

Anthropogenic effect on the underground environment

Lycée international de Valbonne (France)

Class 2nd7 2022- 2023

Through scientific researches, a raise of temperature in the cave has been confirmed. We know thanks to scientific analysis that the increase in a cave's temperature negatively affects its wellbeing. Although it is certain that global warming is affecting the cave's temperature, the excess of human visitors can also have an impact on the underground environment.

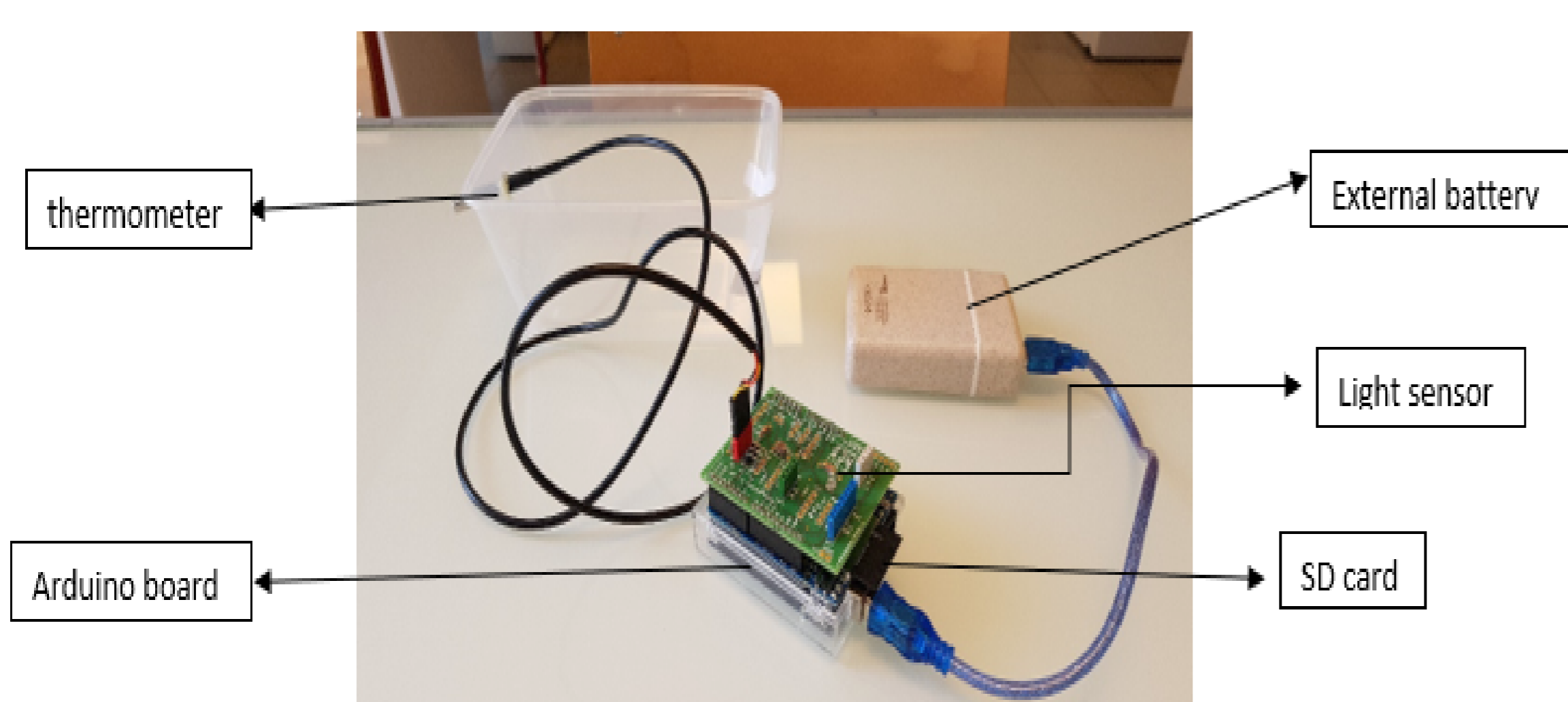
Are the regular human visitors impacting the variations of temperature in the cave?

