GLOBE Investigation
Gozo College Sir Arturo Mercieca Rabat Primary School 2023-2024

Do seasonal differences really affect our soil temperature and soil moisture content?

Organization: Gozo College Sir Arturo Mercieca Rabat Primary School
Student(s): GLOBE/Eco-Schools/LEAF team
Grade Level: Grades K-2, ages 5-8
GLOBE Teacher: Josephine Jesse Mercieca
Report Type(s): International Virtual Science Symposium Report
Protocols: Atmosphere; Pedosphere
Presentation Type: Poster
Optional Badges: I am a Problem Solver, I am a Data Scientist, I am a STEM Storyteller

Summary

Malta is a small island in the Mediterranean *(Fig. 1)* and its soil is the bread and butter of the island. Farmers/Crop Growers do everything to keep the soil rich and secure *(Fig. 2)*, but they do rely on the heavens to feed the soil with water. We are noticing that every year we are getting less and less water from our skies. "A 2022 NSO study by Prof. Charles Galdies show that Malta's average rainfall has decreased by 10.3mm every decade since 1952". (Ellul, 2024) It is important, if not essential, that we investigate our soil moisture content, soil temperature and when these are at their highest concentration. It is vital that we, in collaboration with other GLOBE students from all over the world, pass this information to NASA which updates the global soil moisture map (SMAP) *(Fig. 3)*.

Figure 1: Map of the Maltese Islands in Europe

Figure 2: Our soil and rubble walls

Figure 3: SMAP

About Malta

We first, need to learn about Malta and its climate to really understand the effect of seasonal differences in our soil. Malta is comprised of an archipelago of three inhabited islands: Malta *(Fig. 4)*, Gozo *(Fig. 5)* and Comino *(Fig. 6)* and several smaller unpeople islands. These islands are located south of Sicily and north of Africa in the Mediterranean Sea. It has a population of around 500,000 people making it one of the most heavily populated countries in the world compared to its land mass.

Figure 4: Malta

Figure 5: Gozo

Figure 6: Comino

About Malta's Climate

Malta's climate is best described during its different seasons:

1. **Hot Summers** (June to September) are hot and dry months. Temperatures here range from 28°C to 34°C (82°F to 93°F).
2. **Mild Winters** (December to February) are mild and wet. Temperatures here range from 10°C to 15°C (50°F to 59°F).
3. **Spring** (March to May) and **Autumn** (October to November) enjoyable seasons. The weather is comfortable and plant life comes alive with flowers blooming.
4. **Sea Temperature** (all year round) the water stays warm making it perfect for swimming and doing water activities.
5. **Wind** on the Maltese Islands experience the **Mistral** during the winter months, which is a strong north-westerly wind.
6. **Rainfall** happens during the winter months between October and March (about 22" or 550mm). During the summer months (June, July, August) it is usually very dry.

7. **Daylight** (winter – December, January, February) are not as short as in northern Europe. Malta enjoys 10.3 hours compared to London, Moscow or Warsaw with only 8 hours. December 21 is known as the shortest daylight, from 7:00 am to 5:00 pm and longest daylight is June 21, from 5:30 am till 8:30 pm.

Malta boosts a subtropical-Mediterranean climate where Valletta, the capital of Malta, has been known to have the warmest winters among all European capital's cities.

