

Deliverable D10.10: Provision of collocation service combining ground-based data and satellite and model data

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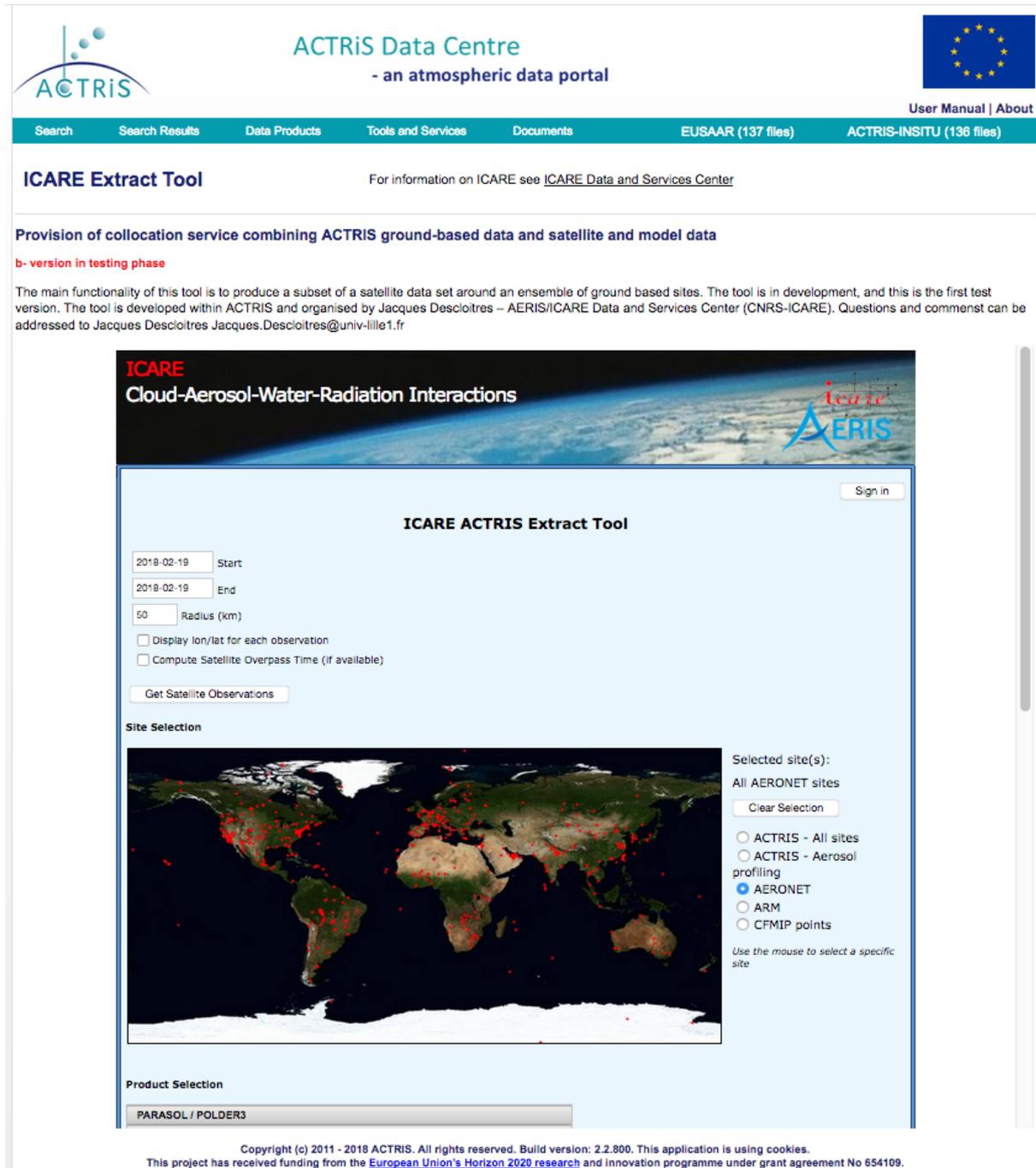
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1 Summary

This document describes the pilot version of the web-based satellite/ground collocation tool implemented in the ACTRIS data portal at:

<http://actris.nilu.no/Content/?pageid=66e93238896c43faa258025495a78c02>

(see Fig. 1). The main functionality of this tool is to produce a subset of a satellite data set around an ensemble of ground locations.



