The relationship between Cloud types and Stargazing possibility in Kinmen

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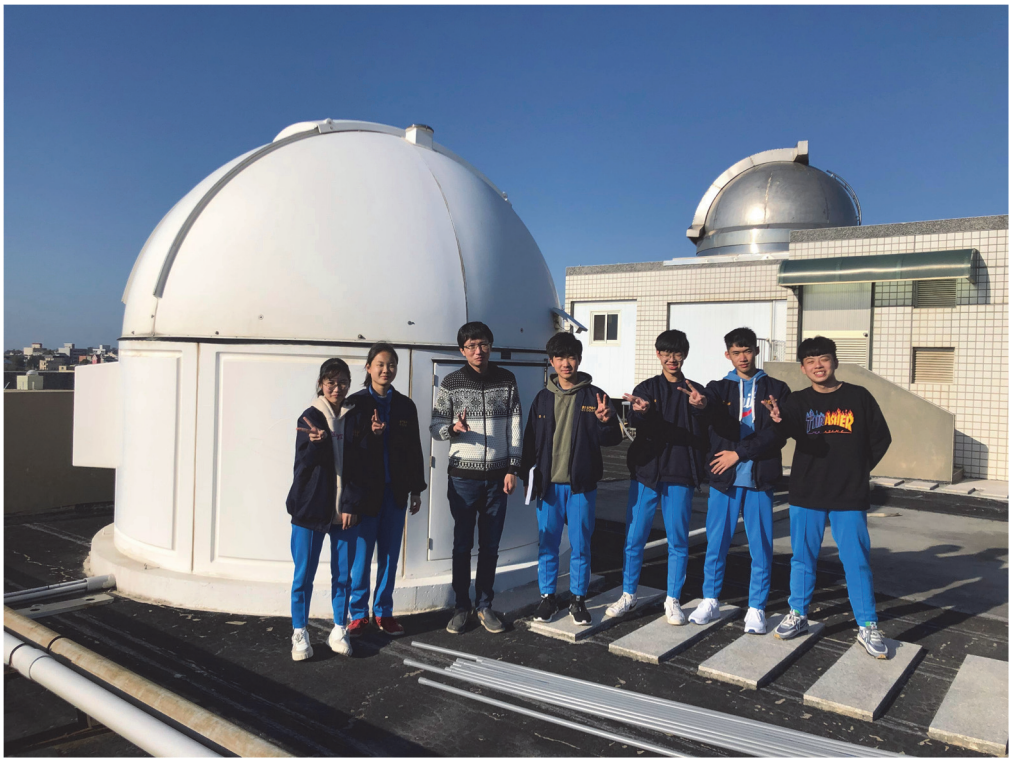
Team photos



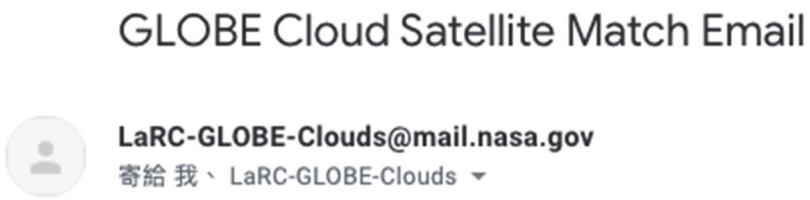
abstract

When we make astronomical observations, it is often impossible to see stars because of cloud cover, therefore, we notice that evening clouds are related to the possibility of stargazing at night. We take evening clouds to analyze cloud types and record whether stars can be seen at night.

Compared the data between temperature and rainfall. We found that there is no direct relationship between the cloud types in summer evening and the possibility of stargazing at night, and the cloud types in winter evening is directly related to the possibility of stargazing at night, If the cloud types were Cumulus and Stratus, the chance of stargazing is low. If there are translucent and feathery clouds, the chance of stargazing is high.

Research motivation

We are a group who like astronomical observation. Every time we use the observatory, we always lose the opportunity because the stars are blocked by clouds. Therefore, we noticed that the evening clouds have a great correlation with the feasibility of stargazing, and took pictures then uploaded them from the Observer App.