Research Question

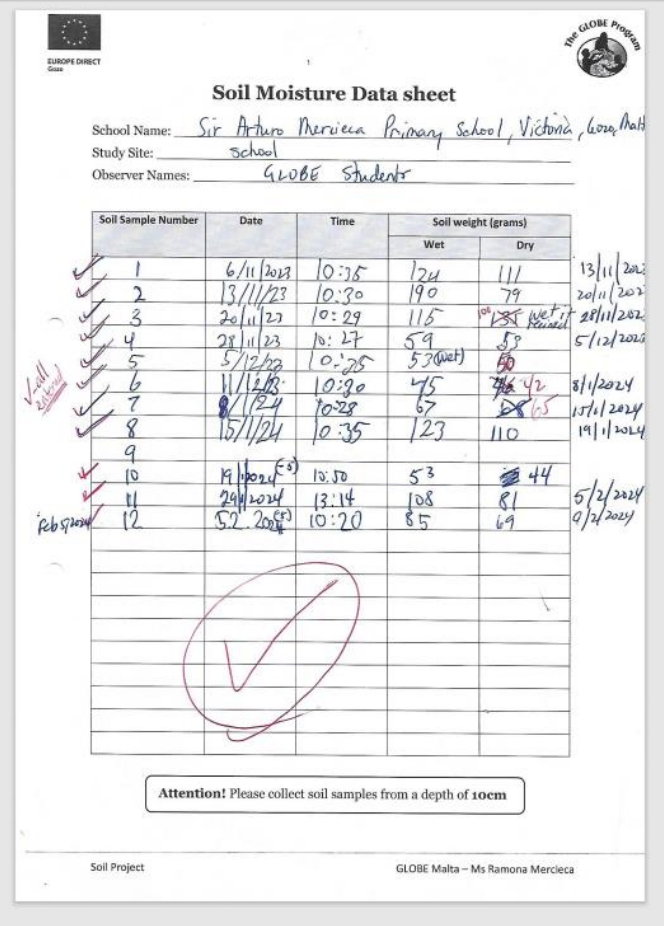
This year our investigation leads us to seasonal difference and how this affects our soil. Specially targeting our soil moisture and the soil temperature within our school grounds. The students came up with the following questions: "Could there really be a difference in soil moisture and soil temperature and in which month is the highest recorded?". While carrying out this investigation, our school entered the UN World Soil Day Poster Competition *(Fig. 7)*, highlighting and informing the importance our soil plays in our ecosystem and the crucial link to water.

Figure 7: UN World Soil Day Poster Competition

Research Methods

We took part in the GLOBE Malta - Europe Direct Gozo Soil Project – Exploring the Hidden World with 6 other schools in Gozo and choose to investigate our soil moisture through gravimetric means. The observation period started in November 2023 till the end of January 2024. Since we wanted to explore if seasons affect the moisture content and soil temperature, it was decided that we needed to extend our research till the 9th of February 2024. Our GLOBE students, once a week, took soil samples from a depth of 5cm – removing rocks, large roots, worms and other insects/animals. Then weighing the soil at the time of packing to record the water content from fresh soil *(Fig. 8).* Next putting the soil sample outside on a ledge for a week to dry. Afterwards when the soil had been dried, it was weighed again. Documenting this on our form *(Fig. 9),* we can tell how much water was in the soil. Moreover, the students on a daily basis, measured the soil surface temperature using an infra-red thermometer *(Fig. 10).* By means of a datalogger *(Fig. 11),* the students measured also other weather parameters, including cloud types; air temperature; air pressure; humidity; rainfall; wind strength and soil surface temperature following the GLOBE protocols. This data was also documented on a data sheet and uploaded to the GLOBE database *(Fig. 12).*

Figure 8: GLOBE Students digging, measuring, weighing, documenting their soil sample



Soil Moisture Data sheet

School Name: Sir Arturo Mercieca Primary School, Victoria, Gozo, Malta
Study Site: School
Observer Names: GLOBE Students

Soil Sample Number	Date	Time	Soil weight (grams)	
			Wet	Dry
1	6/11/2023	10:35	124	111
2	13/11/23	10:30	190	79
3	20/11/23	10:29	115	wet it flushed
4	28/11/23	10:27	59	53
5	5/12/23	10:25	53 (wet)	50
6	11/12/23	10:30	75	42
7	8/1/24	10:28	67	65
8	15/1/24	10:35	123	110
9				
10	19/1/2024 (Fri)	10:50	53	44
11	29/1/2024	13:14	108	81
12	5/2/2024 (Mon)	10:20	85	69

Well watered

Feb 5/2024

13/11/202
20/11/202
28/11/202
5/12/2023
8/1/2024
15/1/2024
19/1/2024
5/2/2024
9/2/2024

