

Observing the changes in weather and magnetic field change in Kinmen

Students :

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Abstract

- Through participation in the GLOBE program for measuring environmental changes, as well as participation in the magnetic field measurement program, we attempted to study the relationship between weather changes and the magnetic field. After eight months of measurement and recording, our observational conclusions show that cloud cover and rainfall are positively correlated, with larger clouds potentially carrying more water vapor, resulting in smaller rainfall on days with relatively less cloud cover. This conclusion aligns with our predictions. The relationship between relative humidity and magnetic field is relatively weak. Recent magnetic field disturbances may cause slight changes in magnetic field measurements, but the impact of these changes is not significant. In conclusion, the relationship between changes in the Earth's system environment and the magnetic field may be a complex, indirect one, so the effects of magnetic field changes on the environment are not apparent.

Motivation

- We are three GLOBE weather observation volunteers from Kinmen High School. In the afternoon, we will measure various weather factors such as temperature, rainfall, take photos of clouds, ground temperature, and air pressure to provide stable observation data for our school. This allows our teachers and fellow students to have long-term information and a better understanding of our school's climate. In July, we participated in a national school project to measure geomagnetism. We conducted measurements at a fixed location every two weeks and uploaded the data to the Internet for everyone to use. Therefore, we would like to take this opportunity of IVSS to share not only our weather data but also the geomagnetic data we have observed, and conduct some related analysis.

Purpose

1. Comparing whether the total magnetic field is related to the change of cloud species
2. Compare whether the total magnetic field is related to the changes of local meteorological indicators
3. Identify the possible causes of the measured total magnetic field variation

experimental process

- Using the Phyphox mobile app, measure the direction and intensity of the Earth's magnetic field every 15 days and record a photo of the measurement. Fill in the designated Google Forms with the results and record all data in GLOBE data. Analyze the magnetic field changes for over a year and plot the trends for the past seven months for humidity, temperature, soil temperature, surface temperature, and precipitation on a line graph. Also, create a table of cloud variations to analyze the correlation between the magnetic field and these variables.

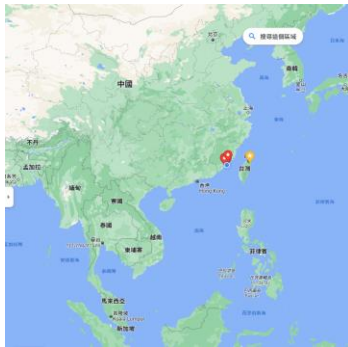
experiment record



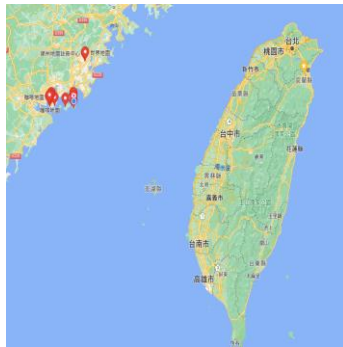
-Globe program observation recording method-

- geomagnetic record -

校名	金門高中	金門高中	金門高中	金門高中	金門高中
紀錄者	李育賢	李育賢+岑驊	盧岑驊	岑驊家	盧岑驊
實驗日期	2022/7/1	2022/7/15	2022/8/1	2022/8/16	2022/10/16
實驗時間	下午 3:00:00	下午 3:00:00	下午 3:00:00	下午 5:00:00	下午 3:00:00
緯度(°)	X	24.42	24.421	24.421	24.421
經度(°)	X	118.309	118.309	118.309	118.309
高度(km)	X	0.021	0.03	0.03	0.023
磁偏角D(°)	X	-4.33	-4.33	-4.33	-4.35
水平傾角I(°)	X	36.91	36.92	36.92	36.92
總磁場(nT)	X	45918.9	45921.3	45923.1	45931.2
水平總磁場(nT)	X	36715	36715	36715.5	36717.5
X方向磁場值(nT)	X	36610.5	36610.2	36610.5	36611.7
Y方向磁場值(nT)	X	-2769	-2771.9	-2774.5	-2784.7
Z方向磁場值(nT)	X	27578	27582.2	27584.9	27595.4
X方向磁場值(mT)	X		-14.6	-3.37	-0.66
Y方向磁場值(mT)	X		11.76	34.04	34.4
Z方向磁場值(mT)	X		-39.51	-31.86	-34.84
絕對值(mT)	X		43.73	46.75	48.96
手機廠牌型號	X	iPhone 13	iPhone13	iPhone13	Iphone13



