Atacama
Large
Millimeter /
submillimeter
Array

Average daily cycles Report

ALMA-20.01.04.00-0020-A-REP

2017-02-24

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Change Record

Version	Date	Affected Section(s)	Author	Reason/Initiation/Remarks
A	2017-02-24	ALL	Natalia Carrera	

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1 Introduction

The purpose of this report is to understand how the atmospheric dynamics behave in the ALMA AOS. Between 2010 and 2016, several variables have been studied, obtaining data from weather station TB2 which is located at the "Llano de Chajnantor", whose coordinates correspond approximately to 23°S 67°W.
In order to work with this data, for the case of the wind direction and the wind speed, hourly values were extracted calculating the average from the original data set. For the case of other variables, hourly values were only extracted from the original data set.

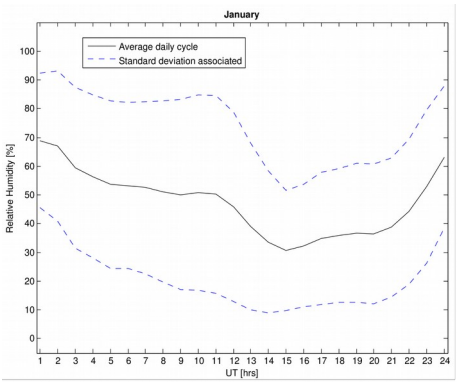
The analysis that will be shown below, corresponds to the study of the average daily cycles of relative humidity (%), temperature (°C), dewpoint temperature (°C), wind direction (°), wind speed (m/s) and pressure (Hpa), for each month of the year. Taking this into consideration, each hour from every month and from the every year was averaged, obtaining 24 values per month. The result of this calculation will show how each variable behaves in an average day.

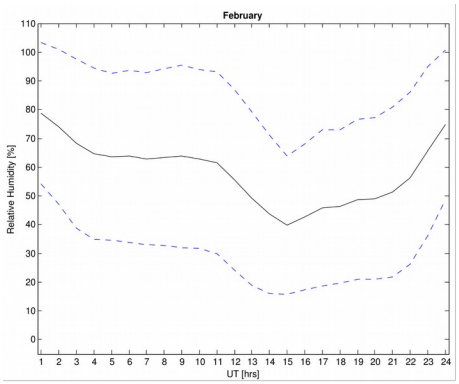
1.1 Acronyms

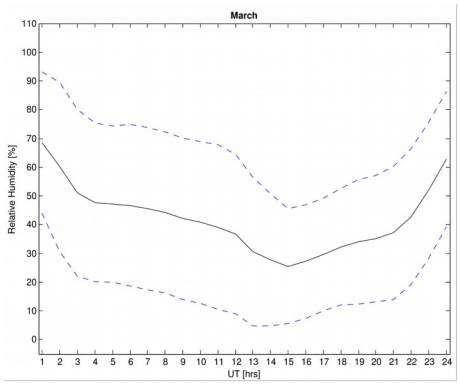
Acronyms	Definition
ALMA	*Atacama Large Millimeter/Submillimeter Array*
AOS	*Any relevant Requirements*
SH	*Southern Hemisphere*