Baume Obscure, the cave that we have studied, is an incredible area situated at an average altitude of around 700m in a karstic environment close to Saint Vallier de Thiey. These fascinating tunnels and rooms has been equipped with stairs and footbridges for easy access, enabling the steady and heavy flow of visitors. The cave of Baume Obscure is a logical choice for our study, as there are light animations that guide visitors through the cave. This allows us to compare the data of the temperature and luminosity sensors previously placed both inside and outside the cave from 28/10/22 to 02/11/22 in order to answer our problematic statement.



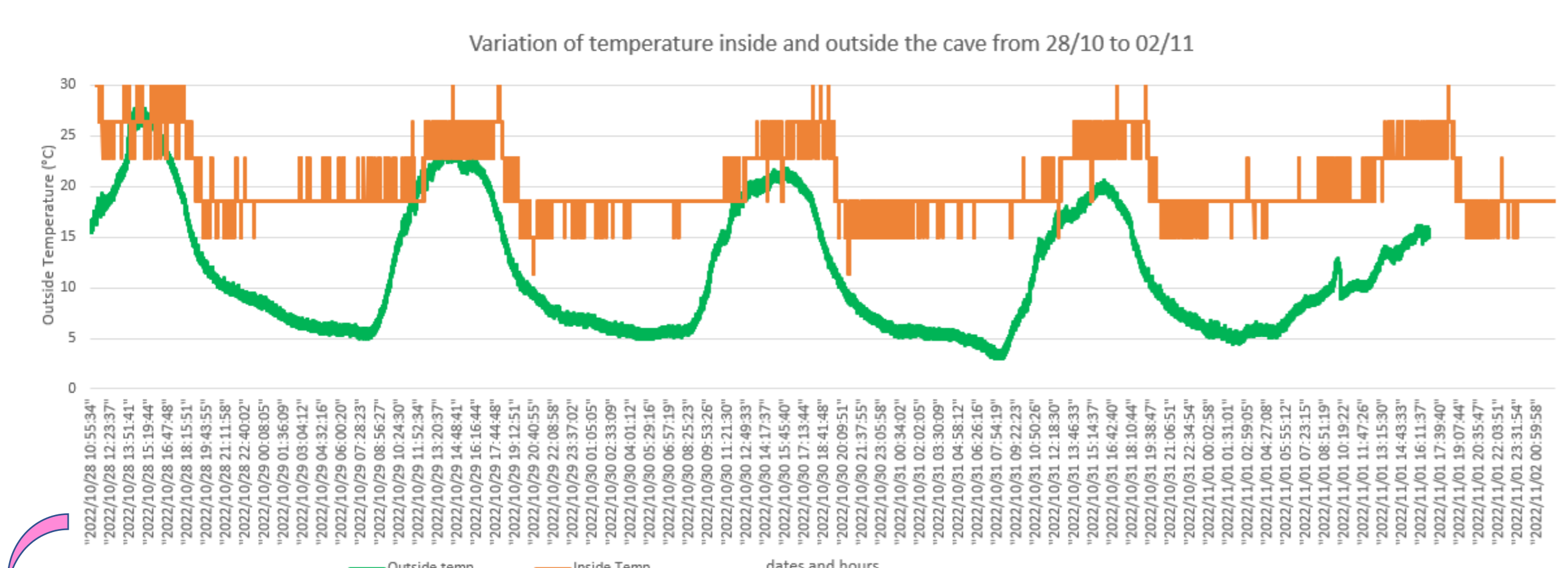
Visit to the Baume Obscure Cave with the 2nd7 class