ACTRIS Data Centre
- an atmospheric data portal

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ICARE Extract Tool

For information on ICARE see [ICARE Data and Services Center](#)

Provision of collocation service combining ACTRIS ground-based data and satellite and model data

b- version in testing phase

The main functionality of this tool is to produce a subset of a satellite data set around an ensemble of ground based sites. The tool is in development, and this is the first test version. The tool is developed within ACTRIS and organised by Jacques Descloitres – AERIS/ICARE Data and Services Center (CNRS-ICARE). Questions and comment can be addressed to Jacques Descloitres Jacques.Descloitres@univ-lille1.fr

ICARE ACTRIS Extract Tool

2018-02-19 Start
2018-02-19 End
50 Radius (km)

Display lon/lat for each observation
 Compute Satellite Overpass Time (if available)

Get Satellite Observations

Site Selection

Selected site(s):
All AERONET sites
Clear Selection

ACTRIS - All sites
 ACTRIS - Aerosol profiling
 AERONET
 ARM
 CFMIP points

Use the mouse to select a specific site

Product Selection

PARASOL / POLDER3

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Fig. 1: Screenshot of the data extract tool implemented in the ACTRIS data portal

2 Service description

Background

The need for combined use of ground-based and satellite data sets is very common: data set inter-comparison, validation activities, contextual data analysis, combined retrievals, etc. The usual approach is to reduce data sets to those observations that verify a condition of geographic collocation (distance between observations lower than a threshold), and temporal coincidence (difference of observation times lower than a threshold). While comparing observation times is usually fairly straightforward, users usually face several challenges when trying to determine collocations:

- download large data volumes while very few coincident observations are needed
- deal with the complexity and the variety of data set access mechanisms and formats
- deal with complex satellite observation geometries
- deal with performance issues when numerous ground stations are used (e.g. a validation across a large network of sites)

Tool principle

The principle of this tool is to deal with the geographic collocation independently from the temporal coincidence. Considering the low observation frequency of satellites at a given location (typically 1-2 overpasses per day for a low-orbiting satellite), the original data set is most drastically reduced when applying the geographic collocation criterion alone. The temporal coincidence condition can be applied subsequently rather than simultaneously with little trade-off on the subset volume.

Tool description

This tool is designed to extract satellite observations around specific sites. It is primarily designed to be used through the web interface:

<http://actris.nilu.no/Content/?pageid=66e93238896c43faa258025495a78c02>

but the output can also be obtained using a UNIX/LINUX command `wget` or `curl` in a command-line or a script file.

This web tool is designed to extract satellite observations around specific sites. As a customization for ACTRIS, "ACTRIS – All sites" is by default the set of ground locations around which the selected satellite data set will be retrieved. Other networks of ground stations can be selected, including "ACTRIS - Aerosol profiling" and the AERONET sunphotometer network. User-provided lists of sites are also supported but this option is yet to be documented. The user selects a satellite parameter (e.g. aerosol optical depth, aerosol Ångström exponent, etc.), a time period and a search radius around each site. All satellite observations within the specified time period and distance around each site will be extracted. The tool handles the satellite data set formats, projections, spatial resolution, orbital pattern, etc. The time of the satellite observation is provided as well as the geographic location if that option was selected.

Examples of supported satellite data sets: PARASOL, Aqua/MODIS, MSG/SEVIRI, CALIPSO/IIR and Envisat/MERIS, Envisat/AATSR, OMI.

A user's guide is available online (see version 1.1 in appendix).

3 Evaluation

This pilot version 1.1 is fully operational and open to the public. A panel of users will be selected to evaluate the tool, provide feedback and suggestions for improvement. User suggestions received by February 1, 2018 will be examined and prioritized based on both pertinence and resources costs. User feedback will keep being considered as an ongoing process, again resources permitting.

4 Appendix 1

Extract tool User Guide Pilot version v1.1

The data extract tool interface provides co-located ground-based observations and satellite data. Users specify a satellite parameter, a time period, a pre-selected network or an individual site for a specific network, and a distance around those sites.

The output is the list of all satellite observations found during the specified time period within the specified distance around the specified ground stations.

