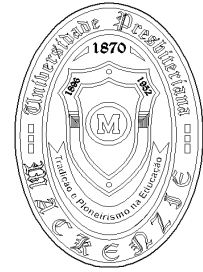




Centro de Rádio Astronomia e Astrofísica Mackenzie

Escola de Engenharia
Universidade Presbiteriana Mackenzie



Project SSTNG

Weather Conditions at CASLEO: 2018 - 2020

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Abstract

This document analyses the weather conditions at CASLEO from March 2018 through January 2021. Average values for temperature, humidity and pressure are 12 °C, 26% and 755 HPa, respectively. Winds come predominately from the West, with a speed < 30 km/h for 90% of the time. Maximum gust speed registered was 185 km/h, however, wind gusts remained below 50 km/h during 90% of the analysed period. The average annual accumulated rain is around 50 mm. Average daily thermal amplitude is around 15 °C and independent of the year season.

Change Record

Version	Date	Sections	Author	Description
1.0	2021-04-13	all	GGC	First Version
1.1	2021-04-17	3	GGC	Thermal Amplitude
1.2	2021-04-19	3 & 4	GGC	UV Index, Diurnal and Nocturnal Temperatures

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Applicable Documents

ID	Doc Id	Title
AD01		

Reference Documents

ID	Author	Year	Doc Id	Title
RD01				

List of Acronyms and Abbreviations

AIV	Assembly, Integration & Verification.
API	Application Programming Interface.
CASLEO	Complejo Astronómico El Leoncito.
CRAAM	Centro de Astronomia e Astrofísica Mackenzie.
HATS	High Altitude THz Solar photometers.
HAX	HATS Control Software.
HML	Heliogeophysical Mountain Laboratory.
ICATE	Instituto de Ciencias Astronómicas y Tecnología Espacial.
kS/s	kilo samples per second.
NTP	Network Time Protocol.
OAFA	Observatorio Astronómico Félix Aguilar, El Leoncito, Argentina.
PWV	Precipitable Water Vapor , tipicamente medido em mm
RTOS	Real Time Operating System.
SOLAR-T	Solar Flare THz photometers on stratospheric balloon flight.
SST	Solar Submillimeter Telescope.
TBC	To be confirmed.
TBD	To be determined.
TT	Terrestrial Time.
UPM	Universidade Presbiteriana Mackenzie.
UTC	Universal Time Coordinated.
WP	Working Package .

