Relationship between astronomical observation and water vapor in weather forecast

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1.Motivation and purpose

The purpose of this study was to estimate the amount of water vapor from the visibility of stars and to predict the weather.

2.Research Methods

2-1 Observations

The weather conditions in the upper reaches of the sky were analyzed by the upper-height weather map (850 hPa).

2-2 observation base

In order to verify the accuracy of the data obtained by the wind thermometer and hygrometer, three observation sites were set up in the vicinity of our house (Fig. 3).

2-3 Exposure time

In order to quantify the way stars are seen, the degree of exposure (in seconds) in which the target star no longer appears in the photograph is called the exposure time.

3. observation results

3-1 Purpose.

The purpose of this study was to determine the amount of water vapor from the visibility of stars, and to explore the relationship between the amount of water vapor and humidity observed by the wind speed

thermometer and hygrometer and the exposure time observed by the camera application.

3-2 Results.

2 It was found that the exposure time of the plots surrounded by orange circles in Fig. 5 was significantly different even though there was almost no difference in humidity.

3-3 verification

Based on the above, I hypothesized that the difference in the visibility of the stars was caused not only by the ground but also by the sky above.

Difference of humidity on the ground 1%...(1)

The difference in humidity in the sky is 17%...(2)

From (1) and (2), it was found that the visibility of the stars is significantly different depending on the high humidity in the sky, even if the humidity on the ground is the same. In addition, in order to investigate the cause of the results in *1 and *3, we analyzed the upper-tier weather map.

The difference between the dew point and the temperature at 9:00 a.m. on the day of the observation is less than 9.78 degrees Celsius...(3)

The difference between the dew point and the temperature at 9:00 a.m. on the day of the observation was more than 22.25 degrees...(4)

From (3) and (4), it was found that it rained when the difference between the temperature and the dew point (humidity) at 9:00 a.m. on the day of the observation exceeded 22.25˚C in winter and summer.

3-4 Considerations.

When it rained the next day, the day of the observation was covered by a high pressure system with dry air (Fig. 7), but a low pressure system with moist air that generated precipitation on the day after the observation was advancing from the west (Fig. 8).

4. Weather forecasting

4-1 Purpose.

The time of exposure was substituted for the straight line of graphs in Figs. 4 and 5 to find out the relationship between the amount of water vapor and the amount of precipitation on the next day.

4-2 ways

Amount of precipitation on the next day ÷Amount of water vapor derived by substituting a straight line...(5)

Equation (5) compares the values derived from the equation (what percentage of the water vapor on the day of observation will be the precipitation of the next day).

4-3 Results.

Thirty percent of the values obtained in (5) were approximated in the 10% range.

4-4 Considerations.

On a day when the values were in the teens, the high-rise weather map seemed to show warm, moist air entering the area where the contour line rises from the south to the north.

5.Conclusion.

It was also found that depending on the weather conditions in the sky above, a percentage of the amount of water vapor observed on a given day would change to the amount of precipitation on the following day.

6. Issues and suggestions for improvement
In the future, I would like to estimate the tendency of the amount of water vapor only by the way the stars look based on the relationship with the method that can be observed every day, and finally, I would like to be able to predict the weather only by the way the stars look.

Keywords: Weather forecasting, Astronomical observation, Water vapor

観測時期	対象とした星	等級
2019年2月～3月	オリオン座のA星	情報なし
2019年4月～7月	北斗七星	３等星
2019年8月～10月	白鳥座	３等星
2019年11月～2020年1月	オリオン座のA星	情報なし

図1 対象とした星

図2 ★対象としている星

図3 観測拠点

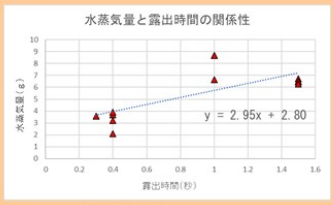

図4 オリオン座(2019.11～2020.2)を対象とした

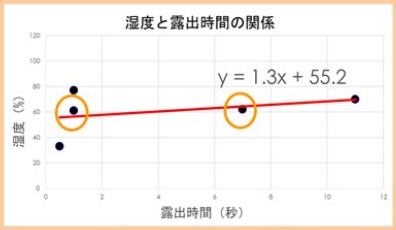

図5 北斗七星(2019.4～7)を対象とした

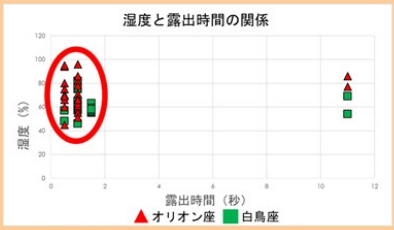

図6 オリオン座(2019.2～3)と白鳥座(2019.8～10)を対象とした

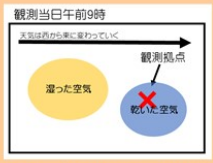

図7 観測当日の午前9時の気象状態

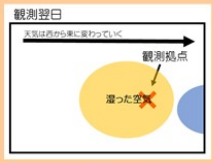

図8 観測翌日の気象状態