The format of the output file is ASCII. It can be obtained either through the interactive interface or using a UNIX/LINUX command `wget` or `curl` in a command-line or a script.

Web interface

Access the extract web-interface:

<http://www.icare.univ-lille1.fr/extract>

Description

This description refers to the pilot version of the extract web-interface.

In the top section of the interface, users can set the parameters of the data retrieval: date range, search radius around ground locations, output options. The "Get satellite observations" button opens a new window and runs the colocation retrieval process.

In the middle section, users can select the network of ground stations around which the satellite data set must be retrieved. The selected locations are displayed on a map.

In the bottom section, users can select one data set from a long list of data sets available at AERIS/ICARE Data and Services Center.

Getting started

By default, no product parameter is selected. The user must select a product parameter in the pull-down menu (e.g. the very first one: PARASOL OC2 Daily Aerosol Optical Depth over ocean at 865nm).

The default start and end dates are the current date. Currently it is the user's responsibility to select a time period where the selected data set is available.

By default, the AERONET sunphotometer network is the set of ground locations around which the selected satellite data set will be retrieved. Several other commonly used networks are available. Users can click on the map to select one specific site from the network.

The default distance threshold used as colocation criterion is 50 km. Currently, it is the user's responsibility to choose a search radius consistent with the data set resolution. If the search radius is too large compared to the data set resolution, the tool may return many satellite pixels within the search radius, and the output volume may be big. If the search radius is too small (typically comparable to or lower than the data set resolution), pixels containing or surrounding a selected site may be ignored if the pixel centers are outside the search radius.

Clicking on the "Get satellite observations" button runs the colocation retrieval process. A new window or tab opens up, and the retrieved colocations are printed chronologically as they are computed. If you're not logged on, you'll be prompted for your username and password.

The colocation retrieval process may take a while depending on the date range and the data set resolution. The longer the date range and the higher the resolution, the longer the execution time. The execution

time is proportional to the number of days and the number of input pixels to process (i.e. inversely proportional to the square of the data set resolution). By design, the execution time is fairly independent on the number of ground locations to consider.

In summary

1-Select a data set parameter from the pull-down menu (mandatory)

2-Select a date range

3-Adjust the search radius

4-Select one site or a set of sites

6-Submit: click on "get satellite observations" button

All satellite observations within the search radius (given in km) around the selected site(s) across the selected date range will be retrieved.

Example (see Screenshots of data extract tool interface (Figures 2 to 4))

Objective: get all available Aqua/MODIS AOD retrievals within a 20-km distance to any AERONET site over January 2016

Product Selection: Aqua/MODIS MYD04_D3 0.1-deg Daily Aerosol Optical Depth at 550nm

Start date: 2016-01-01

End date: 2016-01-31

Radius (km): 20

Site Selection: Selected site(s): All AERONET sites

The corresponding URL for this selection:

http://www.icare.univ-lille1.fr/extract/?dataset=modis_aqua_aod550&sitelist=aeronet&start=2016-01-01&end=2016-02-01&radius=20&modis_aqua_aod550=true

Press the "Get Satellite Observations" button and a new window will open. The execution time is usually less than 2 minutes.

The output header records the parameters used to generate the current output, and the description of each column:

<Variable>: The selected data set variable

<Observation Timestamp>: corresponds to the satellite observation time recorded in the input data set. If this information is not available, the timestamp is arbitrarily set to 12:00. The format of the Observation Timestamp is YYYYMMDDHHMM (YEAR, MONTH, DAY, HOUR, MINUTE)

<Site ID> : Name of the site where a colocation was found

<Number of Observations>: corresponds to the total number of satellite observations found within the search radius

<Sequence of Observations> lists the values of all satellite pixels found within the search radius

```
# Product: Optical_Depth_Land_And_Ocean from
/DATA/LIENS/CMG/maps.myd04_12/2016/maps.myd04_12.v0.1.22.20160101.3
600x1800.hdf
# Description: Aqua/MODIS MYD04_D3 0.1-deg Daily Aerosol Optical
Depth at 550nm
# Search radius around sites: 20 km
# Source for acquisition time: approximation
# <Variable>    <Observation Timestamp>    <Site ID>    <Number of
Observations>    <Sequence of Observations>
Optical_Depth_Land_And_Ocean 201601011200 Abu_Al_Bukhoosh 7 0.205
0.197 0.202 0.203 0.197 0.199 0.2
```

```
Optical_Depth_Land_And_Ocean 201601011200 Abu_Dhabi 1 0.177
Optical_Depth_Land_And_Ocean 201601011200 Adelaide_Site_7 3 0.202
0.188 0.2
etc.
```