Attention! Please collect soil samples from a depth of **10cm**

Soil Project

GLOBE Malta – Ms Ramona Mercieca

Figure 9: Soil Moisture Data Sheets

Figure 10 & 11: GLOBE students using their instruments

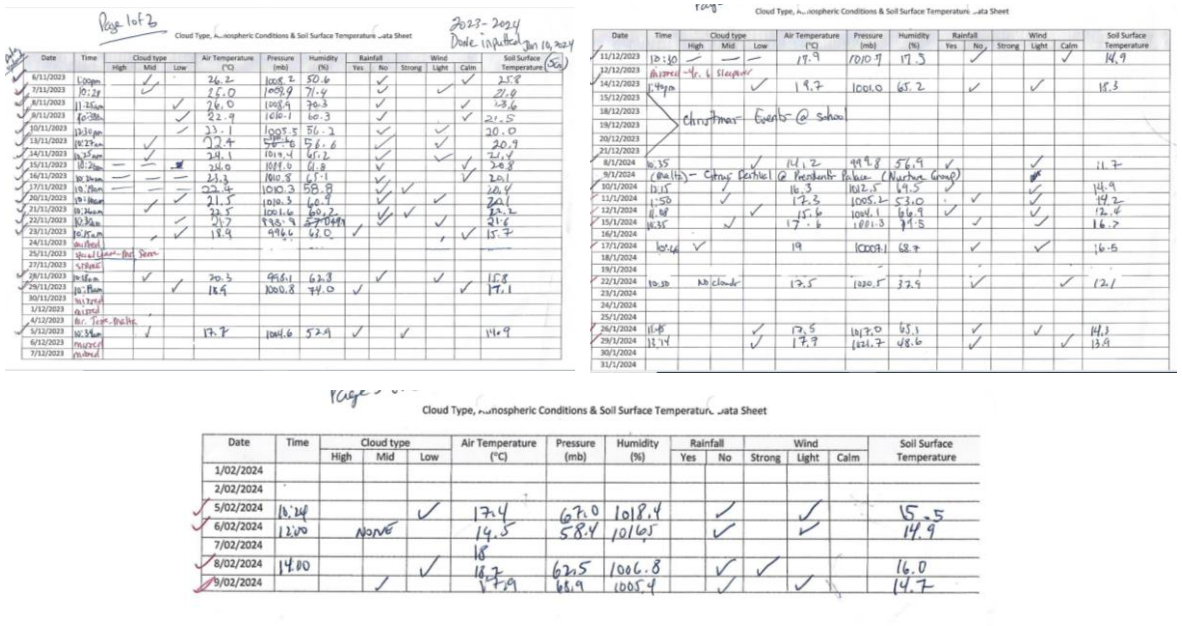


Figure 12: Weather Parameters Datasheets

Results

The screenshots below show data uploaded on the GLOBE website during the observation period between November 2023 and February 2024 *(Figs. 13,14,15)*. (GLOBE, 2024) The students collected daily readings of soil /air temperatures and weekly soil moisture following GLOBE protocols.

