

# **Enhydris: A free database system for the storage and management of hydrological and meteorological data**

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# 1. Enhydris — Introduction

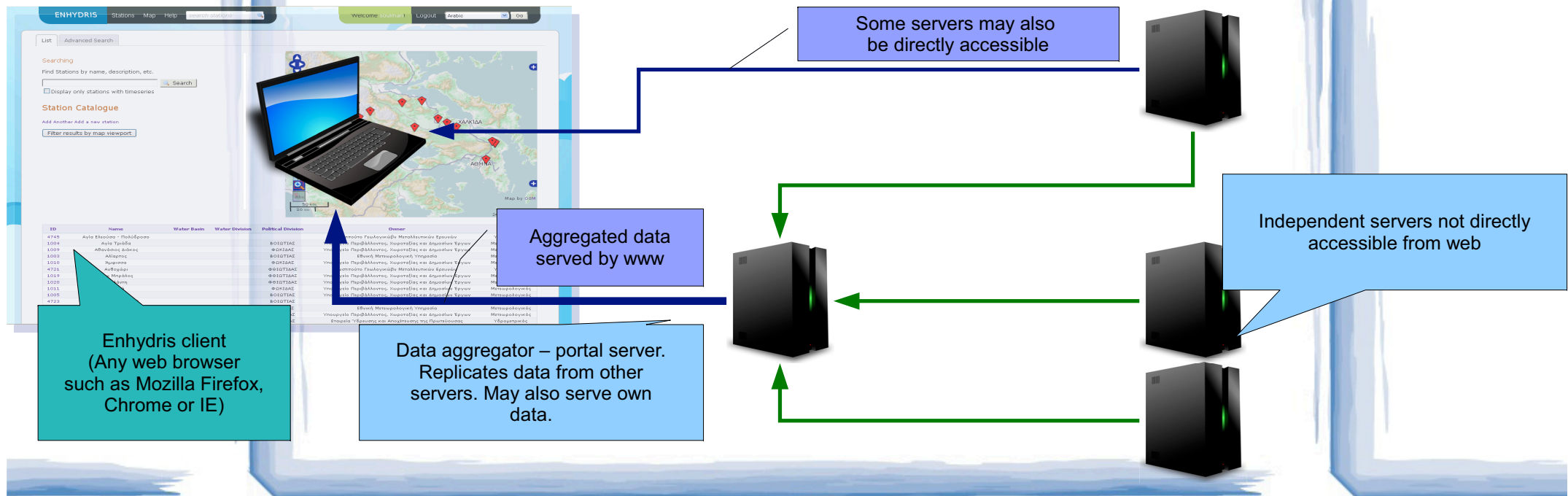
*Enhydris* is a database system for the storage and management of hydrological and meteorological data. It allows the storage and retrieval of raw data, processed time series, model parameters, curves and meta-information such as measurement stations overseers, instruments, events etc.

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 fully secured – restricted system for data storage. Time series can be downloaded in plain text format that can be directly loaded to *Hydrognomon* (<http://hydrognomon.org/>), a free tool for analysis and processing of meteorological time series.

*Enhydris* is free software, available under the GNU Affero General Public License, and can run on UNIX (such as GNU/Linux) or Windows.

## 2. A distributed database system

*Enhydriis* can optionally work in a distributed way. Many organisations can install one instance each, but an additional instance, common to all organisations, can be setup as a common portal. This additional instance can be configured to replicate data from the other databases, but without the space consuming time series, which it retrieves from the other databases on demand. A user can transparently use this portal to access the data of all participating organisations collectively.



### 3. Time series is the core of the system

Time series are holding raw or processed data. Several time scales are possible, ie from minute for fine detailed data to annual or decades for hydro-climatic models.

Time series are related to measurement instruments and / or gauging stations according the hierarchical structure of the database. The hierarchical structure is one of the main design advantages of the database, helping also the geospatial organization of data.