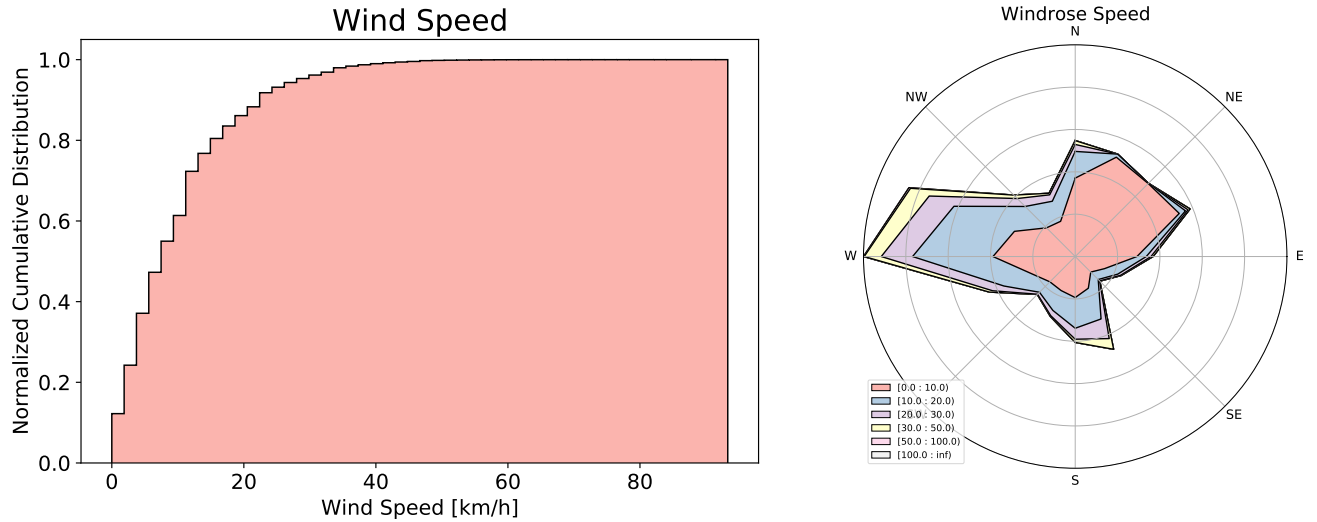


Figure 1: *Left*: Wind Speed Cumulative Distribution. *Right*: Speed Windrose for different speed ranges.

1 Introduction

For the present analysis we use meteorological data from March 2018 to January 2021 obtained from the **Davis Vantage PRO 2** weather station installed near the Heliogeophysical Mountain Laboratory (HML) at CASLEO observatory, where SST is installed. Data has 1 minute time resolution resulting in a total of more than one million records. The station provides temperature, pressure, humidity, wind speed and direction, rain, UV index, Solar radiation, among other weather parameters. While it stores 1 minute mean values, it also saves the maximum and minimum within the interval.

2 Wind

Figure 1 shows the wind speed distribution for the entire data series. In the left panel, the cumulative distribution shows that 90% of the time the wind speed is below 30 km/h. The right panel shows the wind direction: it comes predominantly from the West and in lesser extent from North East. The maximum speed within 1-minute intervals registered is 185 km/h, however, an statistical analysis shows that 90% of the time the gusts have speeds below 50 km/h.

3 Temperature

Temperature distributions are shown in Figure 2, for the whole day, the diurnal and the nocturnal periods. Mean temperature is 12 ± 7 °C, and is < 10 °C, 50% of the time, or < 20 °C 90%. Moreover, diurnal temperatures have a distribution mode equal to 20 °C and nocturnal temperatures 9 °C. On the other hand, CASLEO has high thermal amplitudes, Figure 3 shows the daily thermal amplitude: on the left panel the normalized distribution with a Gaussian fit, on the right, the cumulative distribution. The Gaussian fit has a mean value $\Delta T_{daily} = 14.7$ °C and a standard deviation $\sigma_{\Delta T} = 2.5$ °C. From the cumulative distribution we can infer that less than 10% of the time the thermal amplitude is below 10°C. Moreover, the daily thermal amplitude seems to not having relation with the year season: Figure 4 presents its values in function of the date, the thick black line is the Gaussian mean, while the dashed lines above and below represent one σ from the mean value.

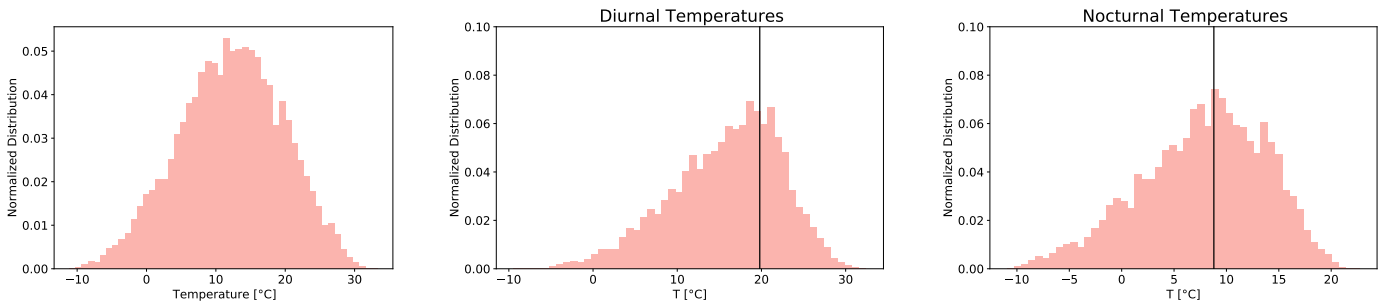


Figure 2: Left Panel: Whole Day Temperature Distribution. Middle Panel: Diurnal Temperature Distribution. Right Panel: Nocturnal Temperature Distribution

