openmeteo.org: a web service for the dissemination of free meteorological data

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1. Abstract

Individuals or organisations managing meteorological or hydrological stations typically need to either collect the data on personal computers or bear the costs required to setup a server. As an alternative, the openmeteo.org database provides users and organisations the option to upload their time series, on condition that their data will be available to the public under a free license (the Open Database License and the Creative Commons Attribution-ShareAlike License, depending on the type of data). Each user has write access to his own data, whereas the public has read access to all the data. Enhydris, the software that powers openmeteo.org, is also free, available under the GNU General Public License v.3, and provides several useful features like time series graphs and plots, display of online data, maps etc. The purpose of openmeteo.org is not only to enable people to manage their data more easily, but also to bring people into a community and encourage a spirit of openness and sharing.

Keywords free data, online data, web service, database, time series

2. The **openmeteo** concept

openmeteo is a project devoted to the development of free hydrological and meteorological software and to the collection and distribution of free hydrological and meteorological data. The project is publicly accessible through the web address:

http://openmeteo.org/

The project has several parts:

- **Public Database** – **openmeteo.org/db**, the international, public database with free hydro-meteorological data offers anyone the possibility to upload their own data.
- **Client software: Hydrognomon** – a time series management and processing stand-alone application. Available under the GNU General Public License version 3, runs under MS Windows and, with Wine, in i386 Unixes such as Linux on i386
- **Server software: Enhydris** – Software that keeps a database of measuring stations, instruments and time series, with a web interface. Enhydris is the software that powers the openmeteo database. Enhydris is cross-platform free software, available under the GNU General Public License version 3.
- **Developers corner** – openmeteo has extended documentation for developers, administrators and any other interested, wishing to install or to hack our software. Anyone can also obtain a full copy of the source code or just some parts and libraries to reuse to other projects. Finally we encourage independents and also companies and organizations to actively participate to the development process, so the result be publicly available.

3. Enhydris

The core of the information system running behind the scenes to implement the **openmeteo.org/db** database service is the **Enhydris** server software application. *Enhydris* is a database system for the storage and management of hydrological and meteorological data. It allows the storage and retrieval of raw data, processed time series, model parameters, curves and meta-information such as measurement stations overseers, instruments, events etc. The database is accessible through a web interface, which includes several data representation features such as tables, graphs and mapping capabilities. Data access is configurable to allow or to restrict user groups and/or privileged users to contribute or to download data. With these capabilities, *Enhydris* can be used either as a public repository of free data or as a secured – restricted system for data storage. Time series can be downloaded in plain text format that can be directly loaded to *Hydrognomon*. More information on *Enhydris* can be found on its own web site:

