

天気予測における天体観望と水蒸気の関係について

長野県諏訪清陵高等学校 天文気象部 3年 高森碧



1. 目的 ~星の見えやすさから天気予測へ~

星の見え方は主に水蒸気に影響を受けている

星の見えやすさから水蒸気量を推測

天気予測に繋がりたい

仮説

- ・星の見えやすさは水蒸気量、湿度とそれぞれ比例しているのではないかな。
- ・標高差によって星の見え方が違ってくるのではないかな。

2. 観測結果 ~水蒸気量・湿度と星の見え方の関係~

2-1 目的

星の見えやすさから水蒸気量を求める事を目的とし、水蒸気量、湿度と露出時間をそれぞれのグラフにして星の見え方との関係性を探った。

2-2 方法

- ①カメラの露出時間を調節する。
- ②誰もが天気予測できるようにスマートフォン(iPhone 8)のカメラアプリ(星降るカメラ)を使用し、露出時間を調節した上で星の見え方を比較する。

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|-----|------------------------------|
| 一般的 | カメラのレンズが開いている時間 |
| 本研究 | 露出時間を短くしていった上で写真上に星が写らなかった時間 |



図1 観測地点

2-3 観測結果

| | オリオン座 | 北斗七星 | 白鳥座 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------|---|-----------------|------------------|------|-------|------|------|-----|----|------|-----|-----|----|------|-----|---|----|------|------|---|----|------|------|-----|----|------|------|---|----|------|------|---|----|------|------|---|----|------|-------|---|----|------|-------|---|----|------|-----|-----|----|------|-----|-----|----|---|----|----|------|-------|------|-----|-----|----|------|-----|-----|----|------|------|---|----|------|------|---|----|------|-------|-----|------|------|-----|-----|------|------|-----|-----|-----|------|-----|-----|------|------|------|-----|------|------|-----|-----|------|--|----|----|------|-------|------|-----|---|----|------|------|-----|----|------|-----|---|----|------|-----|----|----|------|-----|---|----|------|-----|----|----|------|-----|----|----|------|-----|---|----|------|-----|---|----|------|-----|---|----|------|-----|---|----|------|-------|-----|----|------|------|---|----|------|-------|---|----|------|-------|---|----|------|-------|-----|----|
| 日時 | 2019年2月~2019年3月 2019年11月~2020年2月 | 2019年4月~2019年6月 | 2019年8月~2019年11月 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 対象とした星 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| データ表 | <table border="1"> <thead> <tr> <th>西暦</th><th>日付</th><th>露出時間</th><th>湿度(%)</th></tr> </thead> <tbody> <tr><td>2019</td><td>2/17</td><td>1.5</td><td>59</td></tr> <tr><td>2019</td><td>3/2</td><td>1.1</td><td>54</td></tr> <tr><td>2019</td><td>3/9</td><td>1</td><td>46</td></tr> <tr><td>2019</td><td>3/17</td><td>1</td><td>82</td></tr> <tr><td>2019</td><td>3/22</td><td>1.1</td><td>69</td></tr> <tr><td>2019</td><td>3/31</td><td>1</td><td>75</td></tr> <tr><td>2019</td><td>11/8</td><td>1</td><td>75</td></tr> <tr><td>2019</td><td>11/9</td><td>1</td><td>57</td></tr> <tr><td>2019</td><td>11/14</td><td>1</td><td>65</td></tr> <tr><td>2019</td><td>11/21</td><td>1</td><td>61</td></tr> <tr><td>2020</td><td>1/1</td><td>0.3</td><td>65</td></tr> <tr><td>2020</td><td>1/2</td><td>0.4</td><td>77</td></tr> </tbody> </table> | 西暦 | 日付 | 露出時間 | 湿度(%) | 2019 | 2/17 | 1.5 | 59 | 2019 | 3/2 | 1.1 | 54 | 2019 | 3/9 | 1 | 46 | 2019 | 3/17 | 1 | 82 | 2019 | 3/22 | 1.1 | 69 | 2019 | 3/31 | 1 | 75 | 2019 | 11/8 | 1 | 75 | 2019 | 11/9 | 1 | 57 | 2019 | 11/14 | 1 | 65 | 2019 | 11/21 | 1 | 61 | 2020 | 1/1 | 0.3 | 65 | 2020 | 1/2 | 0.4 | 77 | <table border="1"> <thead> <tr> <th>西暦</th><th>日付</th><th>露出時間</th><th>湿度(%)</th></tr> </thead> <tbody> <tr><td>2020</td><td>1/3</td><td>0.4</td><td>77</td></tr> <tr><td>2020</td><td>2/4</td><td>0.4</td><td>38</td></tr> <tr><td>2019</td><td>11/8</td><td>1</td><td>66</td></tr> <tr><td>2019</td><td>11/9</td><td>1</td><td>66</td></tr> <tr><td>2019</td><td>11/21</td><td>1.5</td><td>67.5</td></tr> <tr><td>2020</td><td>1/1</td><td>0.3</td><td>35.9</td></tr> <tr><td>2020</td><td>1/2</td><td>0.4</td><td>3.7</td></tr> <tr><td>2020</td><td>1/3</td><td>0.4</td><td>33.2</td></tr> <tr><td>2020</td><td>1/11</td><td>0.4</td><td>3.21</td></tr> <tr><td>2020</td><td>2/4</td><td>0.4</td><td>2.12</td></tr> </tbody> </table> | 西暦 | 日付 | 露出時間 | 湿度(%) | 2020 | 1/3 | 0.4 | 77 | 2020 | 2/4 | 0.4 | 38 | 2019 | 11/8 | 1 | 66 | 2019 | 11/9 | 1 | 66 | 2019 | 11/21 | 1.5 | 67.5 | 2020 | 1/1 | 0.3 | 35.9 | 2020 | 1/2 | 0.4 | 3.7 | 2020 | 1/3 | 0.4 | 33.2 | 2020 | 1/11 | 0.4 | 3.21 | 2020 | 2/4 | 0.4 | 2.12 | <table