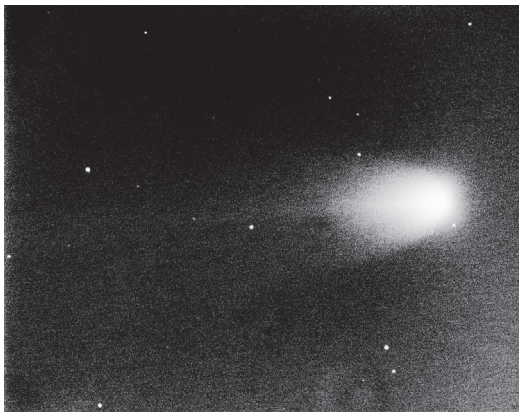


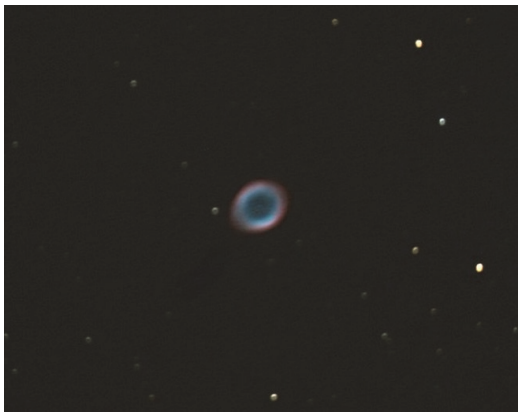
↑↑ We take cloud photos for data and upload them to the Observer App, and we receive emails that the cloud photos match the satellite photos.

↑↑By uploading cloud photos data, our team also participated in the 2022 GLOBE Cloud Challenge.

We also interested in astronomy and started to learn to use the observatory telescope to observe stars. The following two pictures are our astronomical photos.The left picture is C/2021 A1 (from Dec.31 in 2021 to Jan.3 in 2022) taken by the station in our school, which is an astronomical photo taken at a low elevation angle. And the right one is our high-elevation nebula photo.

Atmospheric interference is more serious at low elevation angles than high elevation angles. From the comparison of these two photos, it can be found that even in good weather, it will be affected by the low elevation angle and thick atmosphere.Therefore, it can be inferred that the resolution of observed stars is related to the possibility of stargazing and atmospheric weather conditions, such as clouds. So we want to understand the relationship between changes in the atmosphere and the possibility of observing stars.



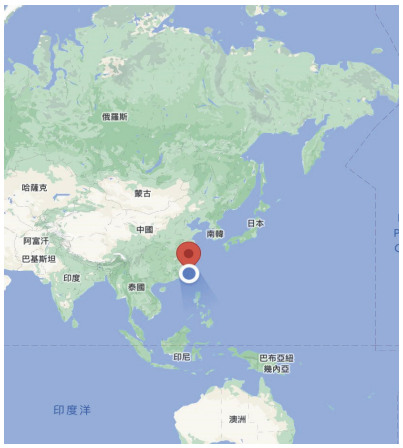


Research purposes

We hope that we can measure the feasibility of stargazing at night by observing the cloud cover and weather conditions of the day, and probe into the relationship between evening cloudiness, cloud types, temperature and the feasibility of stargazing at night.

Geographical location

↓Asia

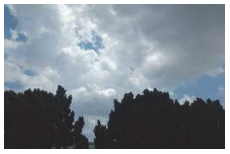
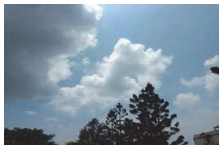


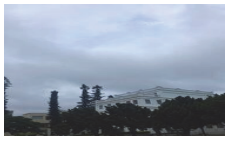
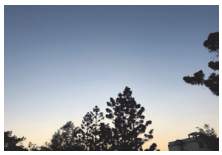
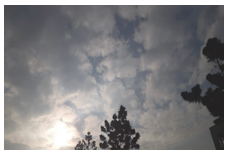
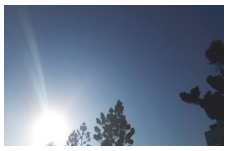
↓Taiwan