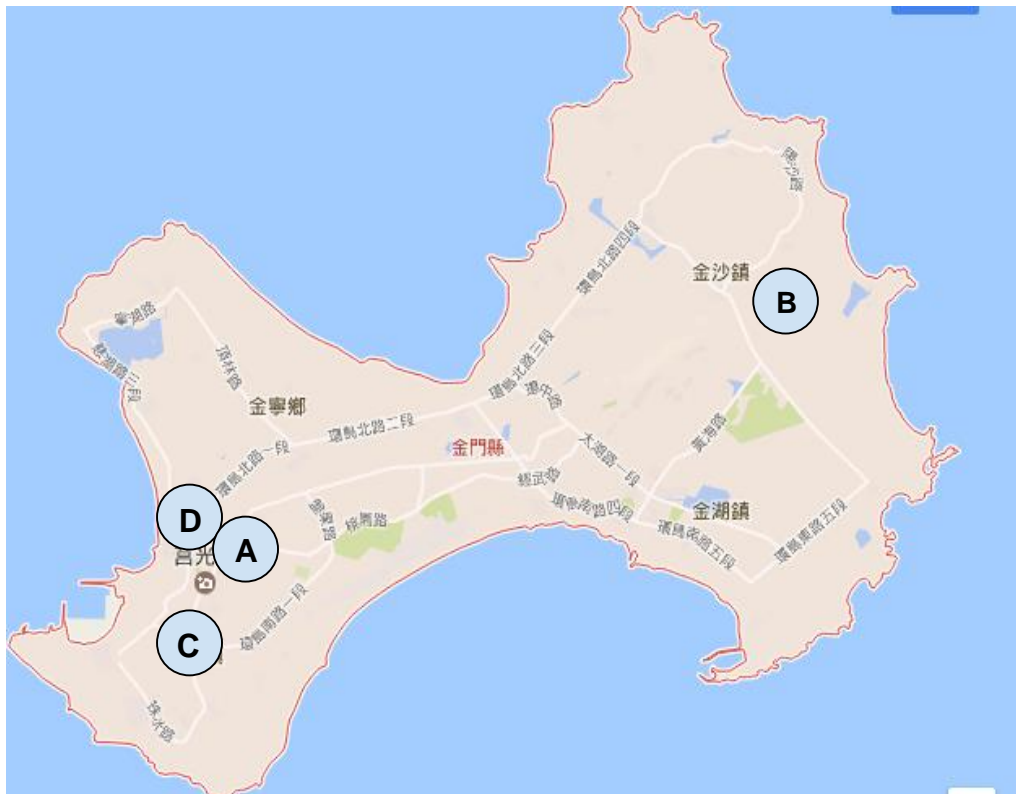
-Asia



-Taiwan



-Kinmen



four location

A:Lu, Cen-Hua house

