

## Athens, Greece

### Location

The Greater Athens Area hydrological observatory is located in the periphery of Attica, in the south of the country, and covers the part of the greater Athens area, which extends beyond the metropolitan city of Athens, the capital of Greece.



### Catchment description

The area covered by the Hydrological Observatory is the most densely populated region in Greece, as it hosts about 35% of the country's population (11,000,000 inhabitants in total) while it does not exceed 2.8% of the country's total surface (about 132,000 km<sup>2</sup> in total).

The areas to the north (around *Parnitha*) are covered with forests, whereas areas to the south and the west of Athens are grassy or barren. Mount *Hymettus* (east) is partly forested. In general the greater Athens area is typically urbanized, with the exception of the greatest part of the southeast region, which is rural.

The main rivers of the area *Ilissos* and *Kifissos*, are nowadays covered in their longest part.

The observatory consists of 10 stations belonging to METEONET network and 7 stations to Experimental Basin (X-BASIN). METEONET stations extend over various catchments, covering totally or partly parts of the mountains *Parnitha* (1.413 m), *Penteli* (1.107 m), *Hymettus* (1.026 m) and *Aigaleo* (468 m), while X-BASIN stations cover a closed hydrological basin covering 127km<sup>2</sup> at the eastern part of *Attica*.

## Hydrological Observatory description

### Key descriptors

Network	Station	Date installed	Altitude (m)
METEONET	Zografou (METEONET station)	08/2005	181
	Menidi (METEONET station)	02/2005	210
	Psyttaleia (METEONET station)	02/2005	20
	Ag. Kosmas (METEONET station)	02/2005	6
	Ilioupoli (METEONET station)	05/2005	206
	Mandra (METEONET station)	07/2005	258
	Galatsi (METEONET station)	06/2005	176
	Penteli (METEONET station)	11/2005	729
	Pikermi (METEONET station)	12/2005	133
	Ano Liosia (METEONET station)	02/2006	184
	Lykorema (flowgauge)	01/2005	280
	Basin outlet (flowgauge)	01/2003	146
	Pikermi (flowgauge)	03/2008	102
X-BASIN	Rafina (flowgauge)	03/2008	27
	Ag.Nikolaos (raingauge)	10/2003	383
	Drafi (raingauge) <sup>1</sup>	12/2003	203
	Bala (raingauge) <sup>1</sup>	12/2003	630

### Hydrological summary

The climate is typically Mediterranean with hot dry summers and cool winters, normally mild in the areas adjacent to the sea and harsher in the mountains. Rainfall totals are in general low with the annual mean being about 400mm, whereas flash floods are common in the area.

As far as the geological background is concerned, the Paleozoic and Mesozoic rocks of Attica region consist of alternations of marbles, gneisses, schists, volcanic tuffs, limestones - dolomites and sandstones, while Neogene and quaternary sediments consist of conglomerates, sandstones, marls, loams and clays.

### Data availability

Data measured in METEONET stations (10 hydrometeorological stations) include:

- precipitation (main and secondary raingauge),
- temperature (min, mean and max),
- relative humidity (%),
- wind speed, gust and direction,
- solar radiation, net radiation and sunshine duration.

The METEONET network data can be downloaded from <http://www.meteonet.gr>.

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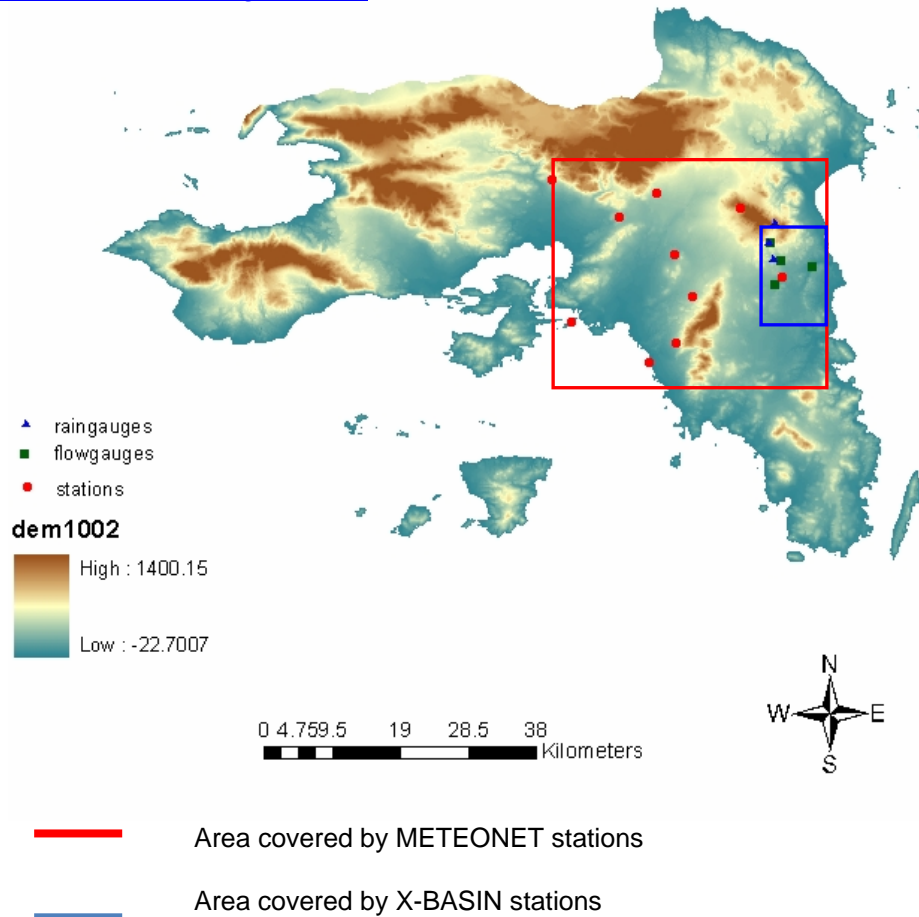
<sup>1</sup> This raingauge was destroyed during the destructive fire event that took place in the area in August 2009 and will be replaced soon.