Air Temperature

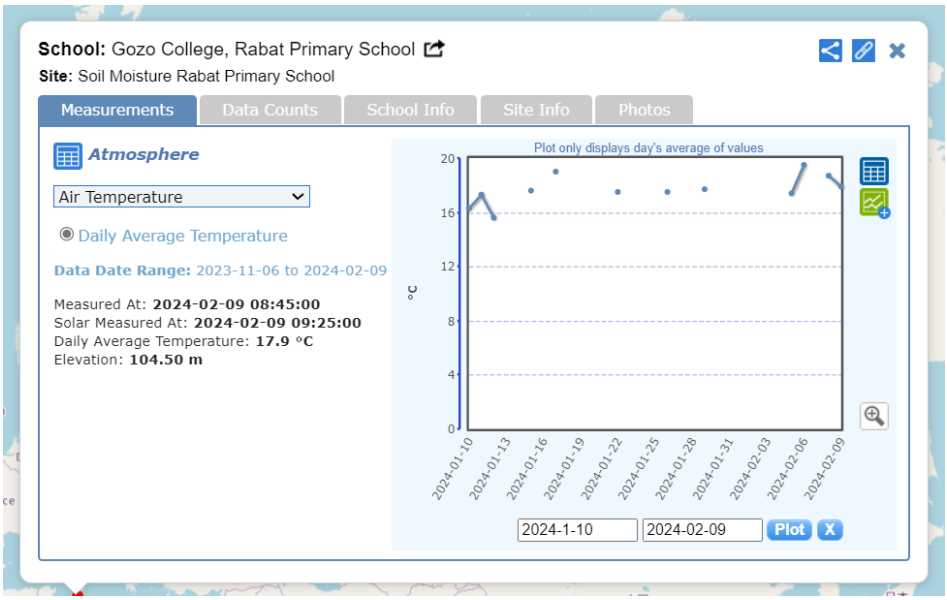


Figure 13: Air Temperature plot of VIZ GLOBE

Soil Temperature

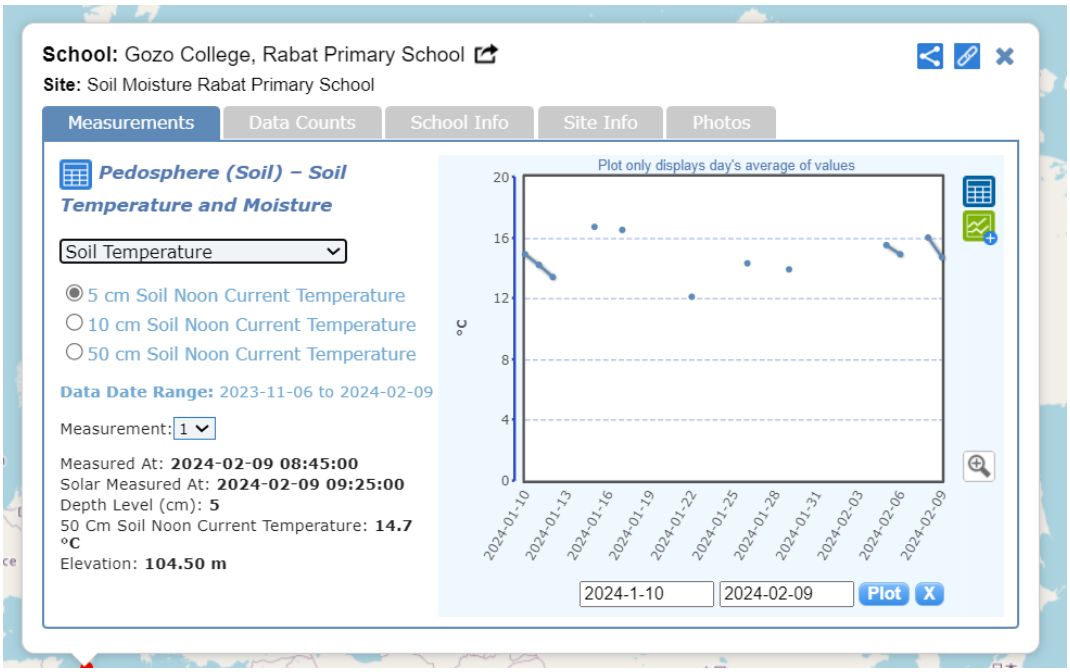


Figure 14: Soil Temperature plot of VIZ GLOBE

Soil Moisture – Gravimetric

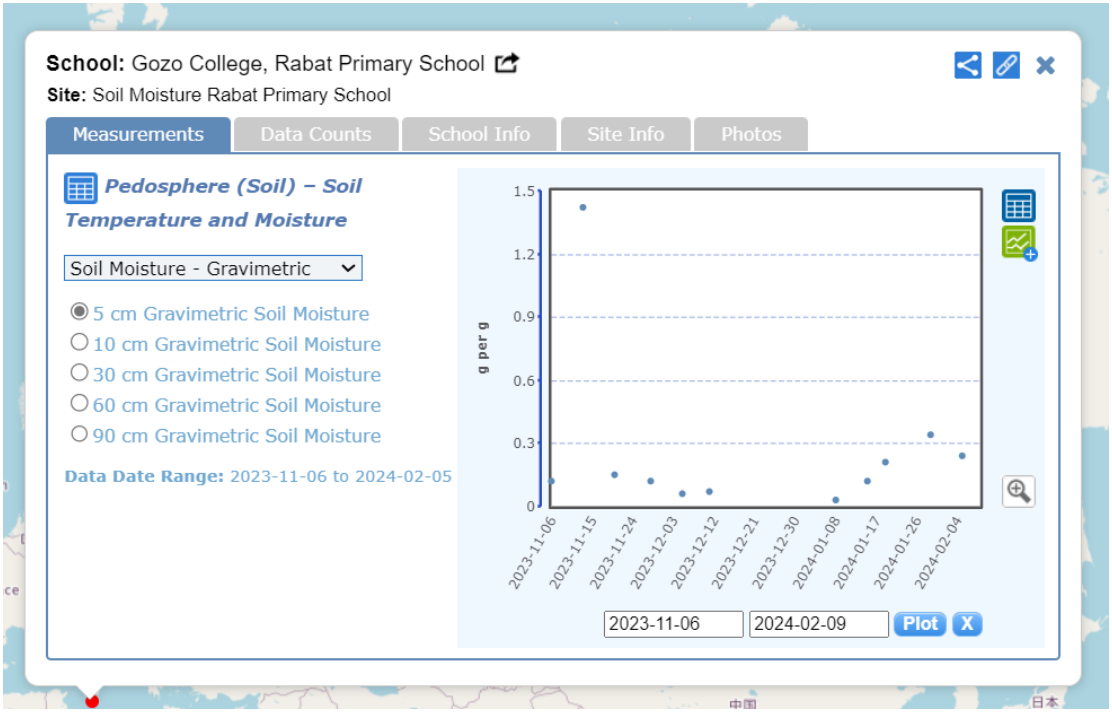


Figure 15: Soil Moisture plot of VIZ GLOBE

Conclusion

Getting back to our original question – "Do seasonal differences really affect our soil temperature and soil moisture content? Is there a relationship with the charts?" We have noticed that the lack of rainfall, is significantly affecting our soil moisture and temperature because there was very little difference between pre – post drying of soil. We notice when the air temperature is high, the soil gets warmer and eventually the moisture content decreases. The lack of moisture in the soil will affect the farmers in a big way. To make matters worse, **CLIMATE CHANGE** is, and continues, to affect our region with higher temperatures during the rainy season – less rainwater makes for drought conditions on our islands. Since the rainfall has become unreliable and not happening during our winter months, we suggest that we change our current pattern by doing more investigations during the Spring and Fall months in order to see if there is a difference.

With the limited data, we can conclude that we need to change our ways of conserving water and the types of crops grown. Especially for us in Malta it is worse – we do not have natural rivers that could supply us with water, instead, we need to learn how to use water wisely. For example, it is important to plant more trees that are adaptable to