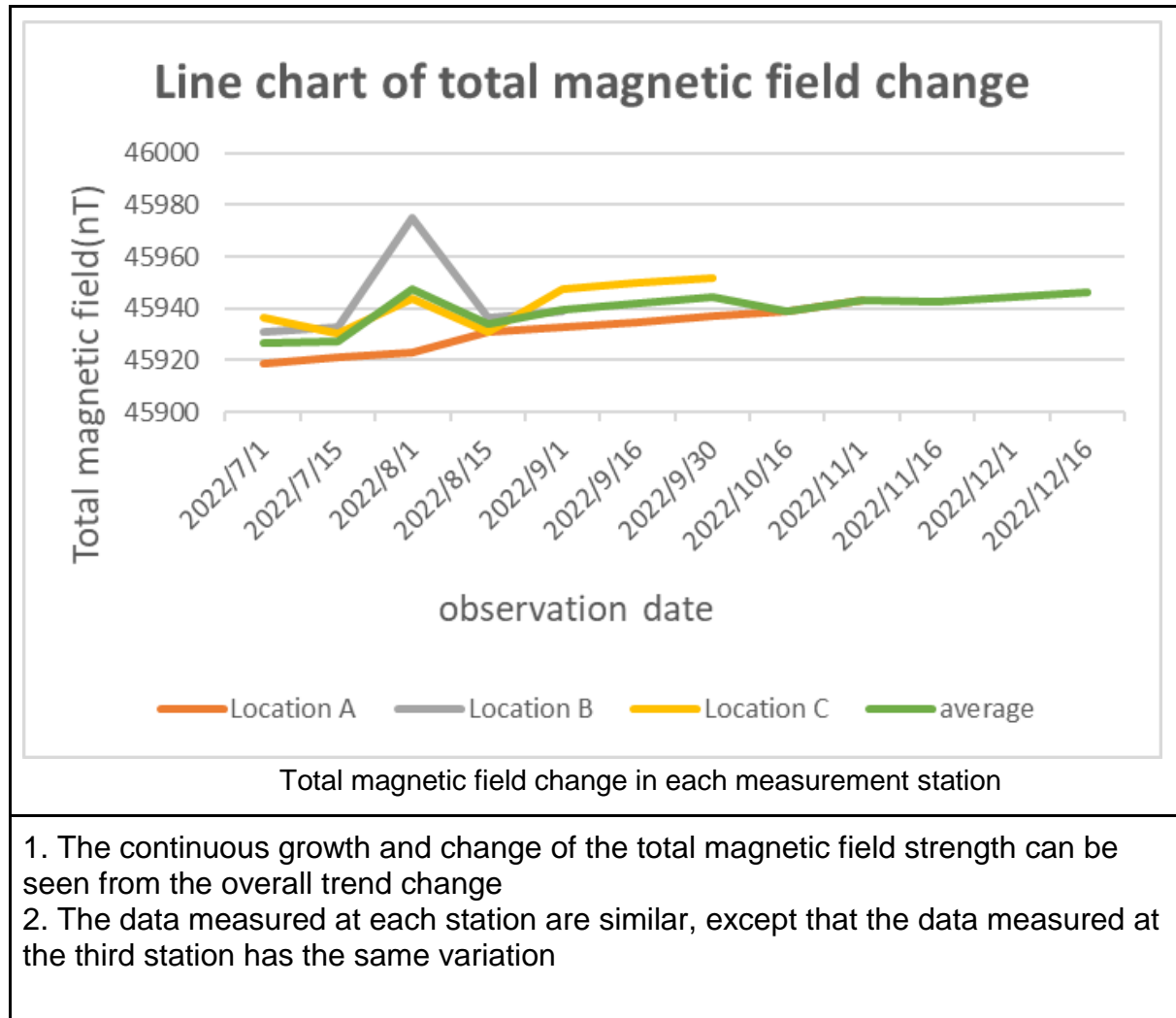
B:Chang, Chi-En house

C:Ou Yang, Kai-Chen house

D:School(GLOBE Observing Weather and Clouds)