With the option "Display lon/lat for each observation", the longitude and latitude of each retrieved pixel are added before each variable. In this example, as the pixel observation time is not available, a 12:00 time is used in the timestamp string. The output file is:

```
# Product: Optical_Depth_Land_And_Ocean from
/ DATA/LIENS/CMG/maps.myd04_12/2016/maps.myd04_12.v0.1.22.20160101.3
600x1800.hdf
# Description: Aqua/MODIS MYD04_D3 0.1-deg Daily Aerosol Optical
Depth at 550nm
# Search radius around sites: 20 km
# Source for acquisition time: approximation
# <Variable> <Observation Timestamp> <Site ID> <Number of
Observations> <Sequence of Observations>
Optical_Depth_Land_And_Ocean 201601011200 Abu_Al_Bukhoosh 7 53.150
25.650 0.205 53.050 25.550 0.197 53.150 25.550 0.202 53.250 25.550
0.203 53.050 25.450 0.197 53.150 25.450 0.199 53.250 25.450 0.2
Optical_Depth_Land_And_Ocean 201601011200 Abu_Dhabi 1 54.250 24.550
0.177 Optical_Depth_Land_And_Ocean 201601011200 Adelaide_Site_7 3
138.450 -34.750 0.202 138.550 -34.750 0.188 138.650 -34.850 0.2
etc.
```

Colocation retrieval using a script

You may also run the colocation retrieval process using the URL of the output window in a wget or curl command at the command line of a unix terminal or in a script.

For example, run this command from a unix terminal:

```
curl --silent --data "user=yourUserName&passwd=1234abcd"
"http://www.icare.univ-
lille1.fr/extract/extract.php?dataset=modis_aqua_aod550&start=2016-
01-01&end=2016-02-01&radius=20&sitelist=actris" >
extract_201601.txt
```

Replace "1234abcd" with your md5-encoded password, which you can determine with the following command:

```
echo -n 'YourPassword' | md5sum | cut -d" " -f1
```

Or run this alternative command using wget:

```
wget --post-data "user=yourUserName&passwd=passwd" -O output.txt
"http://www.icare.univ-
lille1.fr/extract/extract.php?dataset=seviri_aerus_aod06&start=2013-
01-01&end=2013-01-31&radius=5&sitelist=actris"
```

Please note:

- the longer the time period, the longer the execution time
- it is recommended to run the extraction over all the sites of interest and then separating the sites afterwards if necessary. It is more time-efficient than the extraction one site at a time

- for a given time period and radius, higher resolution products take longer than coarse resolution products
- if radius is too small or time range is too short, you may get no observation at all. In this case, the message is either:
 - No file found for the specified data set over the specified time range or
 - Radius (3 km) is too small

Screenshots of the data extract tool

The screenshot shows the ICARE Extract Tool interface. At the top, there is a navigation bar with links for Home, Data Access, Projects, Services, About us, and FAQ. The main heading is 'ICARE Cloud-Aerosol-Water-Radiation Interactions'. Below this, there is a 'Sign in' button.

The 'Dates and radius selection' section includes:

- Start date: 2016-01-01
- End date: 2016-01-31
- Radius (km): 20
- Checkboxes for 'Display lon/lat for each observation' and 'Compute Satellite Overpass Time (if available)'.
- A 'Get Satellite Observations' button.