border="1"> <thead> <tr> <th>西暦</th><th>日付</th><th>露出時間</th><th>湿度(%)</th></tr> </thead> <tbody> <tr><td>2019</td><td>4/7</td><td>1</td><td>61</td></tr> <tr><td>2019</td><td>4/20</td><td>0.5</td><td>33</td></tr> <tr><td>2019</td><td>5/2</td><td>7</td><td>62</td></tr> <tr><td>2019</td><td>5/5</td><td>11</td><td>70</td></tr> <tr><td>2019</td><td>6/8</td><td>1</td><td>77</td></tr> <tr><td>2019</td><td>8/3</td><td>11</td><td>86</td></tr> <tr><td>2019</td><td>8/4</td><td>11</td><td>77</td></tr> <tr><td>2019</td><td>8/5</td><td>1</td><td>82</td></tr> <tr><td>2019</td><td>8/6</td><td>1</td><td>86</td></tr> <tr><td>2019</td><td>8/7</td><td>1</td><td>78</td></tr> <tr><td>2019</td><td>8/8</td><td>1</td><td>71</td></tr> <tr><td>2019</td><td>10/10</td><td>0.5</td><td>94</td></tr> <tr><td>2019</td><td>11/9</td><td>1</td><td>78</td></tr> <tr><td>2019</td><td>11/21</td><td>1</td><td>59</td></tr> <tr><td>2019</td><td>11/14</td><td>1</td><td>55</td></tr> <tr><td>2019</td><td>11/21</td><td>0.5</td><td>80</td></tr> </tbody> </table> | 西暦 | 日付 | 露出時間 | 湿度(%) | 2019 | 4/7 | 1 | 61 | 2019 | 4/20 | 0.5 | 33 | 2019 | 5/2 | 7 | 62 | 2019 | 5/5 | 11 | 70 | 2019 | 6/8 | 1 | 77 | 2019 | 8/3 | 11 | 86 | 2019 | 8/4 | 11 | 77 | 2019 | 8/5 | 1 | 82 | 2019 | 8/6 | 1 | 86 | 2019 | 8/7 | 1 | 78 | 2019 | 8/8 | 1 | 71 | 2019 | 10/10 | 0.5 | 94 | 2019 | 11/9 | 1 | 78 | 2019 | 11/21 | 1 | 59 | 2019 | 11/14 | 1 | 55 | 2019 | 11/21 | 0.5 | 80 |
| 西暦 | 日付 | 露出時間 | 湿度(%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 2/17 | 1.5 | 59 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 3/2 | 1.1 | 54 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 3/9 | 1 | 46 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 3/17 | 1 | 82 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 3/22 | 1.1 | 69 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 3/31 | 1 | 75 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/8 | 1 | 75 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/9 | 1 | 57 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/14 | 1 | 65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/21 | 1 | 61 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | 1/1 | 0.3 | 65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | 1/2 | 0.4 | 77 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 西暦 | 日付 | 露出時間 | 湿度(%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | 1/3 | 0.4 | 77 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | 2/4 | 0.4 | 38 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/8 | 1 | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/9 | 1 | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/21 | 1.5 | 67.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | 1/1 | 0.3 | 35.9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | 1/2 | 0.4 | 3.7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | 1/3 | 0.4 | 33.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | 1/11 | 0.4 | 3.21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2020 | 2/4 | 0.4 | 2.12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 西暦 | 日付 | 露出時間 | 湿度(%) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 4/7 | 1 | 61 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 4/20 | 0.5 | 33 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 5/2 | 7 | 62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 5/5 | 11 | 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 6/8 | 1 | 77 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 8/3 | 11 | 86 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 8/4 | 11 | 77 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 8/5 | 1 | 82 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 8/6 | 1 | 86 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 8/7 | 1 | 78 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 8/8 | 1 | 71 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 10/10 | 0.5 | 94 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/9 | 1 | 78 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/21 | 1 | 59 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/14 | 1 | 55 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2019 | 11/21 | 0.5 | 80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

