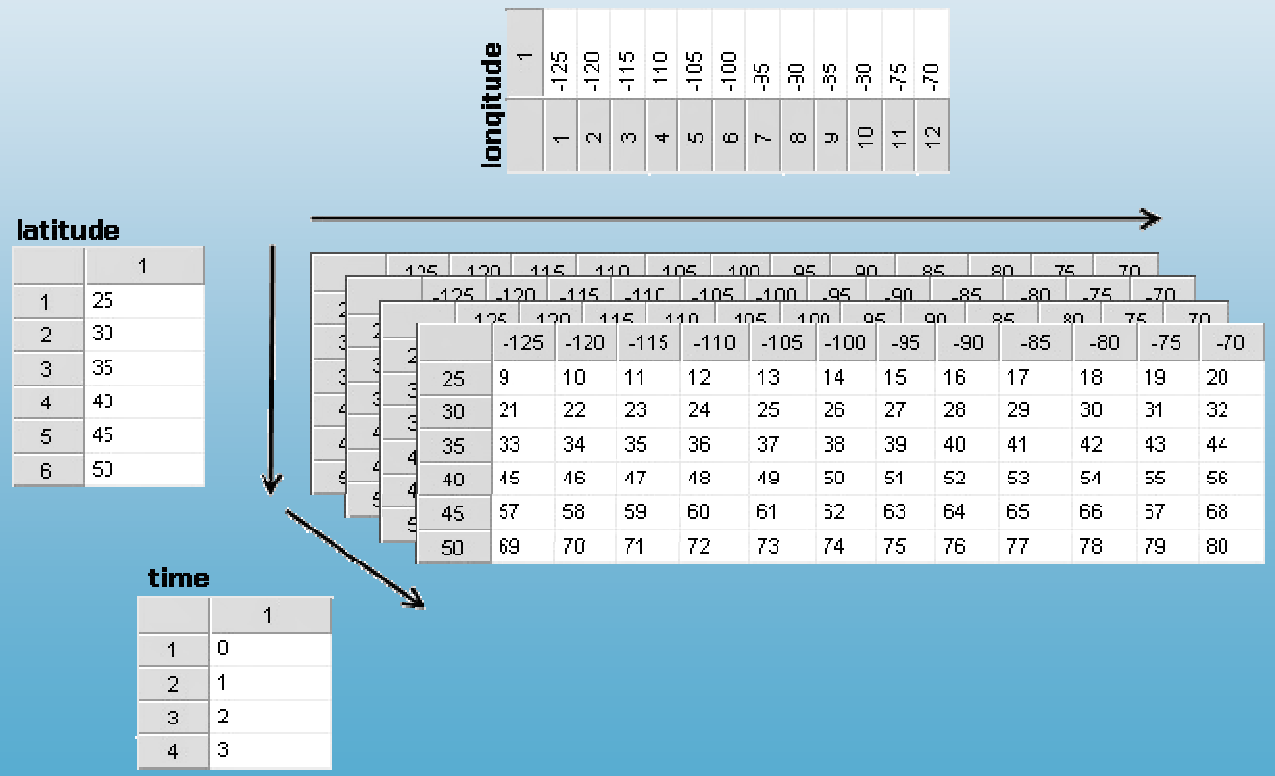
Climate & forecast (CF) conventions

- Locate data in space–time and as a function of other independent variables
  - Coordinate variables:



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Climate & forecast (CF) conventions

- Identify data
  - Enable users to decide what data from different sources is comparable
  - Distinguish variables in archives
- Standard names, standard units…

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Allowed structures of ADAGUC files

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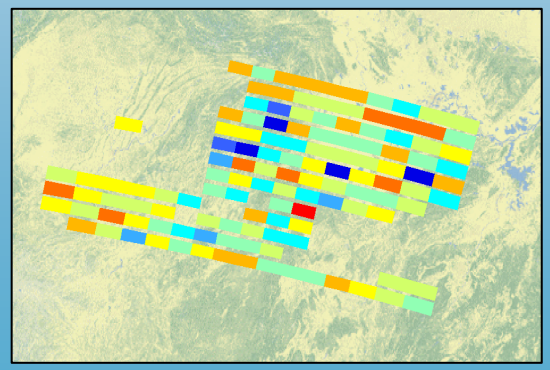
Vector data