#### Timeseries Details

|                               |                             |
|-------------------------------|-----------------------------|
| ID                            | 860                         |
| Related Station               | Zografou (NTUA)             |
| Name                          | ntua_airtemp_irr            |
| Variable                      | Temperature                 |
| Unit Of Measurement           | deg C                       |
| Precision                     | None                        |
| Time Zone                     | EET                         |
| Remarks                       |                             |
| Instrument                    | Air temperature sensor      |
| Start Date                    | Αύγ. 5, 2005, 11:30 πμ.     |
| End Date                      | Μάρτιος 28, 2011, 11:30 πμ. |
| <b>Time stamps properties</b> |                             |
| Time scale                    | 10-minute - 10 minute(s)    |
| Time stamps regularity        | Time step is not strict     |
| Time stamps reference         | Instantaneous values        |
| Actual offset of reference    | 0 minutes, 0 months         |

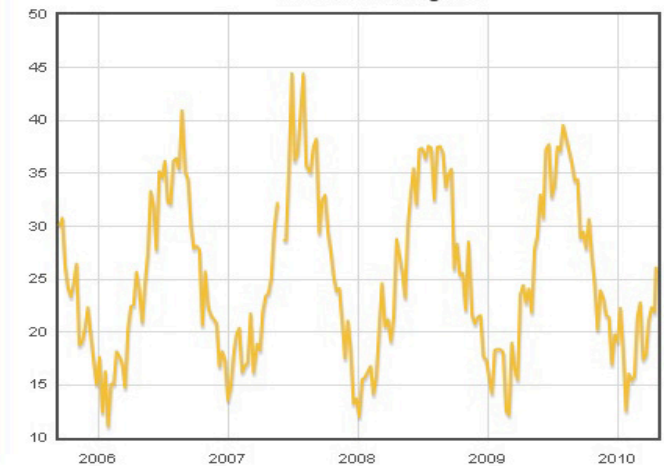


Download Timeseries in plain text from [here](#)

Drag over the **overview** diagram and zoom to a specific period of time.



Timeseries Diagram



## 4. Real time monitoring of hydrometeorological variables

The *Enhydris* database can be updated in real time with data from automatic meteorological stations.

As the database is live updated, The data can be available to the public (or to restricted groups of persons) instantly through the Enhydris web interface.

Several tools help visualize the real-time data e.g. time series charts, data tables etc.

|                            | <b>Agios Kosmas</b><br>2011-03-28 11:00 | <b>Psytalia</b><br>2011-03-28 10:20 | <b>Menidi</b><br>2011-03-28 09:50 |
|----------------------------|---|-------------------------------------|-----------------------------------|
| <b>Temperature</b>         | 17.52 deg C                             | 18.48 deg C                         | 16.15 deg C                       |
| <b>Humidity</b>            | 75.8 %                                  | 60 %                                | 64.38 %                           |
| <b>Rainfall</b>            | 0 mm                                    | 0 mm                                | 0 mm                              |
| <b>Wind speed</b>          | 1.346 m/s                               | 3.402 m/s                           | 1.883 m/s                         |
| <b>Wind gust</b>           | 1.875 m/s                               | 6.25 m/s                            | 3.75 m/s                          |
| <b>Wind direction</b>      | 165.8 deg                               | 246.2 deg                           | 180.3 deg                         |
| <b>Sunshine duration</b>   | 10 min                                  | 10 min                              | 10 min                            |
| <b>Solar radiation</b>     | 801 W/m2                                | 722 W/m2                            | 628.9 W/m2                        |
| <b>Net radiation</b>       | 445.5 W/m2                              | 472.6 W/m2                          | 382.1 W/m2                        |
| <b>Barometric pressure</b> |   |                                     |                                   |

