19th International Conference on Environmental Science and Technology

Kos, Greece, 3 to 6 September 2025

Measuring climate data in school environment: Analysis of Climatic Trends on the island of Chios (2014–2025)

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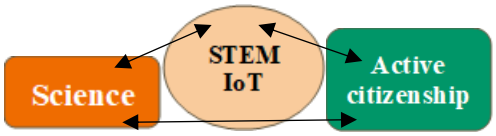
Abstract Teachers of natural sciences theoretically have the ability and privilege to conduct their lessons in a laboratory. In this way, students develop a special interest in the subject of science and acquire additional skills. However, these experiments are typically focus on the syllabus and examinations of secondary schools, without particularly attracting the students' interest. Experimental practice, as a broader concept, includes not only the typical laboratory environment in vitro but also the space, the nature (in situ, in vivo). Such subjects can easily be found if our planet, the environment in which we live, and the understanding of its condition become active laboratory spaces, through experiments where students are active and study and understand the phenomena of climate change, then propose solutions to change the current situation. There are national and European programs available through which students carry out daily experiments within their own school, in a natural environment, process the data, and come to conclusions. This is also a great benefit for teachers, who improve their daily practices while learning to exchange views and interact with colleagues. Students use online applications to share (Internet of Things, IoT), collaborate, and work as a team, trained in soft skills. Case study: Measurements inside and outside of the 1st Lyceum of Chios. Students perform measurements and experiments on basic climate parameters (temperature, humidity, atmospheric pressure, particle concentration, etc.) especially under extreme conditions (heatwave, frost, storm, high dust concentration), using apart their school lab equipment the Davis meteorological station of National Observatory of Athens (NOA), that is situated in school's roof.

Keywords: climate, school, measurements, science, IoT

1. Introduction

The basic idea of the project is shown in the simple schematic diagram below. Through experiments, students are active in studying and understanding the phenomena of climate change by measuring physical quantities such as temperature, humidity, atmospheric pressure, solar radiation, rainfall and then propose solutions for changing the current situation. The measurements and their conclusions are made known to the general public through information activities but mainly through their posting on the internet (school website, EMY website). In this way we reach the desired active citizenship, a healthy form of activism, accessible to the general public.



Climate change

1. Analysis of Climatic Trends on the island of Chios (2014–2025)

2.1. Rainfall Analysis

The analysis of the rainfall in Chios during the period 2014–2025 shows significant seasonal and interannual variability. Winter is consistently the rainiest season, while the trend of overall rain height shows a downward trend. The significant rainfall in 2019 resulted in a very good olive oil harvest, instead of the very poor harvest in years 2022-23. The annual distribution of precipitation is presented in the chart below:

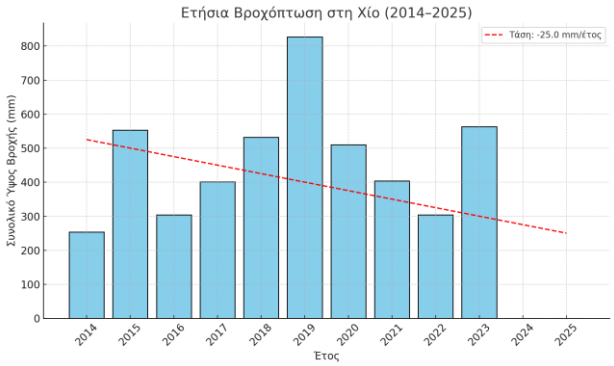


Figure 1. Annual rainfall during last decade and trend.