Research results


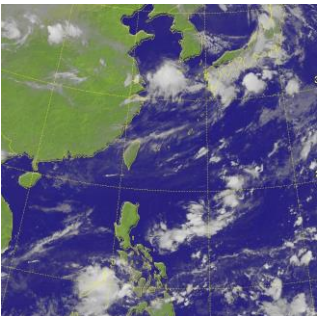
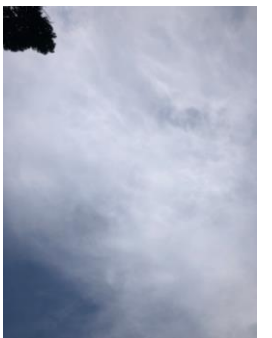
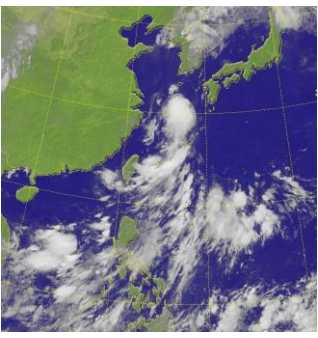
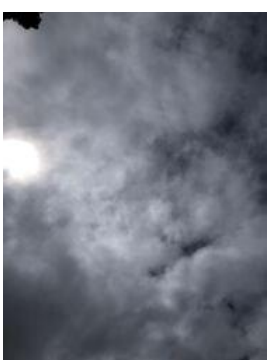
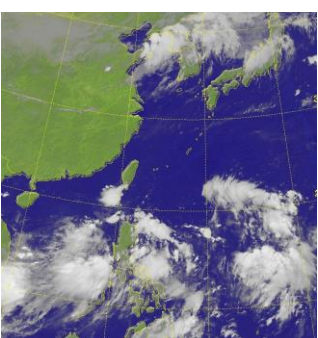

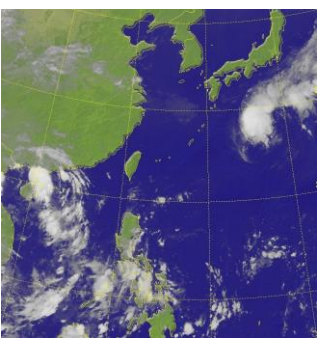
-Line chart of total magnetic field-


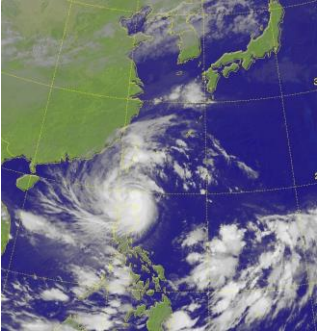

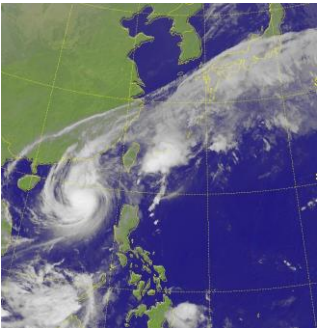

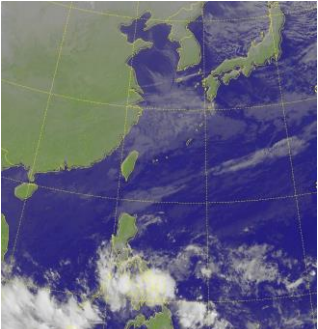

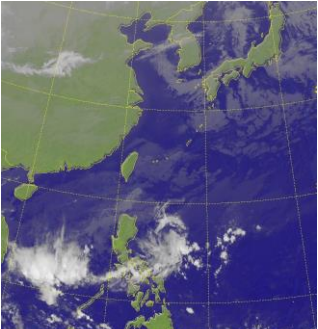


-magnetic changes-


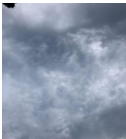
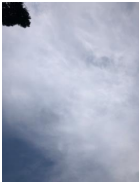
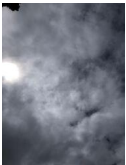
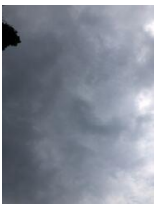



	2022/ 7 /1	2022 /7 /15	2022 /8 /1	2022 /8 /15	2022 /9 /1	2022 /9 /16	2022 /9 /30	2022 /10 /16	2022 /11 /1	2022 /11 /16	2022 /12 /1	2022 /12 /16	2023/3 /1
Average total magnetic field	45926	43130	43808	45933	45938	42441	45942	45938	45941	45942	45944	45946	45948
Average horizontal total magnetic field	36706	35798	36710	36711	35573	36712	36715	36716	36712	36712	36712	36712	36717






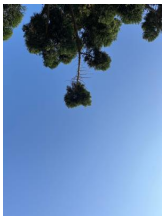
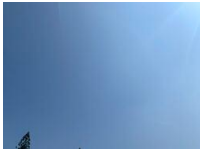