The 'Site Selection' section features a world map with red dots representing AERONET sites. To the right of the map, there is a 'Selected site(s): All AERONET sites' section with a 'Clear Selection' button and radio buttons for:

- AERONET (selected)
- ACTRIS - All sites
- ACTRIS - Aerosol profiling
- ARM
- CFMIP points

The 'Product Selection' section is a scrollable list of data products, including:

- PARASOL / POLDER3
- MODIS
- Aqua/MODIS MYD04_D3 0.1-deg Daily Aerosol Optical Depth at 550nm (selected)
- Aqua/MODIS MYD04_D3 0.5-deg Daily Aerosol Optical Depth at 550nm
- Aqua/MODIS MYD04_L2 NRT 10-km Daily Aerosol Optical Depth at 550nm
- Aqua/MODIS MYD04_L2 10-km Daily Combined DB-DT Aerosol Optical Depth at 550nm
- Aqua/MODIS MYD08_D3 Daily Aerosol Optical Depth at 550nm
- Aqua/MODIS MYD08_D3 Daily Aerosol Fine Mode Fraction
- Aqua/MODIS MYD08_D3 Daily Daytime Cloud Fraction
- Aqua/MODIS MYD08_D3 Daily Daytime Cirrus Fraction
- Aqua/MODIS MYD08_D3 Daily Daytime Cloud Optical Thickness
- Aqua/MODIS MYD08_D3 Daily Daytime Cloud Top Pressure

Fig. 2: Screenshot of the extract tool showing all adjustable parameters (dates, search radius , site(s) and product)