TEMPERATURE AND LUMINOSITY SENSOR

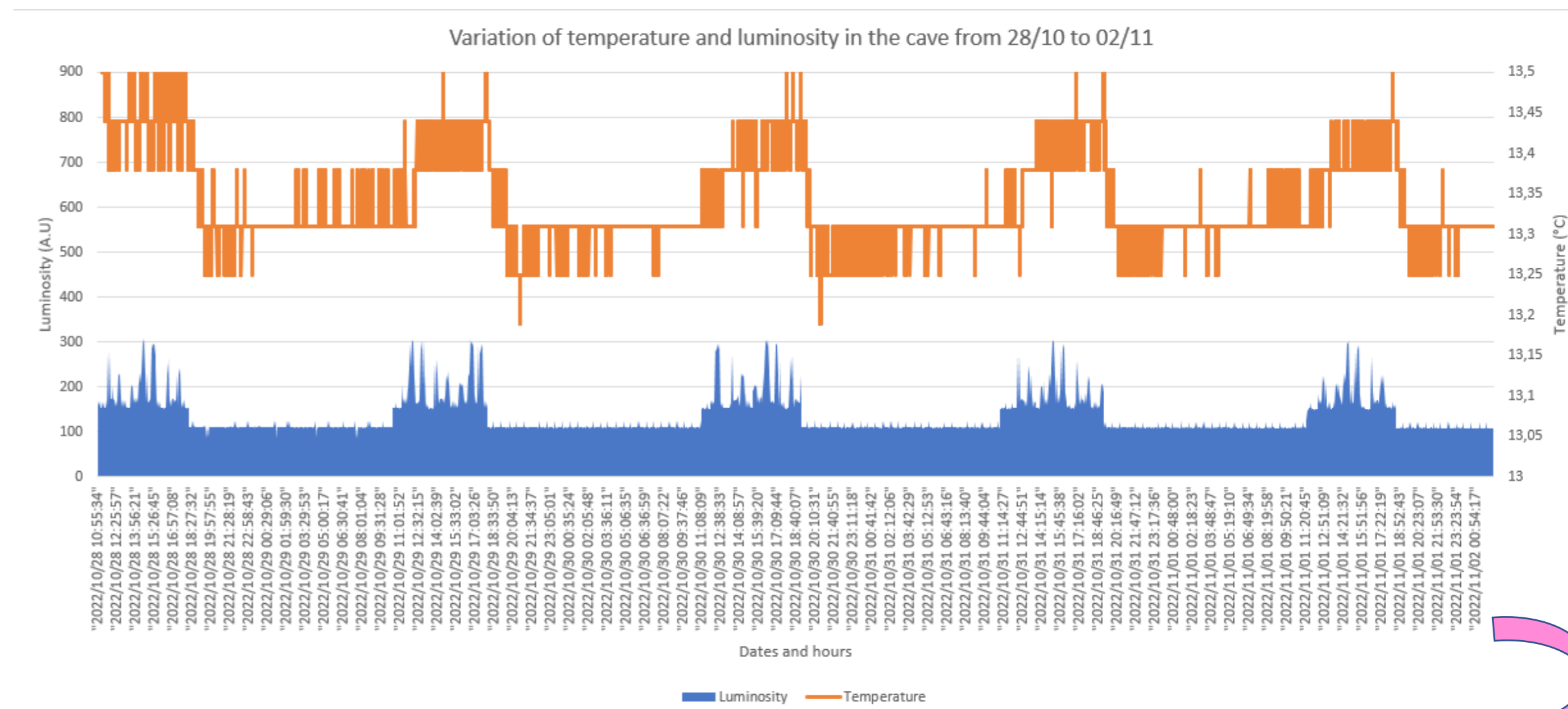