SCIA__OPER_V___TDNO2 … h5

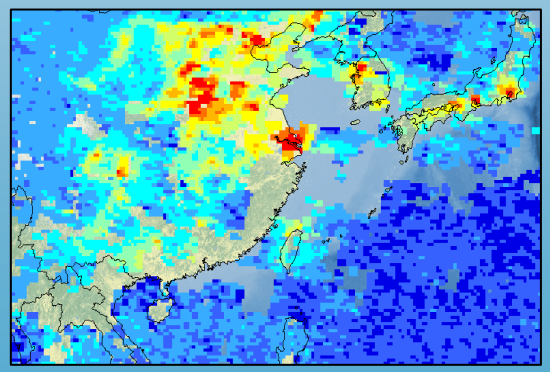
- A
  - iso_dataset
  - product
  - projection
- B
  - time
  - lat (time)
  - lon (time)
  - lat_bnds (time)
  - lon_bnds (time)
- C
  - TDTNO2 (time)
  - TDCNO2 (time)



Geographic raster data

SCIA__OPER_R___TMNO2 … h5

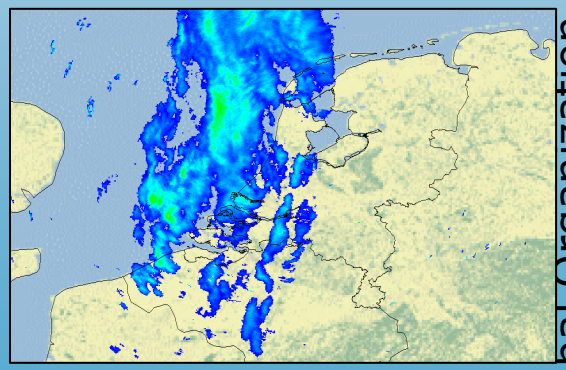
- A
  - iso_dataset
  - product
  - projection
- B
  - time
  - lat
  - lon
- C
  - TMTNO2 (time, lat, lon)
  - TMCNO2 (time, lat, lon)



Projected raster data

RADAR_OPER_R___NL25PCP … h5

- A
  - iso_dataset
  - product
  - projection
- B
  - time
  - y
  - x
  - lat (y,x)
  - lon (y,x)
- C
  - NL25PCP (time, y, x)

