Atacama Weather

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Weather Station Purpose

Record the weather at the site to answer science and engineering questions

- What environmental conditions are expected during the mission?
- How do these conditions affect rover performance and configuration?
- How do these conditions correlate with the existence of microorganisms?
Weather Station

Variables continuously logged the following from April 11 to 26:

- Temperature
- Relative Humidity
- Wind Direction and Speed
- Insolation
  - Campbell Scientific CM3 Pyranometer
  - Directed Perception PTU and solar panels
- Data logging
  - Campbell Scientific CM10 data unit

Analogous to a lander
Temperature

Weather Station Temperature

Date (April 2003) vs. Temperature [°C]
Temperature - Statistics

Peak temperature was 30.02°C on April 10th.
Humidity
Humidity Example for a Single Day

Relative Humidity for April 15th

Humidity peaks at night reaching > 90%
Relative Humidity - Statistics

Humidity for April 13th to 18th

- Max
- Mean
- Min

Hour
Relative Humidity [%]
Wind Speed

Weather Station Wind Speed

Date (April 2003)

Wind Speed [m/s]
Wind Direction

Weather Station Wind Direction

April 18th
the day the robot almost fell off the edge
the earth

Max speed @ weather station: 32 kph (9 m/s)
Max speed @ robot: -55 kph (15.3 m/s)
Example for a Single Day

Wind Speed and Direction April 24, 2003

- High winds in the afternoon 32.5 kph (9 m/s)
- Afternoon wind trend
Wind Speed - Statistics

Wind Speed for April 13th – 26th

- mean
- max
- min

Speed [m/s]

Hour
Dust Devil

Photo taken April 25th by Trey Smith
Insolation

Weather Station Insolation

Overcast day followed by missing data
Insolation - Clear day Statistics

Insolation for a Clear Day

- min
- mean
- max

Characteristic Clear Day Curve
April 10, 12, 13, 17, 18, 19, 20, 21
Characteristic Insolation Curves

Partly Cloudy: April 11, 15, 16, 22, 24, 25, 26

Overcast: April 23
Trends

Seasonal Trends

• Since April is autumn in the Southern Hemisphere:
  • Decreasing temperature
  • Decreasing insolation
  • Increasing cloud cover

Daily Trends

• Afternoon: NNW wind
• Night: humidity
Future Analysis

Refine design parameters for rover
- Wind speed sensor
- Leaf sensor to measure condensation
- Consider maximum temperature for sensors
- Alter solar panel configuration based on insolation and wind data

Construct mission operations based on environmental characteristics
- Avoid or operate at certain times based on
  Afternoon wind
  Insolation
  Humidity
Recommendations for Weather Station

Power Manager and User Interface

• Decrease daily power consumption while maximizing data logged

  Power each component separately

  Monitor battery power and shut off components accordingly to prevent abrupt powerdown

• User-friendly interface to control station

Software

• Automatic photospectrometer operation

• Logging software which separates data by day and instrument. Automate generation of graphs