図2 データ表1

- ・地点による観測データの差は生じなかった。
- ・星を観測するに当たり数百mの標高差は誤差の範囲であった。
- ・白鳥座と北斗七星の星の見え方は湿度との関係は見られなかった。

2-4 考察

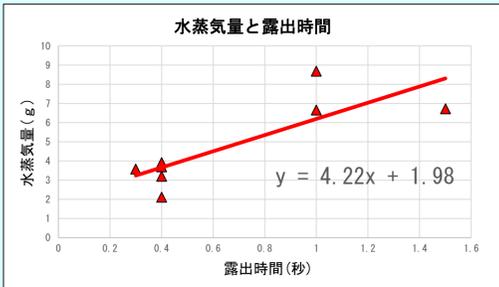


図3 オリオン座(2019.11~2020.2)を対象とした

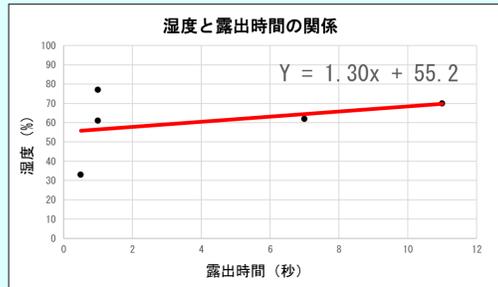


図4 北斗七星(2019.4~7)を対象とした

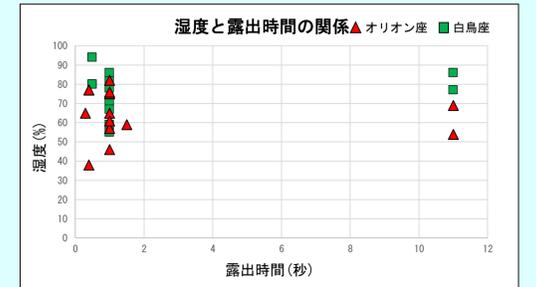


図5 オリオン座(2019.2~3, 2019.11~2020.2)と白鳥座(2019.8~10)を対象とした

| 時期 | 水蒸気量と星の見え方との関係 |
|--------|----------------|
| 11月~2月 | 関係していた |
| 8月~10月 | 関係していなかった |

| 時期 | 湿度と星の見え方との関係 |
|---------------|--------------|
| 4月~6月 | 関係していた |
| 1月~3月, 8月~12月 | 関係していなかった |