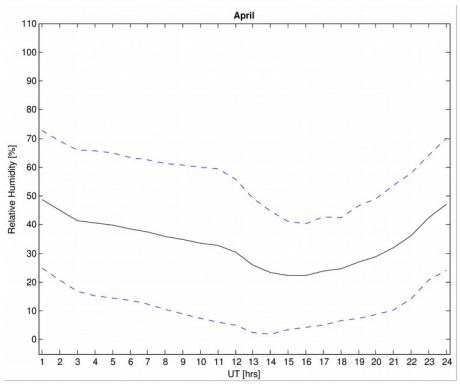
2 Figures

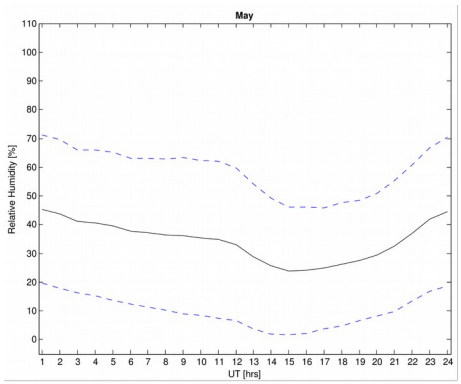
2.1 Relative humidity

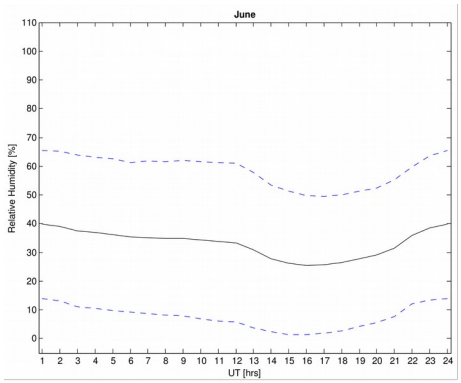


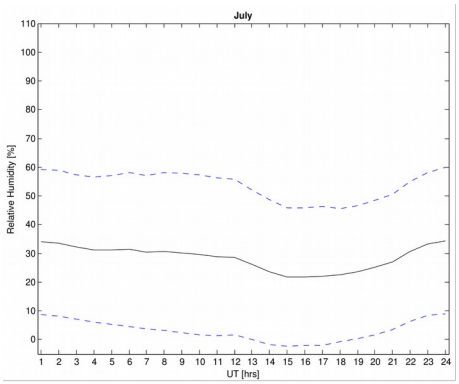


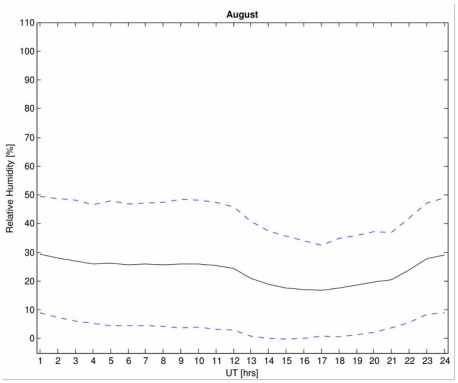


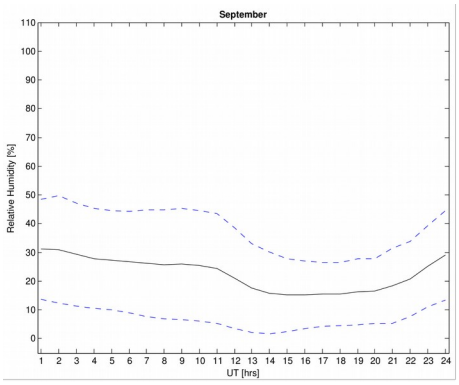


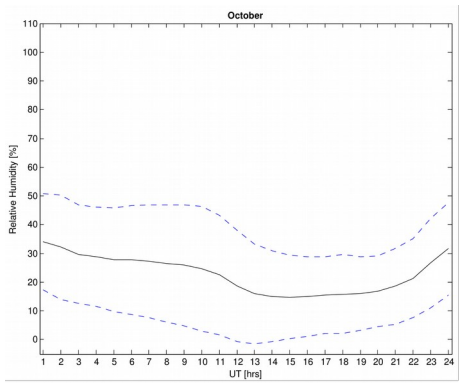


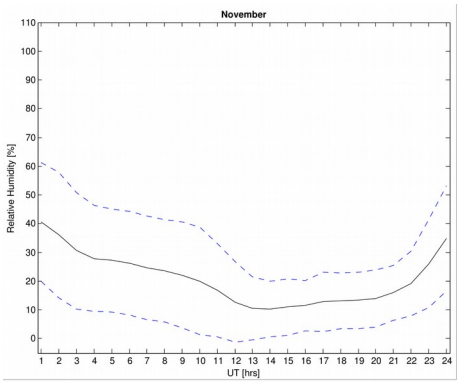