The sensors positioned in the Baume Obscure cave

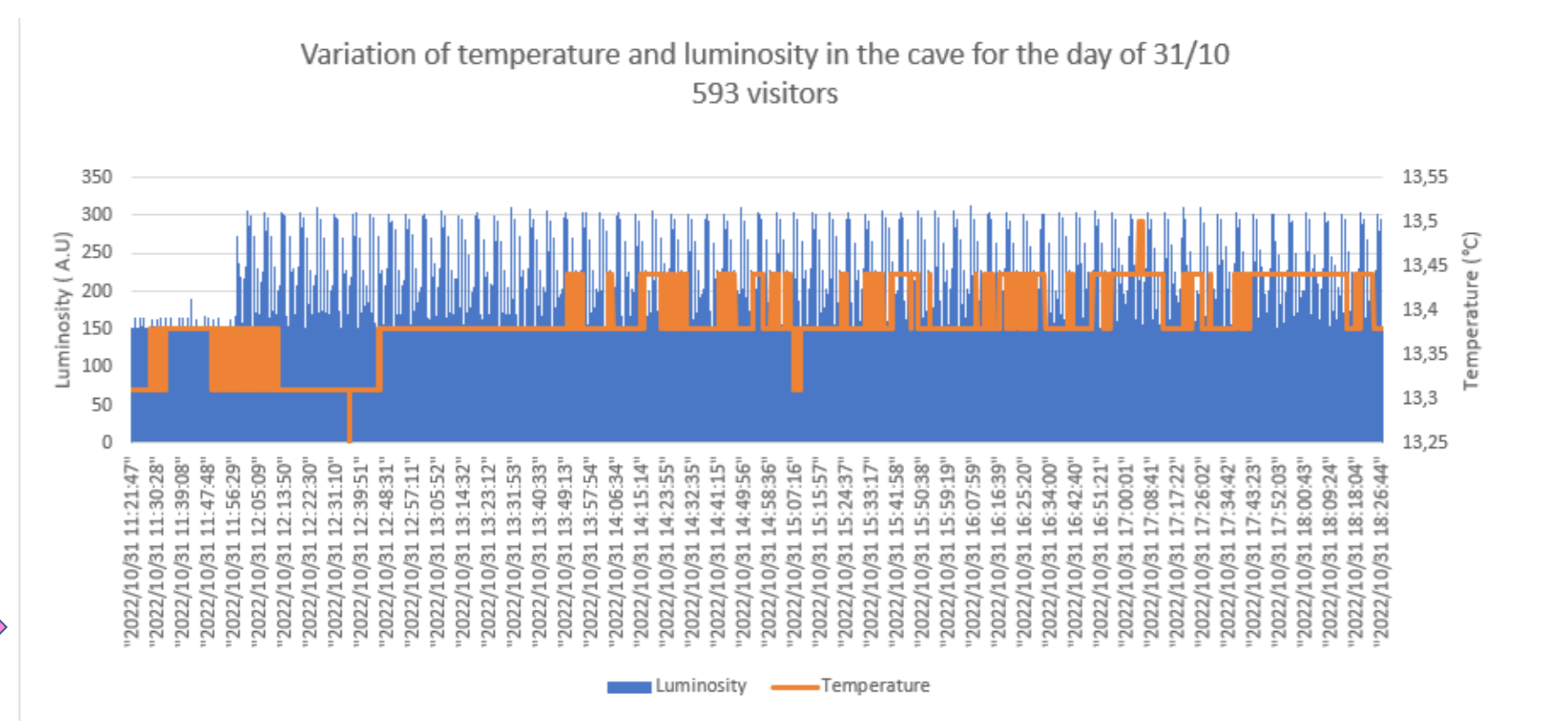