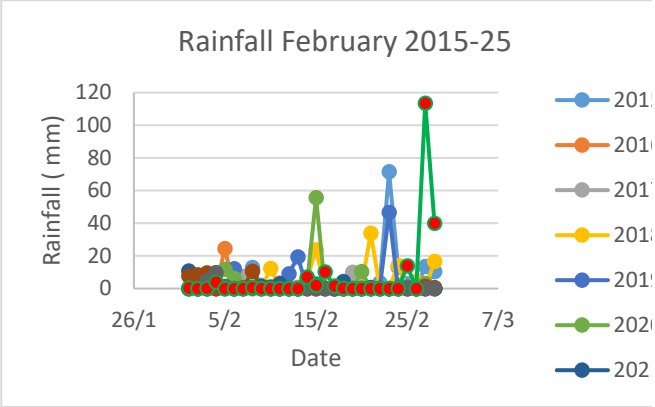


Figure 2. February rainfall during last decade.

Case Study: Extreme Rainfall – February 2025
February 2025 was characterized by extremely heavy rain in Chios, with a total amount of rain reaching 194.0 mm, making it the second rainiest month of the 2014–2025 season. The maximum daily rainfall occurred on February 27, reaching 113.6 mm as it is shown in Fig.2, a value that far exceeds typical precipitation levels on the island. The episode was accompanied by intense wind activity, with an average speed of 9.7 m./s. and a maximum gust of 59.5 km/h. from northeast direction (NE). These conditions are a classic example of a ketophoric weather system, possibly associated with an organized barometric low in the Aegean or a cold penetration front from the northeast.

2.2. Wind Analysis and rainfall

The analysis of the wind data in Chios for the period 2014–2025 shows a net predominance of the northerly winds (S), which are consistently the prevailing daily throughout the year. The average wind speed is higher during the winter, reaching 9.4 m/s. The correlation between wind direction and rain height indicates that the winds from the southwest (SW), northern (N. N.) and Northwest (NNW) addresses are related to the largest amounts of precipitation on the island. Figure 3 presents the total rain associated with each main address.

Table 1. The 5 wind directions with the highest total rain height

Address	Rain Days	Average Rain Height (mm)	Total Rain Height (mm)
SW	146	7.16	1045.0
NNW	106	7.44	788.4
N. N.	135	5.22	704.6
SSE	58	6.99	405.2
S. S.	50	6.82	341.0

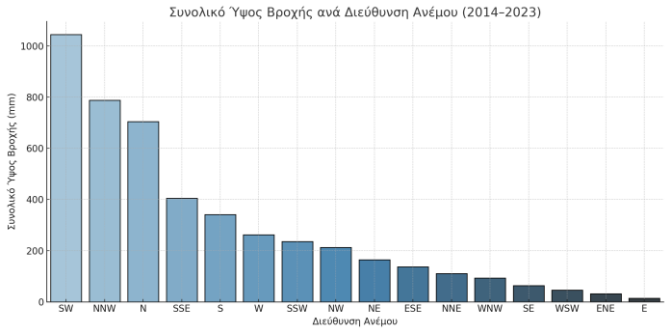


Figure 3. Rain accumulation relative to wind direction during last decade.

Conclusions

Benefits for Students The benefits of such actions as dealing and handling climate data, introduce secondary school students to the issue of climate change, from the perspective of natural sciences and active citizenship, utilizing technology and the Internet of Things (IoT) by developing "citizen science" practices. The aim is for students to research and become more informed about climate change, especially in their homeland, its causes and consequences in various areas of life, both globally, nationally and locally. In addition, children and young people with discovery approaches are informed about the ways in which we can take action to mitigate the rapidly evolving situation or adapt to manage it.
Benefits for Teachers Brainstorming, creative ideas, professional development, collaboration. Creative ideas, practical experiments, collaboration, developing a special interest in the subject matter and acquiring additional skills. Understanding the scientific method and learning how to ask questions and collect the necessary data to get the most complete answer to a given situation. Data processing and sharing (IoT) and drawing conclusions. **Benefits for Schools** Collaboration with institutions (Institutions, University of the Aegean), use of new scientific equipment, success of school and regional initiatives.

References

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Meteorological trends in Creece: https://www.meteo.gr/meteomaps (English version) or https://www.meteo.gr (Greek version)