### NTUA stations graphs

A page for tests on time series charts

Time span: month week day

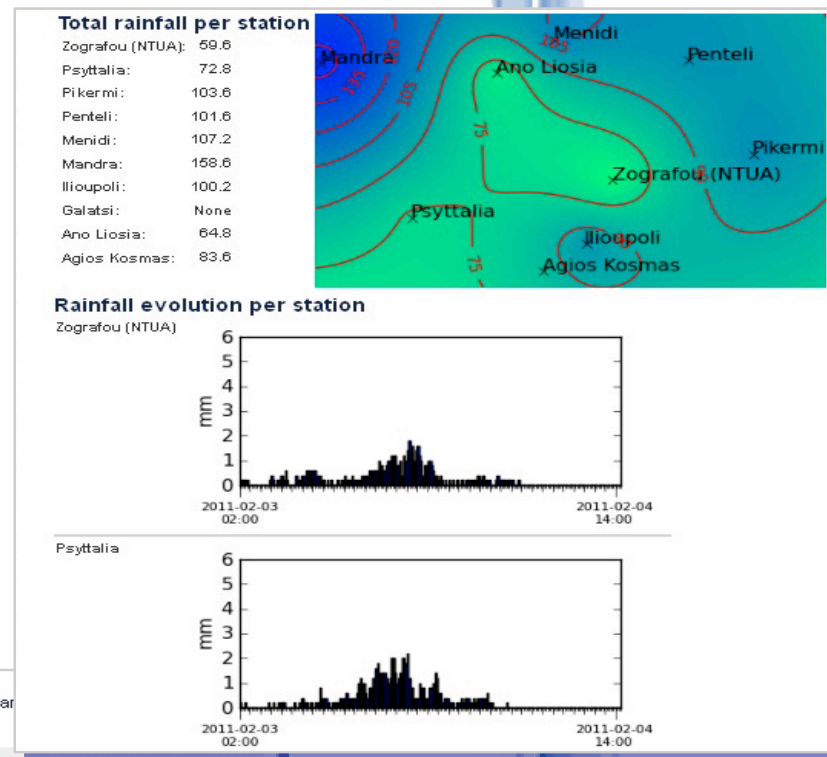


## 5. Detection and reporting of rainfall incidents

*Enhydri*s is extensible: its core is a platform upon which more applications can be built. One such application, which is included with *Enhydri*s 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.

The event report includes charts displaying the evolution of the rainfall per station and a contour chart.

An event cloud (similar to the tag cloud used in blogs) helps the user locate notable rainfall events.



2011

Mar31 Mar20 Mar17 Mar09 Mar07 Mar06 Mar02 Feb24 Feb22 Feb21 Feb19 Feb19 Feb18 Feb03 Jan28 Jan24 Jan12 Jan12 Jan03 Jan02 Jan02

2010

Dec28 Dec16 Dec15 Dec15 Dec13 Dec13 Nov17 Nov13 Nov12 Oct29 Oct27 Oct26 Oct22 Oct18 Oct17 Oct14 Oct14 Oct14 Oct12 Oct10 Oct06 Sep25 Sep25 Sep13 Sep11 Jul26 Jul26 Jul03 Jun30 Jun29 Jun28 Jun28 Jun27 Jun24 Jun23 Jun09 Jun05 May23 May20 May15 Apr06 Mar14 Mar07 Mar07 Feb24 Feb12 Feb10 Feb08 Feb07 Feb07 Feb06 Feb02 Feb02 Jan27 Jan21 Jan16 Jan13 Jan10

## 6. Installations of Enhydris

Several organisations in Greece and Europe have installed *Enhydris*.

- The **Hydrological Observatory of Athens** (<http://hoa.ntua.gr/>), a network of ten (10) automatic meteorological stations and four (4) flow measurement stations installed at the greater area of Athens.
- The **Hydroscope project** is a national Greek database of hydrological and meteorological data, featuring a distributed installation of *Enhydris*: each participating organisation keeps its data on its own server, but all the data are accessible through a common portal (<http://hydroscope.gr/>)
- The **Athens Water Supply Company (EYDAP)** uses *Enhydris* (currently on its intranet only) to manage and store its data.
- **WQ DREAMS** - WQ DREAMS is a database and a web application designed to store and manage water quantity data reported to the European Environmental Agency. All data are related to regions in Europe, mostly at River Basin District level. The temporary URL to reach the website is: <http://wq.wise-dreams.eu/> but it will migrate soon to a permanent link, planed at: <http://wq-dreams.eu/>
- The **openmeteo** database (see below).