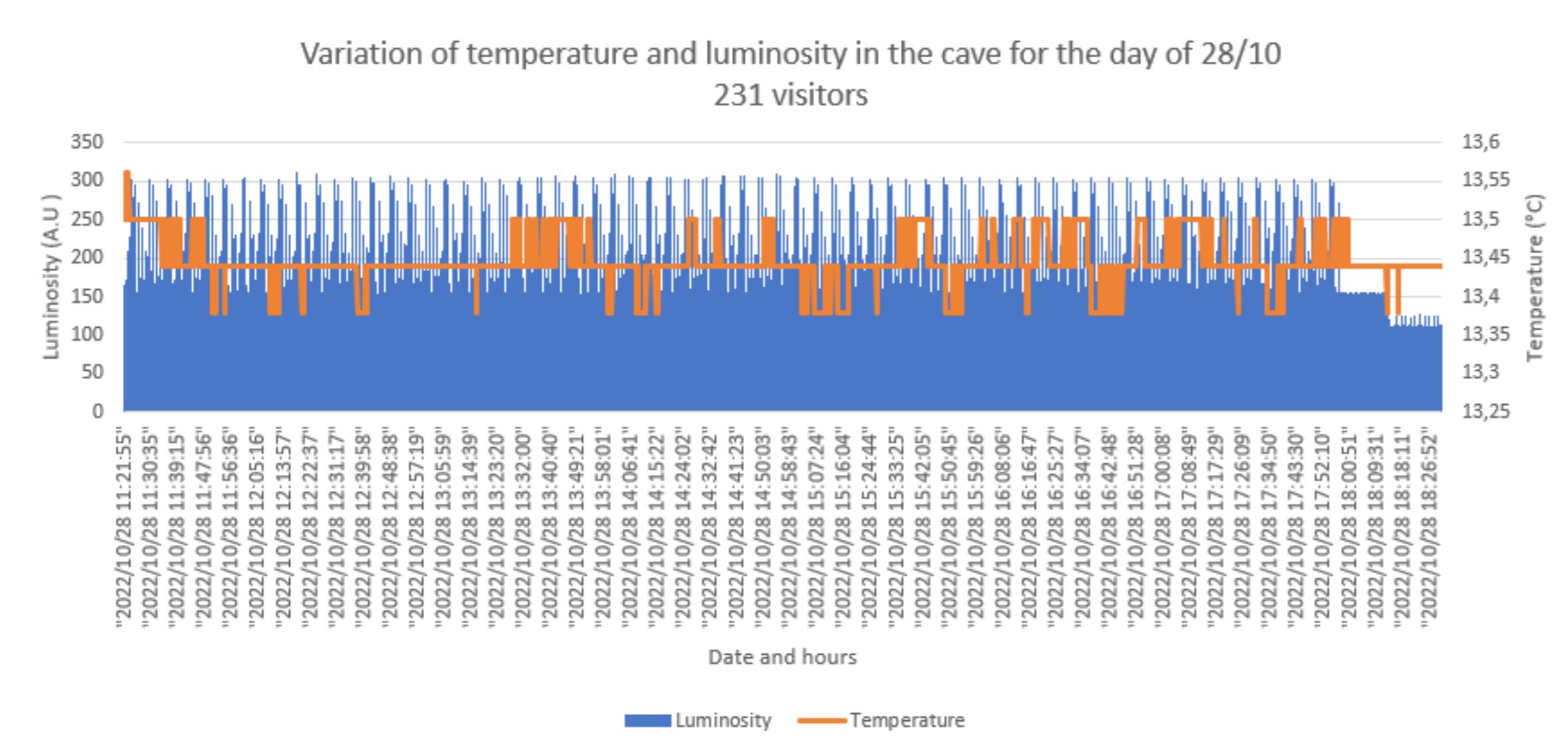
TREATMENT OF DATA