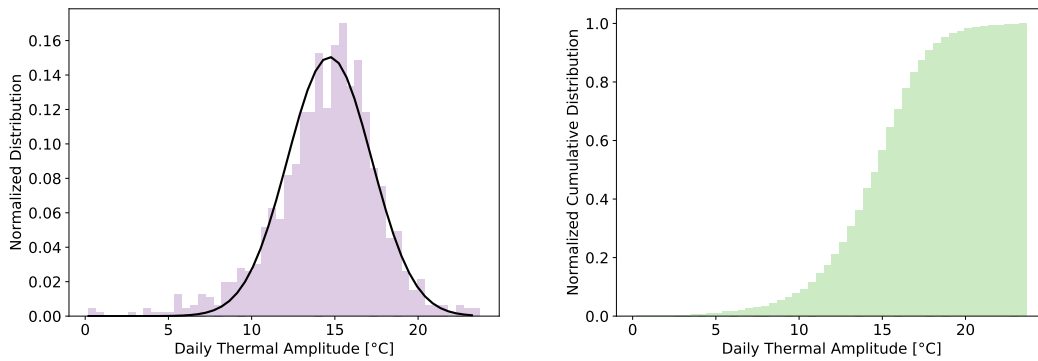


Figure 3: Left panel, daily thermal amplitude normalized distribution, the black curve represents a Gaussian fit to the distribution. Right panel: Cumulative normalized distribution.

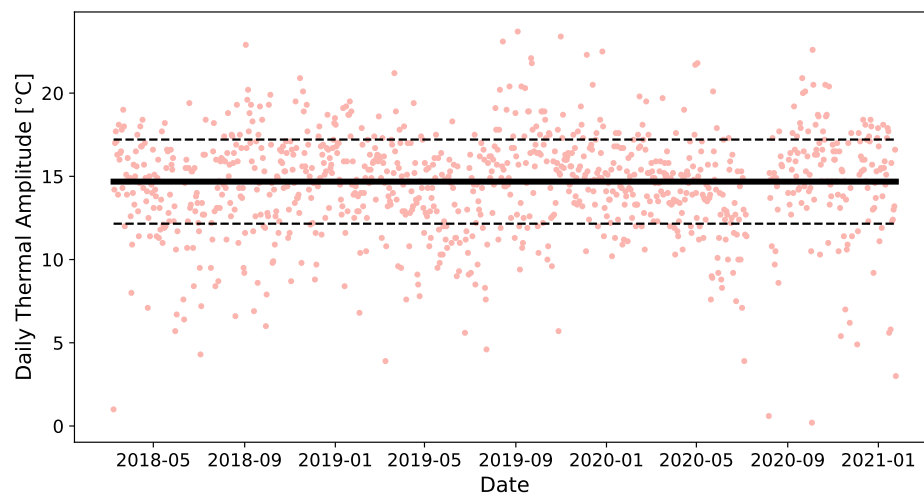


Figure 4: Daily Thermal Amplitude at CASLEO in function of the date. The thick black line represents the mean, while the dashed lines are $1\text{-}\sigma$ above and below the mean.

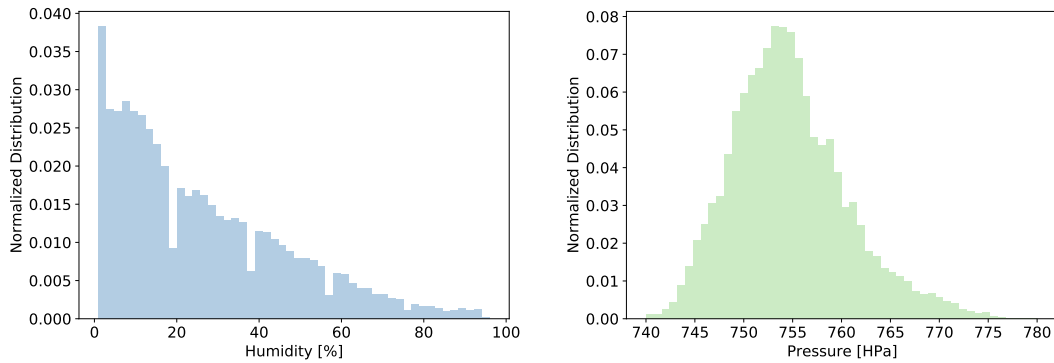


Figure 5: Humidity and Pressure Distributions..