the climate of the Maltese Islands. Trees are very beneficial in that they provide shade which helps retain soil moisture. We also propose to put up rainwater barrels to collect natural rainwater for our school and reuse it to water our plants, etc.

CLIMATE CHANGE is affecting the link between soil and water – NO RAIN!!!

Thank you for listening!

References

Ellul, D. (2024, February 10). *Times of Malta*. Retrieved from The Times of Malta: https://timesofmalta.com/articles/view/desert-malta-course-see-driest-year-ever.1083015#:~:text=A%202022%20NSO%20study%20by,drought%20years%2C%20especially%20since%202000.

GLOBE. (2024, February). *GLOBE Data Viz System.* Retrieved from GLOBE: https://vis.globe.gov/GLOBE/

Badge Description/Justification

I make an Impact

Making a connection to soil moisture/temperature and attributing it to Climate Change. We had a special assembly informing our school how important soil and water. We also planted a tree.

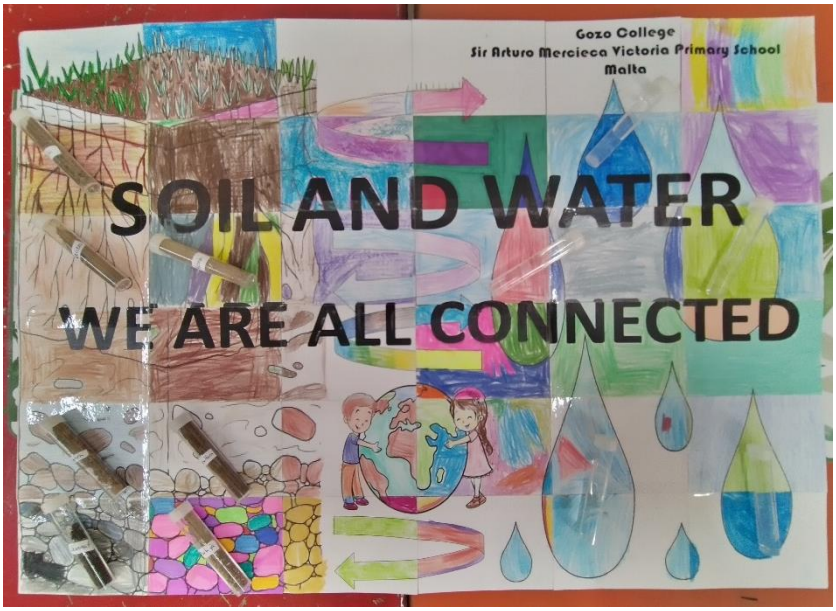
On our GLOBE/Eco-Schools/LEAF noticeboard

Planting a Tree

I am a Data Scientist

Students collect data for 2 ½ months and use instruments such as a data logger, infra-red thermometer, scale, etc. We entered the data onto the GLOBE website. The learners competed in the UN World Soil Day Poster Competition.

GLOBE Students Mixing with Planet Earth



UN World Soil Day Poster Competition

I am a STEM storyteller

Sharing our findings with the whole school & our community through our noticeboard, special assembly and social media.

On our GLOBE/Eco-Schools/LEAF noticeboard

Special Assembly informing our students about our project – SOIL & WATER