# Observing the changes in weather and magnetic field change in Kinmen

*National Kinmen Senior High School*

## Abstract

Through participation in the GLOBE program for measuring environmental changes, as well as participation in the geomagnetic measurement program, we attempted to study the relationship between weather changes and the geomagnetic field. Our observational conclusions show that, the relationship between changes in the Earth's system environment and the geomagnetic field may be a complex, indirect one, so the effects of geomagnetic changes on the environment are not apparent.

## Motivation

We are three GLOBE weather observation volunteers from Kinmen High 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 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.

## Methods

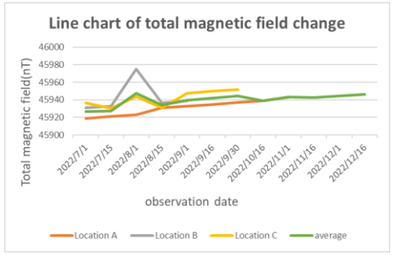
Using the Phyphox mobile app, measure the direction and intensity of the Earth's magnetic field every 15 days and record a photo of the measurement. Fill in the designated Google Forms with the results and record all data in GLOBE data. Analyze the magnetic field changes for over a year and plot the 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.

| 校名 | 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 | 李育賢+侑岑 | 顯侑岑 |
| 實驗日期 | 2022/7/1 | 2022/7/15 | 2022/8/1 | 2022/8/15 |
| 實驗時間 | 下午 3:00:00 | 下午 5:00:00 | 下午 5:00:00 | 下午 3:00:00 |
| 緯度(°) | 24.436 | 24.436 | 24.436 | 24.436 |
| 經度(°) | 118.314 | 118.314 | 118.314 | 118.314 |
| 高度(km) | 0.024 | 0.024 | 0.024 | 0.024 |
| 磁偏角D(°) | -4.33 | -4.06 | -4.25 | -4.34 |
| 水平傾角I(°) | 36.94 | -30.22 | -30.22 | 36.94 |
| 總磁場(nT) | 45924.7 | 31941.7 | 31941.7 | 45930.5 |
| 水平總磁場(nT) | 36707.6 | 27600.2 | 27600 | 36709 |
| X方向磁場值(nT) | 36603.1 | 27524.1 | 27524 | 36603.9 |
| Y方向磁場值(nT) | -2769.8 | -2048 | -2046.5 | -2776.3 |
| Z方向磁場值(nT) | 27597.7 | -16077.9 | -16078 | 27605.4 |
| X方向磁場值(mT) | -3.31 | -3.28 | -8.91 | 2.86 |
| Y方向磁場值(mT) | 39.29 | 38.5 | 38 | 29.63 |
| Z方向磁場值(mT) | -26.12 | -27.06 | -30.57 | 14.47 |
| 絕對值(mT) | 47.26 | 47.17 | 49.58 | 33.09 |
| 手機廠牌型號 | IPHONOE13 | IPHONOE13 | IphoneX | IphoneX |

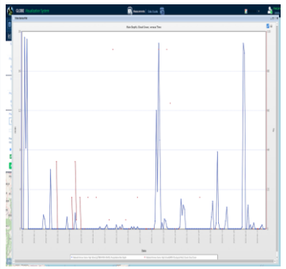
## Purpose

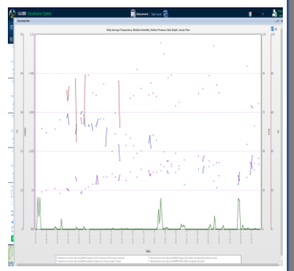
1. Comparing whether the total magnetic field is related to the change of cloud species
2. Compare whether the total magnetic field is related to the changes of local meteorological indicators
3. Identify the possible causes of the measured total magnetic field variation

## Results




1. The continuous growth and change of the total magnetic field strength can be seen from the overall trend change
2. The data measured at each station are similar, except that the data measured at the third station has the same variation





1.Through the chart, it can be found that cloud cover and rainfall are positively
2. 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.