-weather change-

Date	cloud	satellite images	
2022/7/15			<p>July and August are the summer months in Taiwan, and are influenced by the southwest monsoon, which blows the moisture from the ocean towards the northeast, leading to a higher cloud cover during this season.</p>
2022/8/1			
2022/8/15			
2022/9/30			<p>Starting from September, the wind direction changed from southwest to northeast, and there was no obstruction. The</p>

2022/10/16			area was directly affected by the northeast monsoon, and the cold air mass from China formed a high-pressure system, resulting in clear skies without clouds in the Kinmen area of Taiwan.
2022/11/1			
2023/1/3			During winter, the Taiwan Strait is influenced by the "East Asian Winter Monsoon," which causes dry and cold air to move along the Chinese coast and accumulate as a high-pressure system. The air flow passes over the eastern region of China, resulting in dry and cold air. As a result, the skies above Kinmen are clear and cloudless.
2023/1/19			

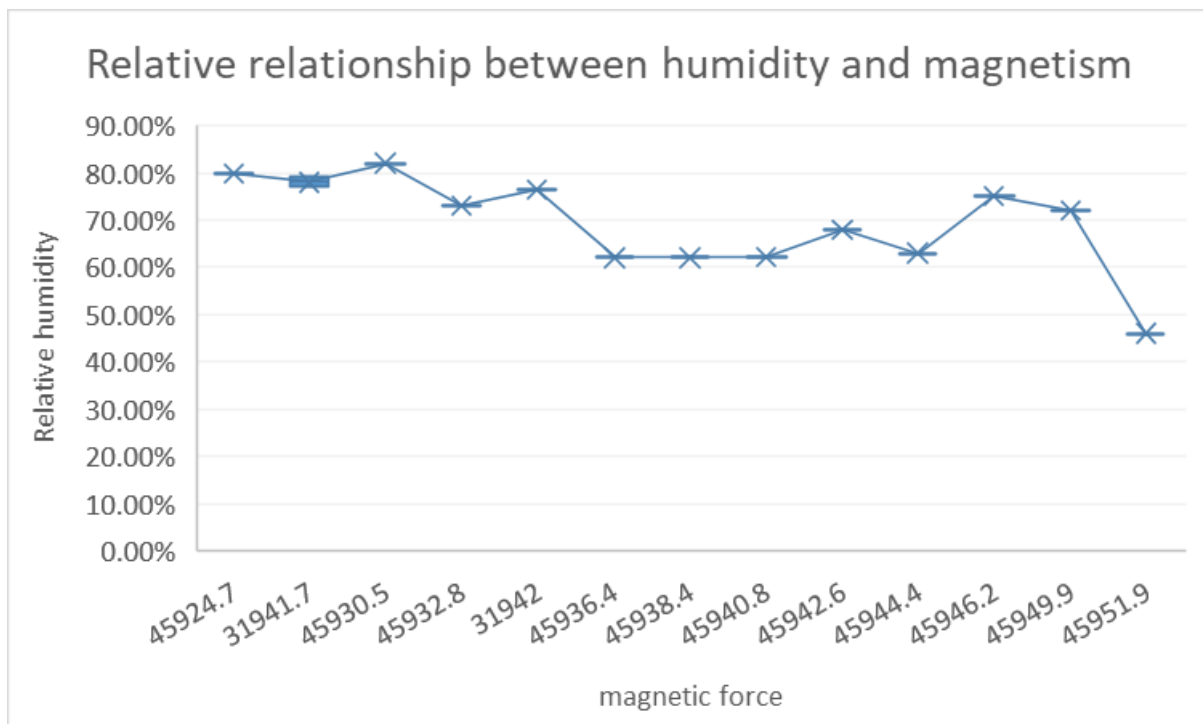
-Environmental Index Record-

	Date	types of clouds	Magnetic field chang	Temper ature	humidi ty	air press ure
1	2022/7/1		45924.7	32.7 °C	79.8%	1007. 6
2	2022/7/15		31941.7	30.9 °C	79.0%	1005 .3
3	2022/8/1		31941.7	28.2 °C	77.0%	1008 .8
4	2022/8/15		45930.5	28.6 °C	82.0 %	1008 .6
5	2022/9/1		45932.8	32.3 °C	73.0 %	1004 .0
6	2022/9/16		31942	31.9 °C	76.5 %	1005 .0
7	2022/9/30		45936.4	34.2 °C	62.0 %	1015 .5
8	2022/10/1 6		45938.4	25.7 °C	62.0 %	1011 .3