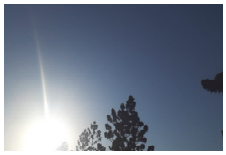
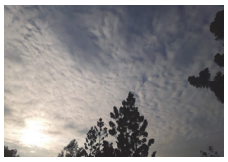
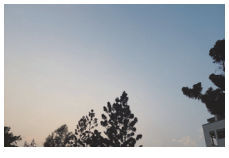
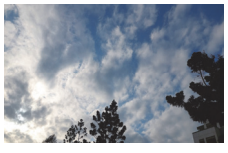
↓Kinmen

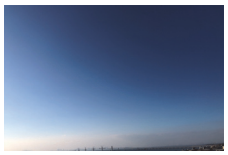
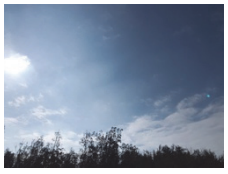
↓Observatory in Kinmen senior high school

Research result

date	photos of sky		cloud types	Special weather	temperture (°C)	whether to see the stars
6/11			Cirrocumulus		29	X
6/15			Cirrostratus filosus		28	X
6/21			Altostratus nebulosus		27	X
7/7			Cumulus fractus		28	X
7/9			no cloud		27.5	X
7/12			Cumulus fractus		28.5	X
7/16			Stratocumulus		29	X
7/17			Stratocumulus		29.5	X
7/21			no cloud		31.5	X

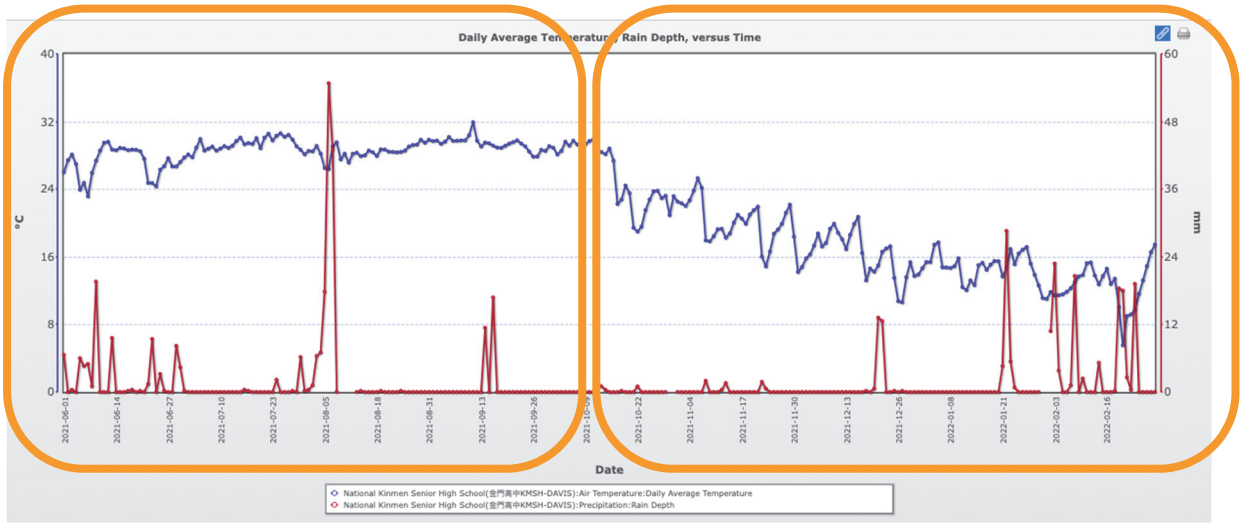
7/23			Stratocumulus		31	X
7/30			Nimbostratus		28	X
10/18			no cloud		23	O
10/20			Stratocumulus maculosu		23.5	X
10/22			Nimbostratus undulates	Rainfall: 2 mm	19	X
10/26			no cloud		24	O
10/27			Cirrocumulus radiatus		24	O
10/28			Altocumulus floccus		23	O
11/02			Altostratus opacus	Cloudy but rainless	22	X
11/05			no cloud		24	O