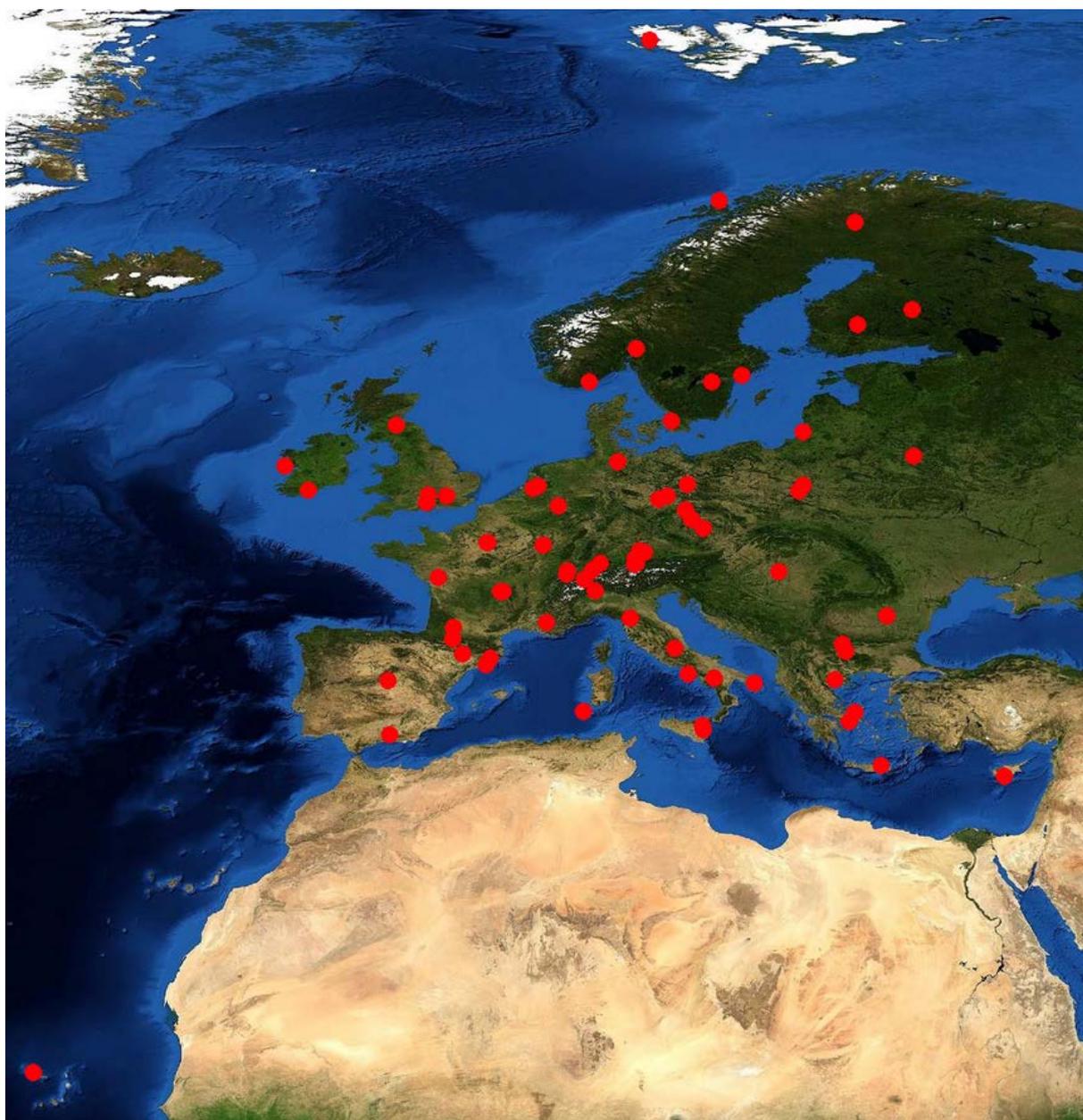


Fig. 3: Map showing the location of all ACTRIS sites (80)

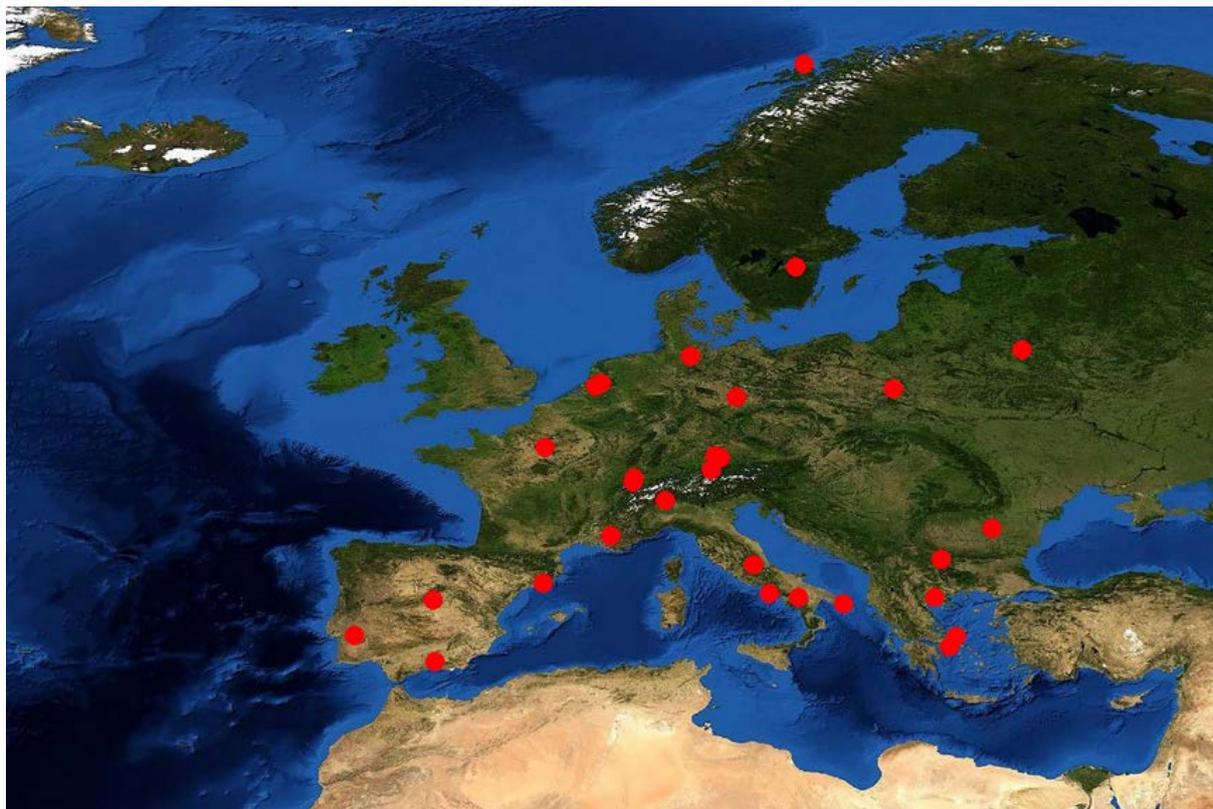


Fig. 4: Map showing the location of all ACTRIS Aerosol profiling sites (29)