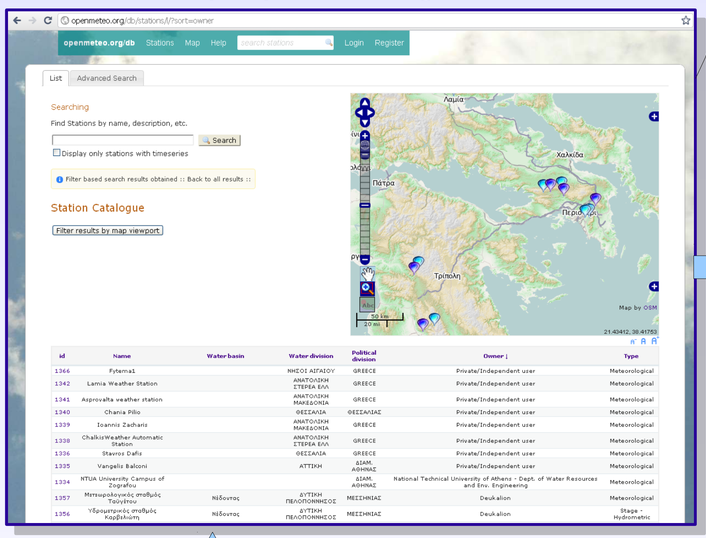
http://openmeteo.org/enhydris/

4. Licenses

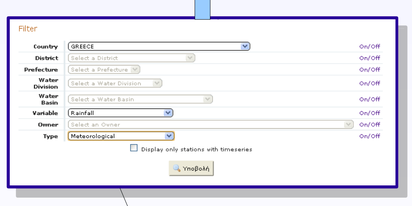
We have chosen two licenses for user submissions, depending on the nature of data:
a) for time series, the **Open Database License** (http://opendatacommons.org/licenses/odbl/), with the individual records that comprise the time series being licensed under the Database Contents License; and
b) for images, audio-video material, and substantial pieces of text, the **Creative Commons Attribution ShareAlike License** (http://creativecommons.org/licenses/by-sa/2.5/). The database as a whole is also licensed under the **Open Database License**.

5. The system

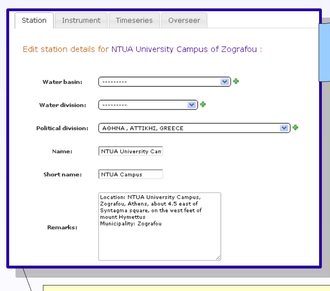
http://openmeteo.org/db/



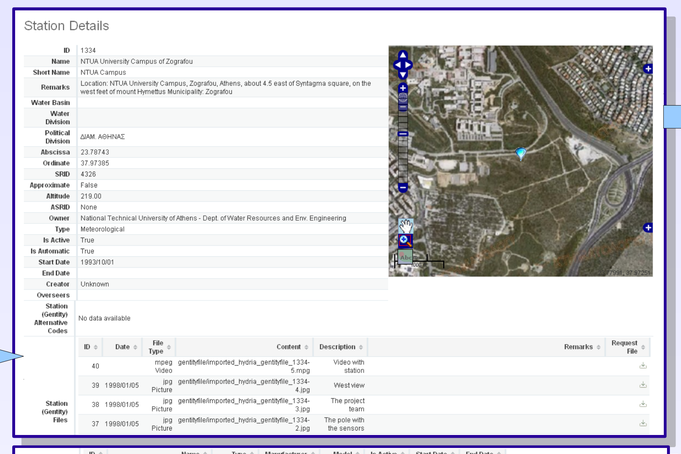
Stations are both displayed in lists and maps. Map is a simple web GIS application allowing users to locate stations in conjuction with other searching capabilities. Data are available for both logged-in and anonymous users.

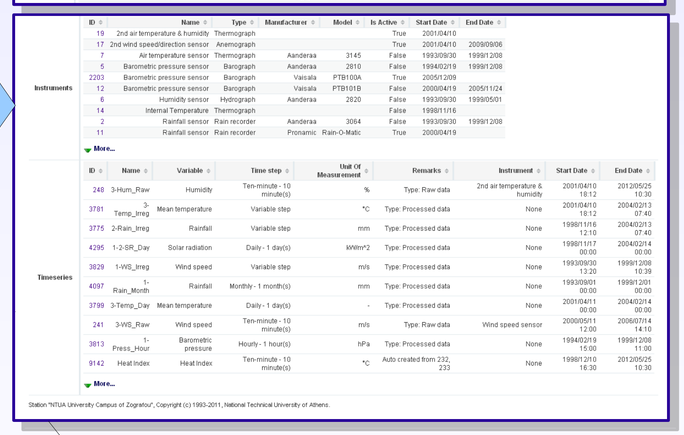


Users can search for stations using several criteria such as variable type, geographical area etc.