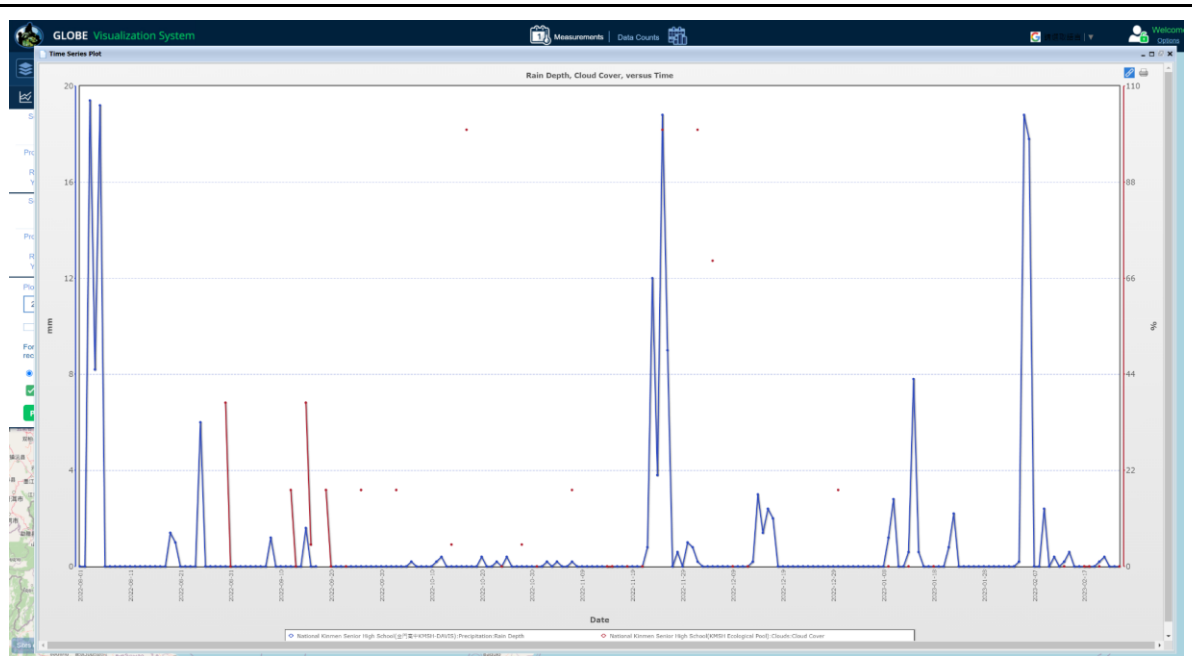
9	2022/11/1		45940.8	20.9 °C	62.2 %	1014 .4
10	2022/11/16		45942.6	25.0 °C	68.0 %	1013 .7
11	2022/12/1		45944.4	17.6 °C	63.0 %	1022 .0
12	2022/12/16		45946.2	13.8 °C	75.0 %	1026 .8
13	2023/1/3		45949.9	17.4 °C	72.0 %	1022 .0
14	2023/1/19		45951.9	13.3 °C	46.0 %	1026 .4
15	2023/2/28		45950.7	15.9 °C	58.0 %	1021 .5
16	2023/3/1		45948.2	15.7 °C	77.0 %	1019 .1

1. You can see a significant temperature change on 11/16, which is also reflected in the air pressure readings.
2. On 11/16, the air pressure increased and the sky had no clouds.
3. The magnetic field showed similar changes on 7/15, 8/1, and 9/16, but there were no significant changes in other data.