## Hydrological Observatory description

X-BASIN stations (4 automatic streamflow gauges and 3 stand-alone raingauges) record flow data and precipitation.

Specialized staff carries out additional measurements of hydrological, hydrogeological and chemical interest with a properly equipped Mobile Van. These measurements include soil infiltration capacity and hydraulic conductivity measurements, groundwater level measurements and measurements of the water's basic qualitative parameters.

All data from the X-Basin and the Mobile Van can be downloaded from <http://xbasin.chi.civil.ntua.gr/xbasin/>.



## Research activity and outputs

- Flood plain analysis
- Hydrological regime evaluation
- Bioclimatic indexes and maps
- Statistical analysis and elaboration

## Facilities

Monitoring devices were installed following the installation guidelines set by the WMO, in order to adequately cover the whole area.

## Hydrological Observatory description

Measurements from all METEONET network stations are recorded every 10 minutes and are stored in a database, which is updated three times a day. The data are then processed and are available over the internet. Additionally, piezometric calculations in specific boreholes and chemical analysis of the stream water are repeated every one and two months respectively.

The database is equipped with the infrastructure required to integrate temporally and spatially the hydrometeorological data, calculate bioclimatic indexes (the Summer Simmer Index, the Heat Index and the Martone Drought Index), produce the corresponding bioclimatic maps and statistically process the recorded information.

Concerning the gauges of the X-Basin, the temporal resolution of the 4 automatic streamflow gauges and the 3 stand-alone raingauges is also set to 10 minutes. The recorded data are stored in separate databases, which are updated every 2 weeks.

Discharge measurements are repeated every week, while measurements of the hydraulic conductivity and chemical analysis are carried out every month and infiltration capacity measurements every 6 months. These additional measurements are carried out at several locations in the X-Basin area with the help of the Mobile Van and are repeated whenever it is considered necessary.

### **Institutional support**

All stations of the Observatory are operated by the Laboratory of Hydrology and Water Resources Management of the National Technical University of Athens<sup>2</sup> (NTUA). The Mobile Van is also owned by the Laboratory, which employs specialized staff to carry out the hydrogeological and chemical measurements.

### **Value to network**

All data which are available from the METEONET network and the X-Basin provide the necessary input to estimate the hydrometeorological regime and carry out hydrogeological studies in the Greater Athens Area, an area that includes both urban and rural environment.

Data can be further used for the assessment of climate and land use change effects in the Mediterranean region.

The Athens Area Observatory provides data for hydrological conditions that are frequently found in the Mediterranean region but which are quite different from those monitored by many other observatories in the network. Some additional distinguishing features of the Athens Area in the European context are its high population density and its low annual rainfall.

### **Contact for further information**

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<sup>2</sup> <http://www.chi.civil.ntua.gr/en/index.html>

## Hydrological Observatory description

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### References

- 1) Papathanasiou C., Safiolea E., Kalogiros Y. and Mimikou M. (2007) "Comparative analysis of rain gauge and radar precipitation estimates in the Attiki area", Proc. *10th International Conference on Environmental Science and Technology*, 5 - 7 September, Kos, Greece.
- 2) Papathanasiou C., Safiolea E., Makropoulos C. and Mimikou M. (2009) "The FLADAR Project and its contribution to the implementation of the EU Flood Directive 2007/60", Proc. *11th International Conference on Environmental Science and Technology*, 3-5 September, Chania, Crete, Greece.