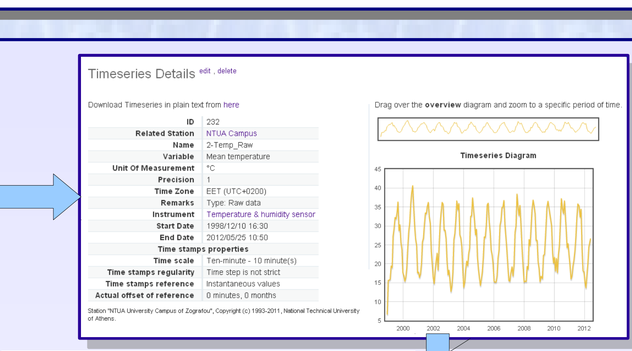


Anyone can create an account to access some special features: Logged-in users can create new stations. Station creators can edit their data and they can also grant other users as station "maintainers" allowing them to edit data.

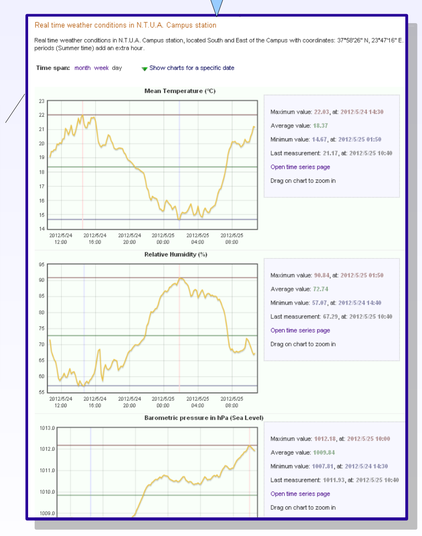




Each station has its own webpage displaying general information, map position, attached files (pictures etc), measuring instruments and sensors and of course time series. Web links allow users to browse the time series and instruments special pages.



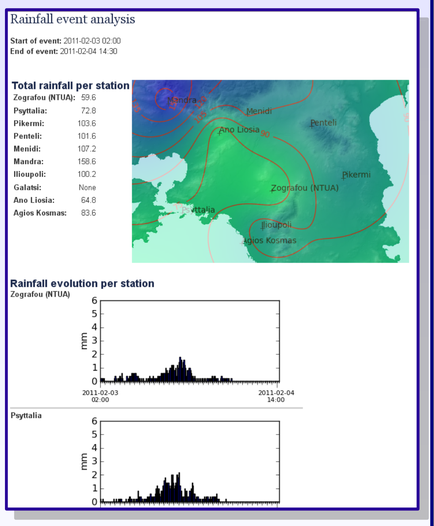
A web-page displaying time series properties. Time series are the "core" of the system. Data can be user-uploaded by web forms or auto-updated by logger-modem connection. Users wishing automatic logging can ask from openmeteo for a special setup. Data form is very flexible and supports a wide range from raw data of fine time scales such as 5 minutes to processed climatic data of large time scales.



Time series then can be used to supply application with data, like the charting page displayed to the right. Time series charts visualize real time measurements as well as historical data. Users can focus in desired time periods by zoom obtaing also respective statistics.

6. Extensions

Enhydris, the software running behind **openmeteo.org/db** is extensible: its core is a platform upon which more applications can be built. One such application, which is included with *Enhydris* and can optionally be installed, is hrain, which detects and visualizes rainfall events on a geographical area. It can be seen in action in the *Hydrological Observatory of Athens* (http://hoa.ntua.gr/), a network of 10 meteorological stations covering the wide area of Athens. There also numerous *Enhydris* applications, e.g. for automatic aggregation, contour maps of any hydro-meteorological variable etc. These applications can be installed for *openmeteo.org/db* as well for its users on request.
The rainfall event report includes charts displaying the evolution of the rainfall per station and a contour chart.



Another possibility is to setup a site which offers a subset of the openmeteo database. Recently, a research project for the assessment of flood flows in Greece, called "*Deucalion project*" uses the openmeteo.org database. In the project site located at: http://deucalionproject.gr/ only a portion of the database is displayed. Of course in openmeteo.org, the full database is available.

7. References

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