Lab 3 - The ATMOS41 system

Magnus Wood, October 6th, 2021, BSYSE 541

## 

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **N** | **Mean** | **Median** | **Std Dev** | **Min** | **Max** |
| Solar radiation (W/m2) | 722 | 343.924 | 253.5 | 240.931 | 54 | 833 |
| Air temperature (° Celsius) | 722 | 14.601 | 14.7 | 0.5 | 13.2 | 16.1 |
| Relative humidity (%, 0 – 1) | 722 | 0.494 | 0.492 | 0.02 | 0.446 | 0.563 |
| Horizontal wind speed (m/s) | 722 | 1.096 | 1.02 | 0.577 | 0.07 | 3.72 |

Table 1. Summary statistics table for chosen parameters

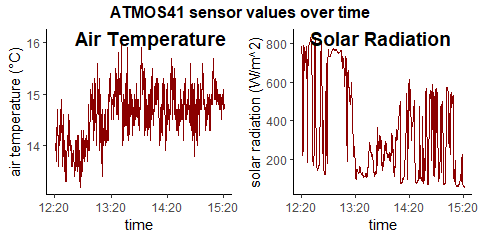


Figure 1. ATMOS41 sensor values for air temperature and solar radiation for the measurement period

### ATMOS41 Sensors Specifications

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Range** | **Accuracy** |
| Solar radiation | 0 to 1750 W/m2 | ± 5% of measurement typical |
| Precipitation | 0 to 400 mm/h | ± 5% of measurement from 0 to 50 mm/h |
| Vapor pressure | 0 to 47 kPa | Dependent on humidity and temperature, between ± 0.04 and ± 0.07 at time of data acquisition |
| Relative humidity | 0 to 100% RH (0.00-1.00) | Dependent on humidity and temperature, ± 2% at time of data acquisition |
| Air temperature | -50 to 60 °C | ± 0.6 °C |
| Humidity sensor temperature | -40 to 50 °C | ± 1.0 °C |
| Barometric pressure | 50 to 110 kPa | ± 0.1 kPa from -10 to 50 °C, ± 0.5 kPa from -40 to 60°C |
| Horizontal wind speed | 0 to 30 m/s | The greater of 0.3 m/s or 3% of measurement |
| Wind gust | 0 to 30 m/s | The greater of 0.3 m/s or 3% of measurement |
| Wind direction | 0° to 359° | ± 5° |
| Tilt | -90° to +90° | ±1° |
| Lightning strike count | 0 to 65,535 strikes | Variable with distance, >25% detection at <10km typical |
| Lightning average distance | 0-40 km | variable |

Table 2. Summary of ATMOS41 sensor specifications

## Sensor Working Principles

### Pyranometer

The pyranometer is a silicon-cell sensor that produces an output signal in mV in proportion to the total incoming direct and diffuse sunlight. The sensor has an input range of 300 to 1150nm and has a filter and diffuser in place, for which details are not given. The accuracy of the measurement is dependent on the tilt angle of the sensor. The sensor is quite sensitive to dust and debris and will give inaccurate results if obscured.

### Air temperature sensor

The air temperature sensor is located underneath the body of the unit, at the center. The heart of the sensor is a tiny thermistor, which changes resistance with a change in temperature. The resistance value is used along with wind speed and solar radiation to calculate a corrected temperature value. As the equation is dependent on accurately measured solar radiation, the same factors which can affect the pyranometer (dust/debris, tilt) can result in error in the air temperature sensor.

### Vapor pressure sensor

The vapor pressure sensor measures relative humidity, temperature, and vapor pressure. It is located underneath the body of the unit and is protected from direct sunlight and direct contact with water. The vapor pressure sensor can measure the vapor pressure of the air in kPa and using the air temperature provided by the separate air temperature sensor, is able to calculate the relative humidity as well. These calculations are dependent on an accurate air temperature reading from the air temperature sensor, which is in turn dependent on the accuracy of the pyranometer. Thus an obscured or tilted pyranometer has a cascading error effect upon both the air temperature and humidity measurements.