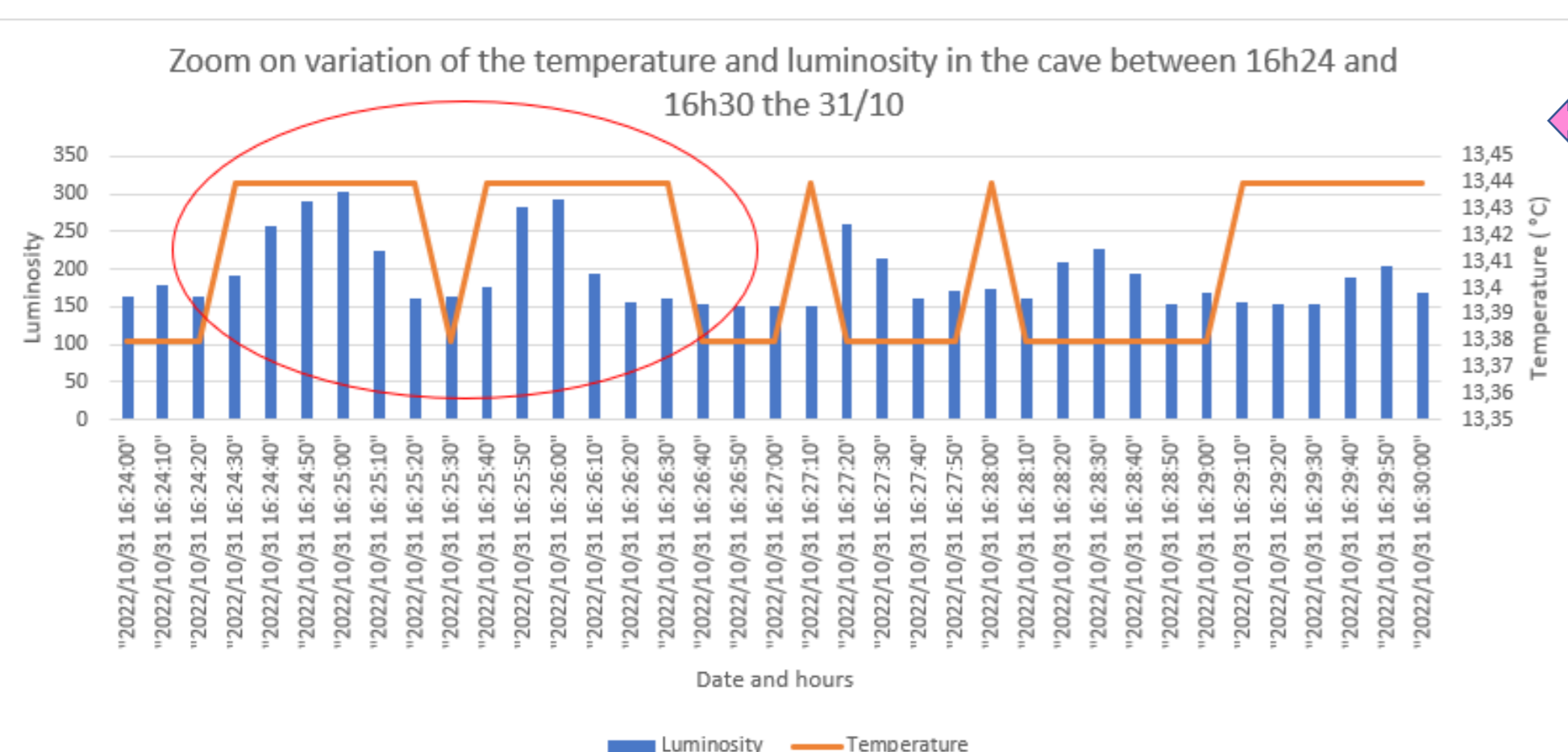
Between October 28 and November 2, both outside and inside the cave temperatures increase during the day and decrease at night. When looking at the scale, we notice that the temperature in the cave barely varies over time.