-Relative relationship between humidity and magnetism-



-environmental data statistics picture-



-Statistics of cloud cover and rainfall from August to February-

1. Through the chart, it can be found that cloud cover and rainfall are positively correlated.



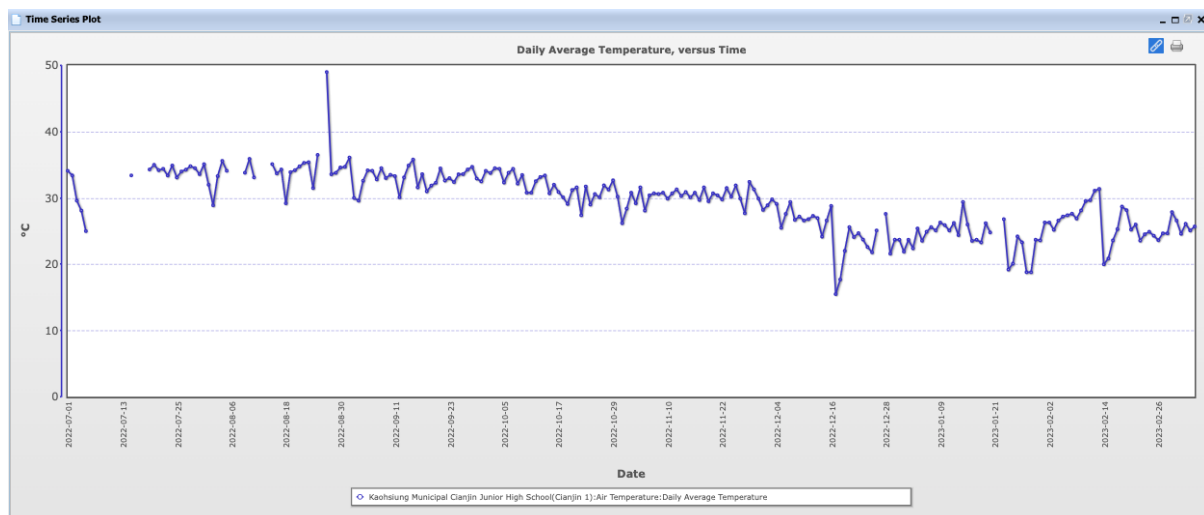
-Noon humidity (red), cloud cover (purple), air temperature (blue), automatic station rainfall (green) from manual observation from August to February-

1. There are many changes in various data during the half year of observation, but no direct relationship with geomagnetism can be seen.

discussion:

The relationship between humidity and magnetic field:

- During our 7-month magnetic measurement, we found that the total magnetic field strength of the Earth showed a gradual increase. As we conducted our observations in the Northern Hemisphere, the season also coincided with winter. As winter approaches in Kinmen, the humidity tends to decrease. Therefore, we hypothesize that there may be an inverse correlation between the Earth's magnetic field and humidity and temperature.