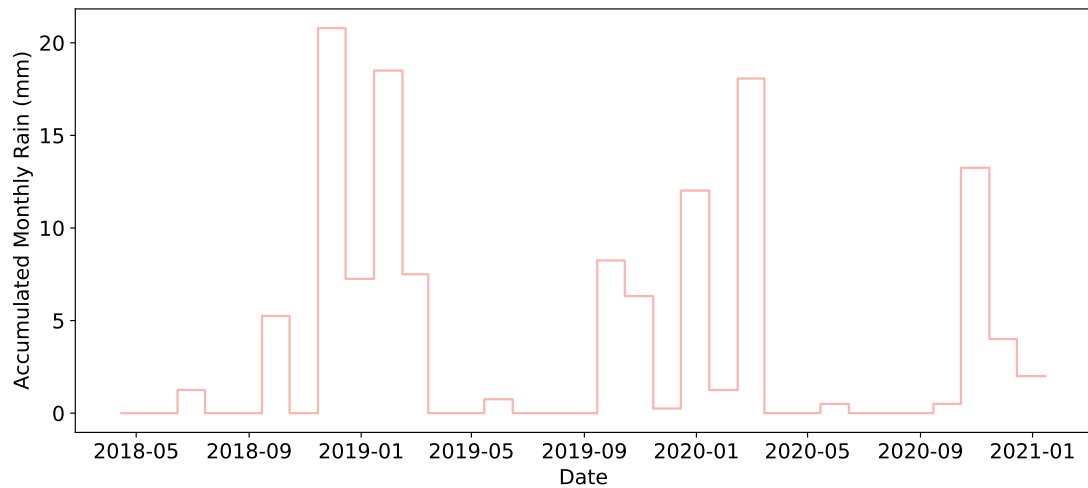


Figure 6: Monthly accumulated rain.

4 Other Weather Conditions

In Figure 5 we show the pressure and humidity distributions. Pressure is very stable with a mean value 755 ± 5 HPa. The average humidity is 26% while is 50% of the time below 20%. Rain is very scarce in the observatory. During 2019 and 2020, the two years with full data coverage, the accumulated rain was 56 mm and 43 mm, respectively. In general winters are very dry with no precipitation at all, while summers concentrate the rains of the year (Figure 6). The UV Index is shown in Figure 7. The UV Index has a maximum value < 16 and 50% of the time it is below 4.

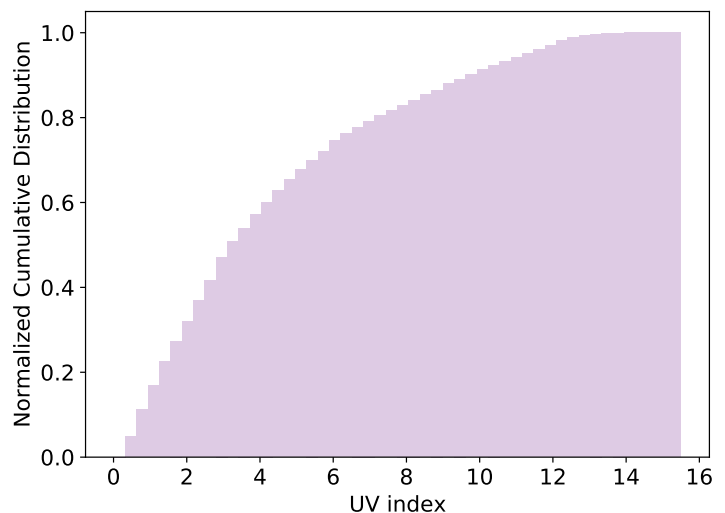


Figure 7: UV Index Cumulative Distribution.