# 7. Enhydri is a geospatial enabled application

Enhydri uses free software technologies such as *GeoDjango*, *PostGIS* and *Open Layers* to store, process and display geospatial data.

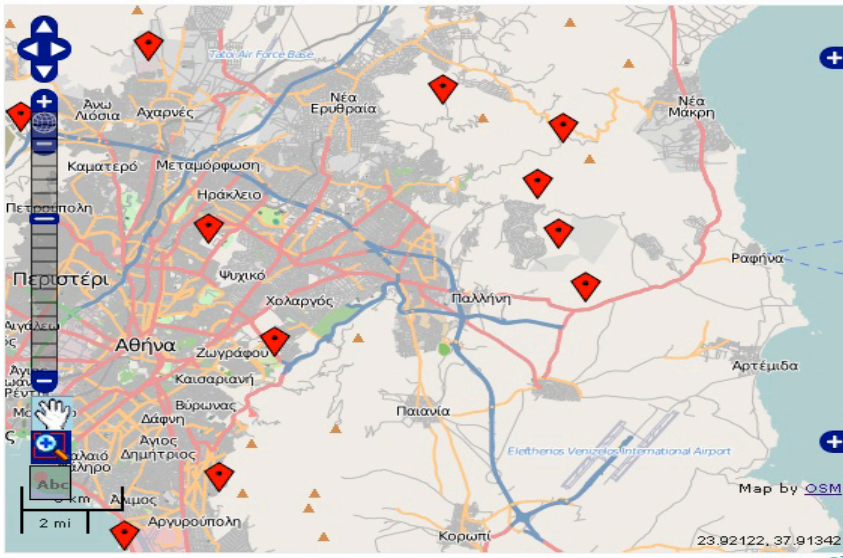
Maps are integrated in the *Enhydri* interface, and stations in specific areas may be located with geospatial queries.

List    Advanced Search

### Station Catalogue

Filter results by map viewport

List of stations of the Hydrological Observatory. Click on the name of the station to display additional information, instruments and timeseries



| ID  | Name                     | Water Division | Political Division | Owner                                   | Type             |
|-----|--------------------------|----------------|--------------------|---|------------------|
| 4   | Agios Kosmas             |                | Greece             | National Technical University of Athens | Meteorological   |
| 349 | Ag. Nikolaos (XBasin)    |                | Greece             | National Technical University of Athens | Meteorological   |
| 17  | Ano Liosia               |                | Greece             | National Technical University of Athens | Meteorological   |
| 338 | Drafi-discharge (XBasin) |                | Greece             | National Technical University of Athens | Flow measurement |
| 50  | Drafi (XBasin)           |                | Greece             | National Technical University of Athens | Meteorological   |
| 9   | Galatsi                  |                | Greece             | National Technical University of Athens | Meteorological   |



Geographical data services are of a well adopted industrial standard: the KML and such information can be shared to several web sites, beyond *Enhydri* web and map application.

With the *Open Layers* technology several background map layers may be used. The default background layers are that of *Open Street Map*, a free source of geographical data.