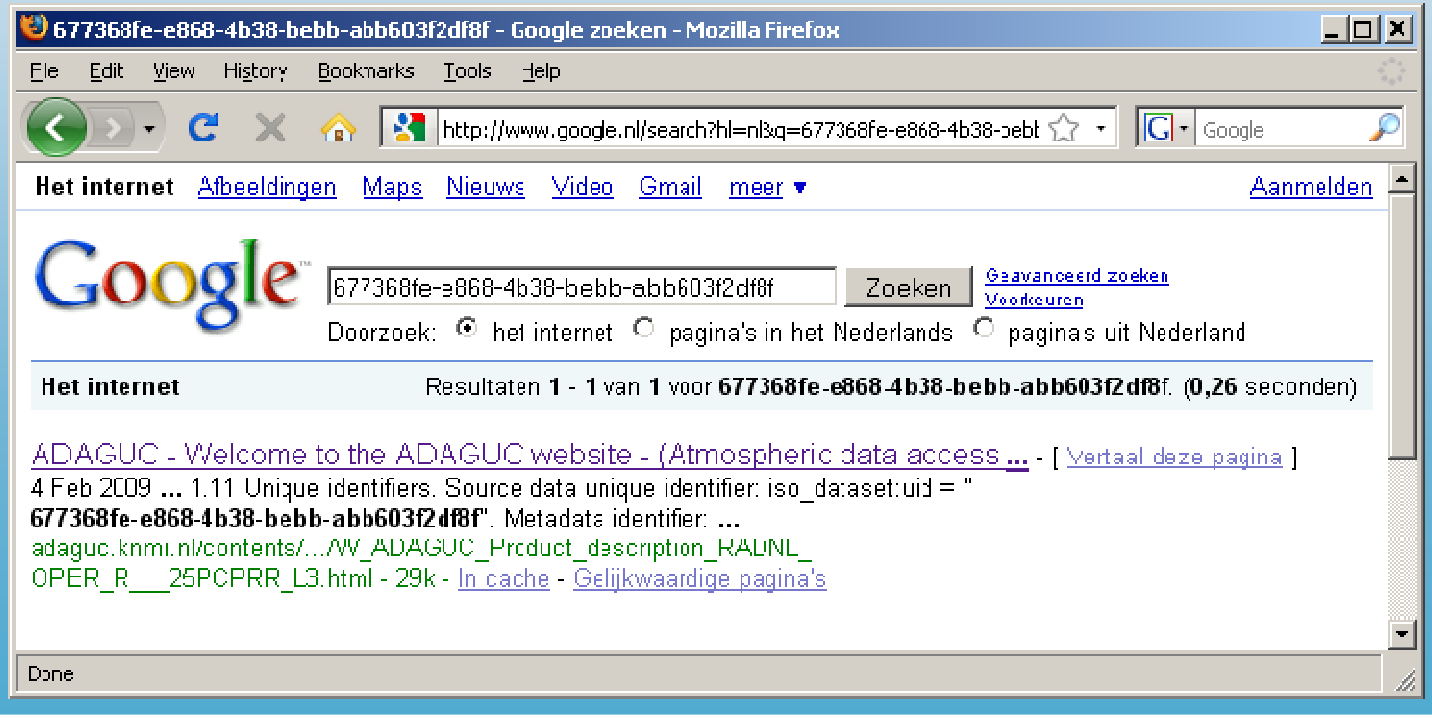


attributes with metadata | coordinate variable | data

Unique identifiers (UID)

- Unique identifiers to make data unique
  - Google on UID provides the description of the data!

```
    iso_dataset:abstract = "Radar precipitation measurements above the Netherlands, on a 1.
ive minute time interval. The intensity is in kg/m2/hour (mm/hour). The dataset is created
ility, the original unit reflectivity in DBZ is converted to precipitation flux in kg/m2/h.
ith the formula R = 10^((PixelValue -109)/32)." ;
    iso_dataset:status = "ongoing" ;
    iso_dataset:type = "dataset" ;
    iso_dataset:uid = "677368fe-e868-4b38-bebb-abb603f2df8f" ;
    iso_dataset:topic = "atmosphere" ;
    iso_dataset:keyword = "Precipitation" ;
    iso_dataset:max-x = 10.9f ;
    iso_dataset:min-x = 0.f ;
    iso_dataset:max-y = 56.f ;
```



GDAL/OGR drivers

- GDAL / OGR
  - Open source translator library for raster geospatial data formats
  - Used in many software products
    - UMN MapServer, GeoServer, Quantum GIS, ArcGIS, GRASS, OpenEV etc..
  - GDAL - Geospatial Data Abstraction Library
    - Access raster data
  - OGR - Simple Feature Library
    - Access vector data
- GDAL/OGR extensions available with support for the ADAGUC data standard

http://trac.osgeo.org/gdal/wiki/ADAGUC

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OGC Webservices

- Enabled by UMN MapServer
  - GDAL → UMN MapServer
- Custom made WMS/WCS
  - Dealing with real time data (updating without service restarting)
  - Will become public available next year
- Web Mapping Service (WMS) for visualization
- Web Feature Service (WFS) for feature data access
- Web Coverage Service (WCS) for raster data access
- Why OpenGIS services?
  - Data discovery
  - Multiple output formats
  - Resampling/ interpolation
  - Spatial/temporal selections
  - Easy connection to GIS programs