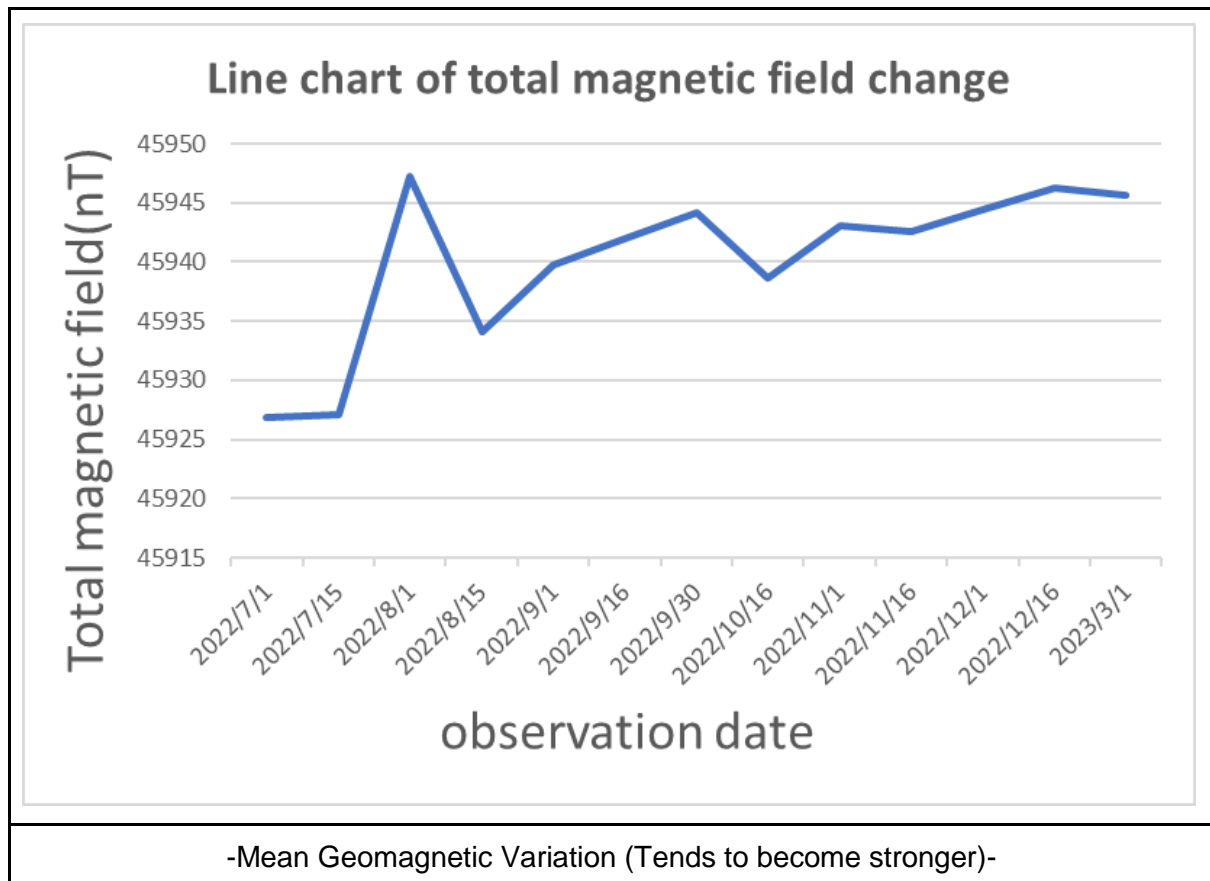
Correlation between Cloud Cover and Rainfall:

We found a positive correlation between cloud cover and rainfall, which is clearly shown in the observation data. When cloud cover increases, there is also an increase in rainfall to some extent. We hypothesize that this may be due to larger clouds carrying more water than smaller ones, resulting in more rainfall. However, we cannot rule out other factors, such as differences in cloud height or cloud formation. Therefore, in the absence of other factors, the conclusion that larger clouds result in more precipitation is consistent with our hypothesis.

Causes of Geomagnetic Variations:

In terms of overall changes in the magnetic field, there is a trend of increasing magnetic field strength. Although some slight changes have been observed at certain observation stations, all three stations show a slight upward trend in the

numerical values. Although not very noticeable, this trend can still be observed from the images. We believe that this may be due to the fact that the Earth's magnetic field undergoes free fluctuations.



Conclusion:

1. We hypothesize that there may be an inverse correlation between magnetic fields and humidity.
2. We found that rainfall and cloud cover are positively correlated.
3. There is no direct impact relationship between rainfall and geomagnetism.
4. magnetic fields showed an overall increase in total magnetic field strength during the seven months of observation.

Reference

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110 年度氣象資料表|金門縣農業試驗

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交通部中央氣象局：

<https://www.cwb.gov.tw/V8/C/>

地磁 (Earth's Magnetic Field)-王尊

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2022 太空天氣回顧：

<https://swoo.cwb.gov.tw/swapp/news/show/20230103001/>

太陽週期 維基百

科：<https://zh.wikipedia.org/wiki/%E5%A4%AA%E9%99%BD%E9%80%B1%E6%9C%9F>

太陽風暴釀地磁擾動 鄭明典示警「亮紅燈」曝對地球影

響：<https://news.ltn.com.tw/news/life/breakingnews/3725611>