We observe that the temperature and the luminosity in the cave increase simultaneously. The luminosity is linked to the light animations for the visitors. We also observe small variations of temperature at night.



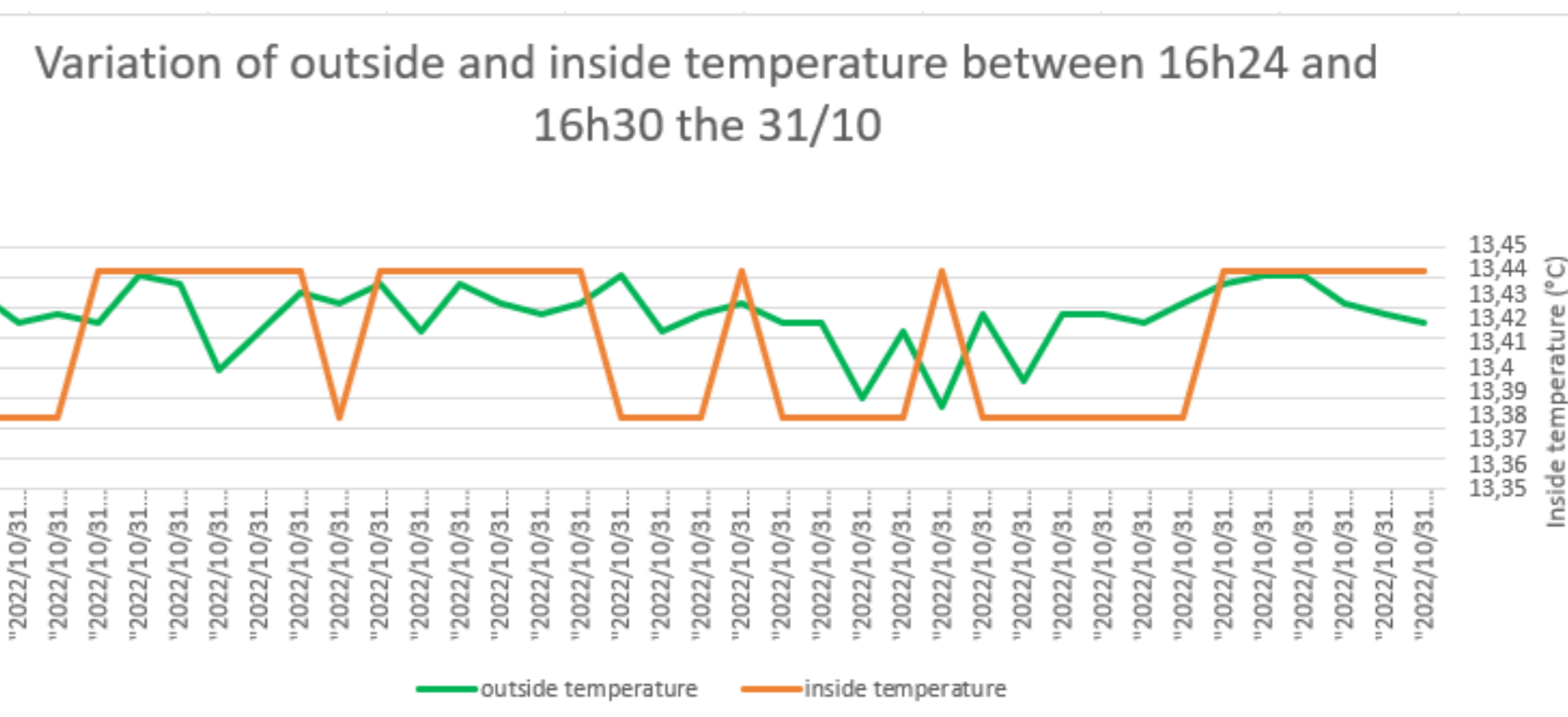
We compared the data of two days with different numbers of visitors each in order to see if the presence of visitors has an impact on variations of temperatures during daytime.



It seems that some peaks in temperatures are related to the increase of luminosity thus to the presence of visitors.

We therefore checked if it wasn't related to variations of outside temperatures instead.

We note that the small variations of T° highlighted on the zoom do not really correspond to the variations of outside temperature. They could be correlated with the increase in luminosity in the cave and therefore with the presence of visitors.



Dates	number of visitors	Temperature average inside the cave from 10h to 17h	Temperature average outside the cave from 10h to 17h	Temperature average inside the cave from 17h to 0h00	Temperature average outside the cave from 17h to 0h00	day/night indoor temperature differential	day/night outside temperature differential	difference between indoor and outdoor temperature during the day
28/10/2022	231	13,44	22,45	13,34	12,67	0,1	9,78	9,01
29/10/2022	362	13,38	20,6	13,3	9,74	0,08	10,86	7,22
30/10/2022	551	13,36	18,67	13,31	9,73	0,05	8,94	5,31
31/10/2022	593	13,36	16,52	13,33	9,25	0,03	7,27	3,16
01/10/2022	487	13,36	12,59	13,31	6,66	0,05	5,93	-0,77

As we can see on this table, the average temperature inside the cave is almost always the same despite the variation of the number of visitors. So these comparisons don't enable us to jump on the conclusion that the visitors have an impact on the inside temperature of the cave...

Some of the data seen previously has allowed us to establish a link between the presence of visitors and slight increases in temperature inside the cave. However, the averages taken do not allow us to show with certainty the existence of a link between the presence of visitors and the variations in temperature inside the cave.

However, the analysis of nighttime variations of temperature inside the cave suggests that the small variations registered by our sensor are due to simple air flows in the cave.

Although we have not shown any impact of visitors on the temperature in the Baume obscure cave, scientific research has shown that in the Pech Merle cave (Occitanie, France), for example, the ambient temperature has increased by 0.3°C due to the number of visitors. Furthermore, although the temperature in the caves is approximately constant all year long, it is known that it depends on the outside temperature. So, if the outside temperature increases due to global warming, the temperature in the caves may also increase. All these factors can threaten the whole cave ecosystem.