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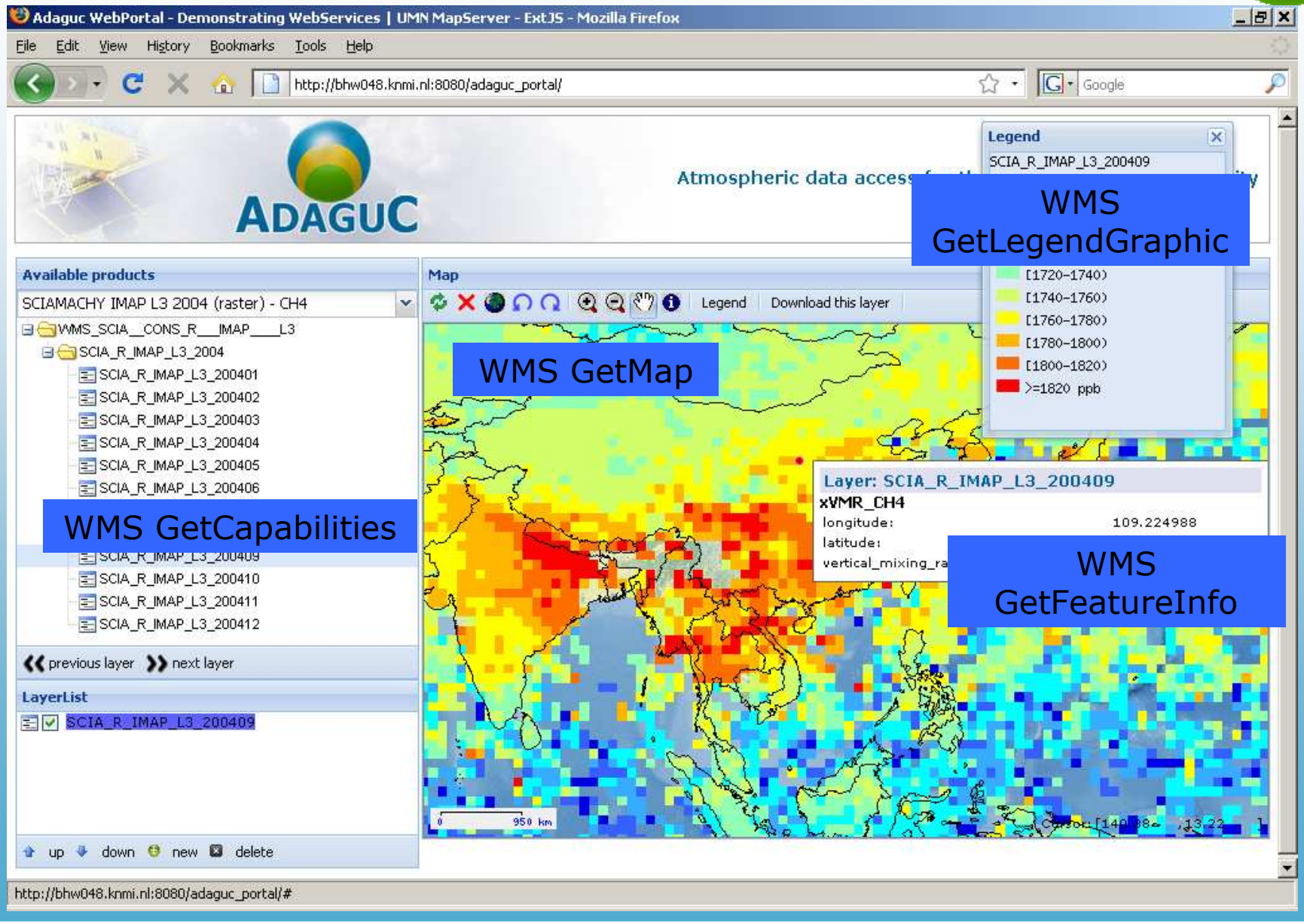
ADAGUC Web Portal