オリオン座と白鳥座の星は同じ見え方をしている

2-5 検証A

・グラフから見られた傾向を元に翌日の降水量の予測に繋げるために、(次の日の降水量) ÷ (グラフの直線に代入して導き出した水蒸気量) の式で、導き出した値が一定になると仮定して、比較した。

| 西暦 | 日付 | 求めた値(%) |
|------|------|---------|
| 2019 | 3/2 | 11.58 |
| 2019 | 3/9 | 80.8 |
| 2019 | 3/22 | 0.89 |
| 2019 | 6/8 | 14.99 |

図6 データ表2

→ 求めた値(図6)が一部10%代で近似していた

2-5 検証B

・値が近似しているのは上空の気象条件によるものだと考え、高層天気図を解析した。

| | A. 特異的な等高線 | B. 通常の等高線 | Aのイメージ図 |
|-------|-------------------|-------------------|--------------------------|
| イメージ図 | | | |
| 事象数 | 2/5 | 3/5 | |
| 説明 | 等高線が南から北に盛り上がっている | 等高線が北から南に盛り上がっている | 暖かく湿っている空気が入り込んでいるように見える |

図7 特異な等高線

→ 気象条件によって式の値が一定になる

2-5 検証C

・オリオン座と白鳥座の星の見え方と湿度が関係がない事が読み取れた。その原因を探るために高層天気図を解析した。検証したところ、要因は読み取れなかったものの、気温と露点の差と天気に関係があること(図9)が読み取れた。

| 西暦 | 日付 | 気温と露点の差(°C) | 翌日の天気 |
|------|-------|-------------|-------|
| 2019 | 8/6 | 8.43 | 晴れ・曇り |
| 2019 | 8/7 | 7.6 | 晴れ |
| 2019 | 11/8 | 6 | 曇り・晴れ |
| 2019 | 11/9 | 6.65 | 晴れ・曇り |
| 2019 | 11/11 | 4 | 晴れ |
| 2019 | 11/14 | 4.27 | 晴れ・曇り |
| 2019 | 1/1 | 9.77 | 晴れ・曇り |
| 2020 | 1/2 | 13.09 | 晴れ |
| 2020 | 1/3 | 4.87 | 晴れ・曇り |
| 2020 | 1/11 | 4.97 | 曇り・晴れ |

図8 データ表3

| 観測当日の気温と露点の差(°C) | 観測翌日の天気 |
|------------------|---------|
| 9.78°C未満 | 晴れ又は晴れ |
| 22.25°C以上 | 雨 |

図9 気温と露点の差

・気温と露点の差が22.25°C以上の気象状態のイメージ

| | 観測当日の気象状態 | 観測翌日の気象状態 | 観測翌日の天気 |
|-------|---------------------|--------------------------------|---------|
| イメージ図 | | | |
| 凡例 | × 観測地点 | ● 湿った空気 | ● 乾いた空気 |
| 説明 | 乾いた空気を持った高気圧に覆われている | 降水を発生させる湿った空気をもった低気圧が西側から進んでくる | 翌日が雨になる |

図10 気象状態

4. まとめ

冬と夏に限り、降水になるときの条件(図9)を見つけることができた。また、特定の気象条件(図7)によって観測した日の水蒸気量の1割が翌日の降水量になることが分かった。

5. 今後の展望

四季を通して観測し、その傾向から星の見え方のみで水蒸気量を推定することで、天気予測に繋がりたい。

6. 参考文献

- (1) 気象庁. 「過去の気象データ検索」 <https://www.data.jma.go.jp/obd/stats/etrn/index.php> (2020年5月10日閲覧)
- (2) yuuk176. 「keisan 生活や実務に役立つ計算サイト」 <https://keisan.casio.jp/exec/user/1551691336> (2020年5月10日閲覧)
- (3) EIGHTVE DESIGN, Inc 「星降るカメラ」
- (4) 一般財団法人日本気象協会 長野支店 「高層天気図 (850hPa・700hPa)」 (2019年11月23日取得)