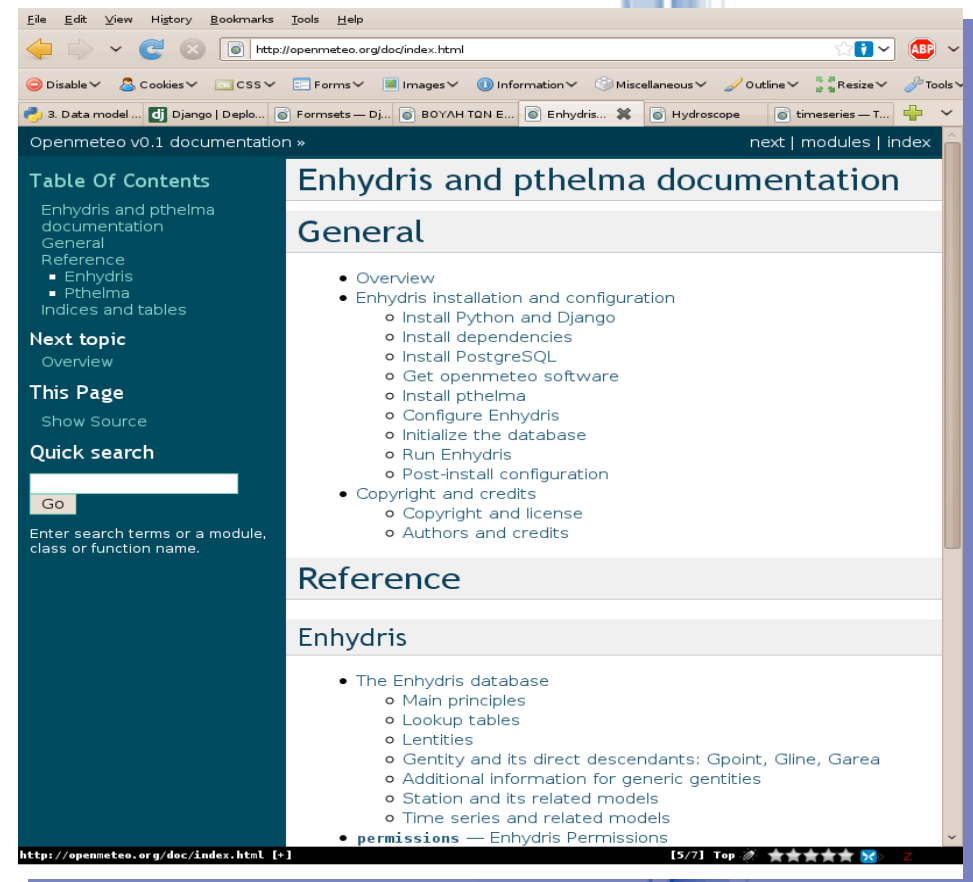


## 8. Support possibilities

Not only is Enhydris free software, it also has detailed documentation for administrators and developers. Therefore, your computer guy can probably install and maintain it, especially if they have a background in Python.

If you don't have such a computer guy, there are many Python specialists and companies on the market who would love to offer you commercial support. For example, indifex.com, the Greek company who created Enhydris under supervision by the NTUA, will be more than happy to take your money.

Free software also allows you to have new features developed without the need to ask us for permission.



The screenshot shows a web browser displaying the documentation for Openmeteo v0.1. The page is titled "Enhydris and pthelma documentation" and is organized into sections: "General", "Reference", and "Enhydris". The "General" section includes an "Overview" and "Enhydris installation and configuration" with sub-points like "Install Python and Django", "Install dependencies", "Install PostgreSQL", "Get openmeteo software", "Install pthelma", "Configure Enhydris", "Initialize the database", "Run Enhydris", and "Post-install configuration". The "Reference" section includes "Enhydris" with sub-points like "The Enhydris database", "Main principles", "Lookup tables", "Lentities", "Gentity and its direct descendants: Gpoint, Gline, Garea", "Additional information for generic gentities", "Station and its related models", and "Time series and related models". The "Enhydris" section includes "permissions — Enhydris Permissions". The browser's address bar shows "http://openmeteo.org/doc/index.html".

## 9. Data is like software: it's better when it's free

Another option is to not maintain your own *Enhydriis* installation, but, instead, to use <http://openmeteo.org/db>, an international, public meteorological database we have created.

*Enhydriis* has a security system that allows it to be used either in an organisational setting or in a public setting. In an organisational setting, there are privileged users who have write access to all the data. In a public setting, users can subscribe, create stations, and add data for them, but they are not allowed to touch stations of other users.

By using <http://openmeteo.org/db>, you can avoid the hassle of maintaining your own database, and you can contribute to the worldwide availability of free meteorological data.

*Enhydri*s is free software, available under the terms of the GNU Affero General Public License version 3. It is developed with Python, Django, and C.

Get poster: <http://itia.ntua.gr/1120>

More information on the [openmeteo.org](http://openmeteo.org) project, source code and free database at: <http://openmeteo.org/>