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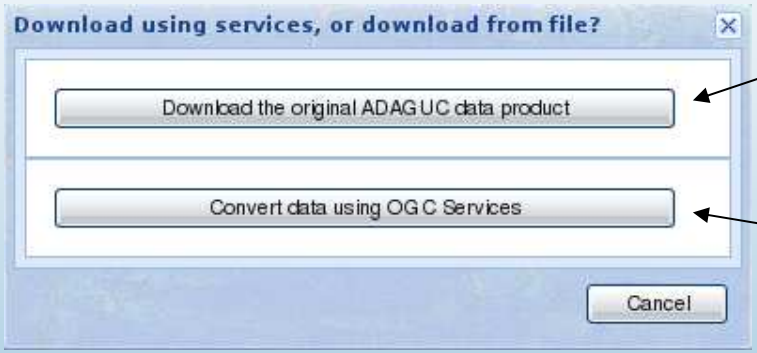
Download data from the Portal

- Download the original file,
  or convert to your favorite GIS format using OpenGIS

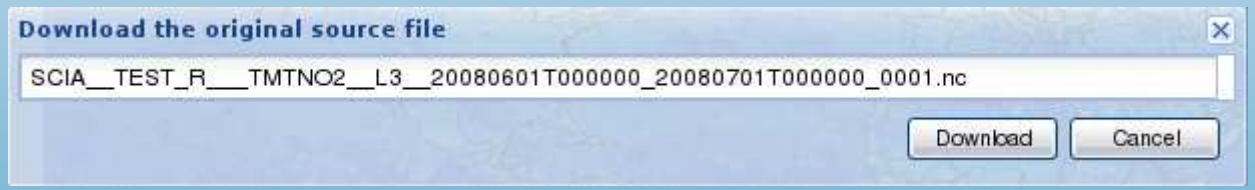


WCS DescribeCoverage

WFS MetadataURL

WFS or WCS?

- Download the original file



- Raster files are downloaded using WCS
- Vector files are downloaded using WFS
- Depending on the datatype the proper service is automatically selected

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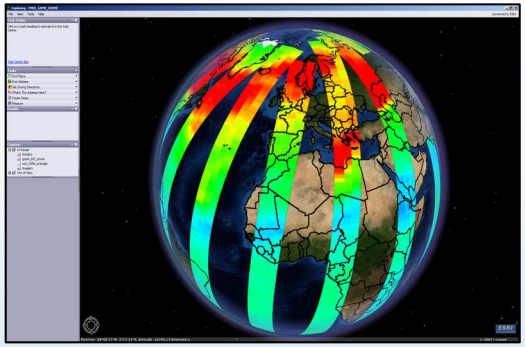
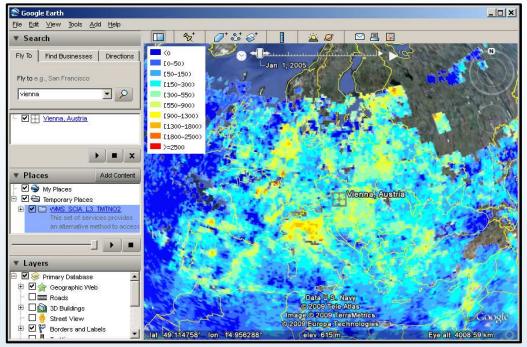
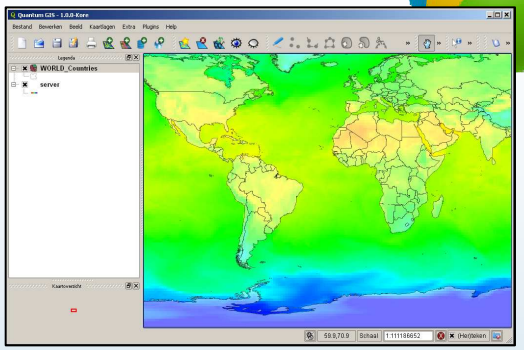
ADAGUC in GIS programs