11/10			no cloud		20	O
11/18			Stratocumulus opacus		18.5	X
11/19	＃partial lunar eclipse					O
12/14	#Geminid meteor shower		no cloud		19	O
12/20			Altostratus nebulosus	Rainfall: 13mm	20.5	X
12/27			Altocumulus cumulogenitus		11	X
1/7			Altocumulus mammoths		15	O
1/13			Cirrus feather		13	O
1/14			Altostratus translucidus		12.5	O
1/17			Altocumulus floccus	The gas layer is humid and does not rain	14	X

1/18			Altocumulus opacus		15.5	X
1/19			no cloud		16	O
1/20			Altocumulus opacus		16	X
1/21			Altocumulus opacus	Rainfall: 5mm	14	X
1/22			Stratocumuls vittatus	Rainfall: 28.5mm	15	X
1/24			Altocumulus floccus		15.5	O
1/25			Cirrostratus filosus		17	
1/28			Altocumulus translucid		15	
2/4			Nimbostratus	Rainfall: 4.5mm	11.5	X

2/5			Stratocumulus uittatus		11.5	X
2/6			Stratocumulus opacus		12	X

Discussion



↑Rainfall and temperature of Kinmen from October 2021 to February 2022
↑From July to September (on the left side of the figure), the average daily temperature is high, and after October (on the right side of the figure), the average daily temperature drops and the temperature is low.

1.Rainfall and temperature in October and February can be roughly observed, and the temperature in Winter in Kinmen is related to rainfall. If it rains on the day, the temperature will be significantly lower than the previous day. Combined with our observations, we deduce that the night sky visibility from July to September is inconsistent with the daytime weather conditions, and conversely, after October, the evening sky visibility is consistent with the daytime.

2.In the summer of Kinmen (June to July), the sky often looks white and foggy, there is a lot of water vapor, and the clouds are more linear and organized, and the clouds are lower and thicker than in winter. There was almost no rain last summer, and we found that even though there were fewer clouds in the afternoon and evening, the stars were often invisible at night, often obscured by thick clouds. The cloud cover varies greatly in summer, and the brightness of the sky at night and the cloud cover in the evening are observed without special accuracy.

3.In winter, when the evening cloudless sky is usually clean and sunny, there is an opportunity to observe the starry sky at night. In the presence of cumulus or stratus clouds, it is not easy to observe the stars, and as long as it is a light-shielding cloud species, the sky cannot be observed that night. If it rains before evening observation, leaving the sky cloudless, it is easy to observe, whereas if the clouds are all over the sky and there is very little rain or rainfall, the stars cannot be observed that night.

4.The humidity was higher that day, and the clouds were densely distributed, and there were no stars in sight.

Cloud species	Cumulus	Nimbostratus	Altocumulus	translucidus	feather	Altostratus nebulosus	Stratocumulus
Stars can be observed				√	√		
Stars cannot be observed	√	√	√			√	√
Rain		√	√			√	√

Conclusion

1.The cloud in the evening and night of summer varies greatly, and it is impossible to determine whether to observe stars at night based on the cloud types in the night.
2.The cloud types of the winter evening are directly related to whether to see stars at night.
3.Cumulus and Stratus clouds make the stargazing opportunity low, and if there are translucent and feathery clouds, there is a high chance of seeing stars.
4.In Kinmen, rainy weather temperatures will be lower.

Badges

I am a collaborator:

1.Observe and photograph clouds, record daily temperature
2.Analyze daily cloud types
3.Record whether the stars are able to be seen at night
4.Organize photos and datas
5.Make a charts and forms
6.Write report and summarize the conclusion
We discuss what we observe and conclusion together

I am a data scientist:

We record whether we can see stars at night by ourselves. We use the GLOBE observer App to observe and record clouds. We also get weather data, such as temperature and precipitation, from the school's observation equipment. We analyze and organize the correlation of these data and make a graph.

I am a STEM storyteller:

We have Facebook and Instagram accounts to upload and share what we observe. The accounts record our research process, and we upload and share what we have learned in our research.

Instagram:KMSHObservator
Facebook:The GLOBE Program Taiwan-KMSH

Reference

1. Book: 105 Mysteries of Clouds

2. CWB Data observation inquiry system Web.

https://e-service.cwb.gov.tw/HistoryDataQuery/