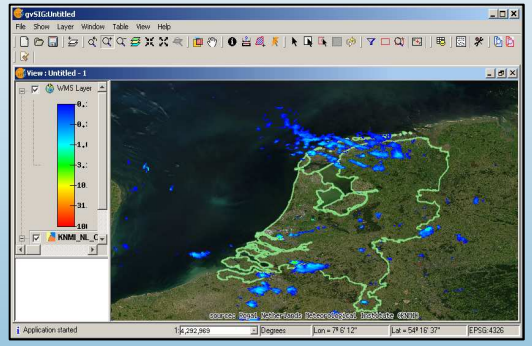
ArcGIS Explorer



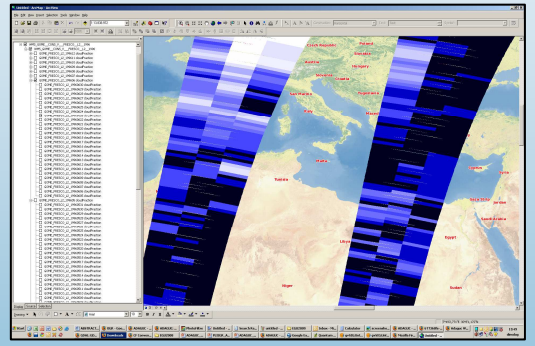
Google Earth



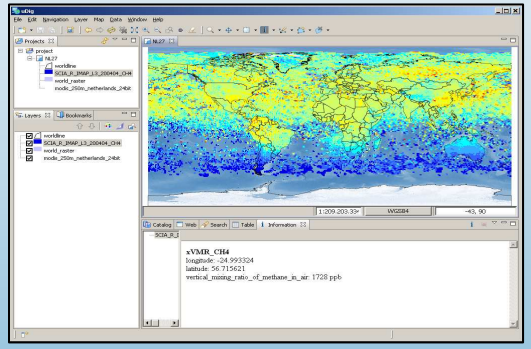
Quantum GIS



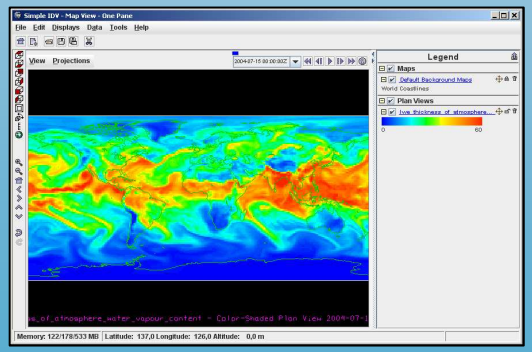
gvSIG



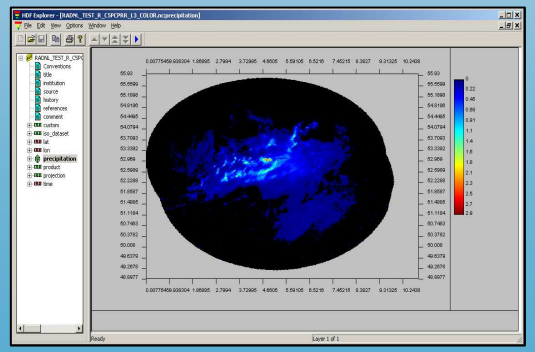
ArcGIS Desktop



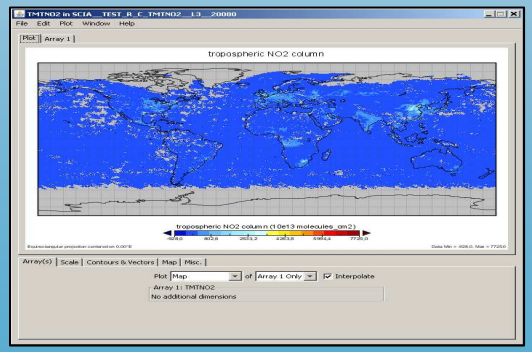
UDIG



IDV



HDF Explorer



NASA'S Panoply

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Future of ADAGUC

- Creating a metadata generator (NetCDF → HTML)
- Creating an ADAGUC format validator
  - With possible inclusion/reuse of the NCAD-CMS CF validator ?
  - Via website or as application
- Possible (Dutch) national standard for raster data
  - Contacts with Geonovum, responsible for geo-standards in the Netherlands
- Extensions of the standard
  - Pilot with in-situ measurements (format/OGR/UMN)

- More and more products are being served via ADAGUC
  - Meteosat, Climate scenarios, RADAR

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Questions?

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