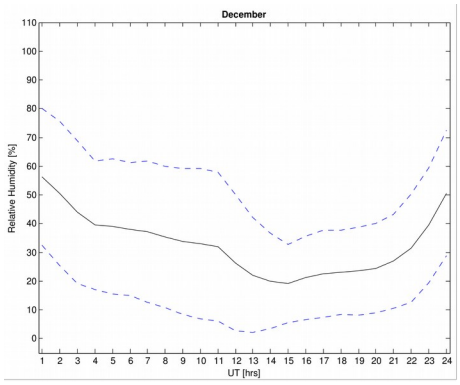












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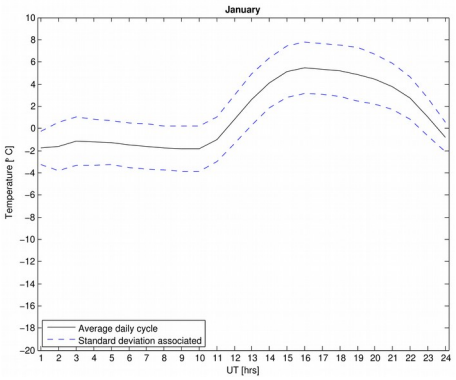

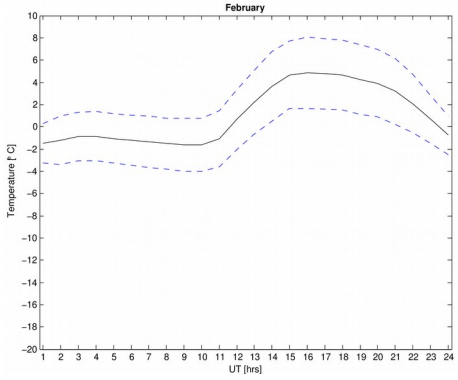

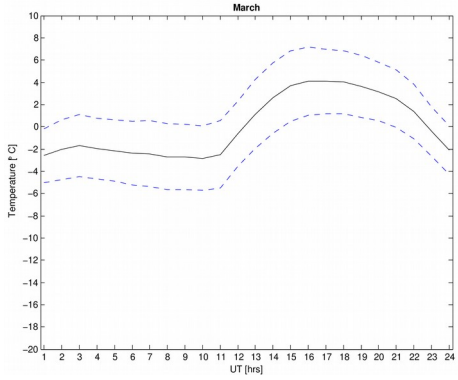

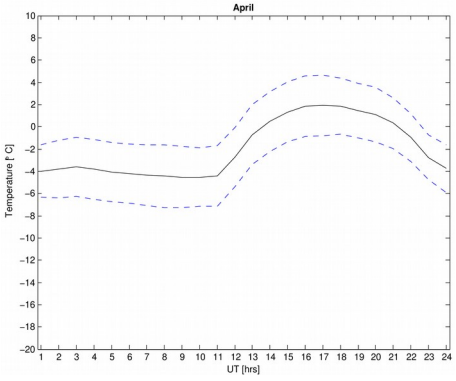

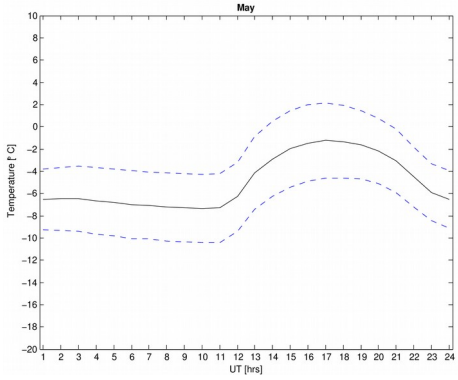

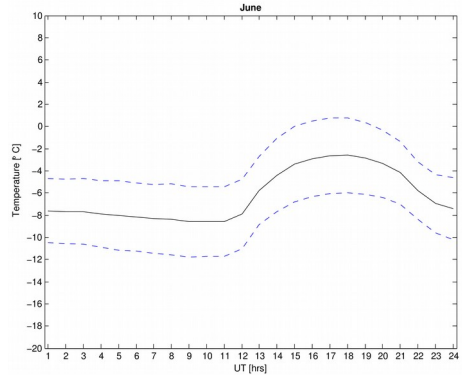

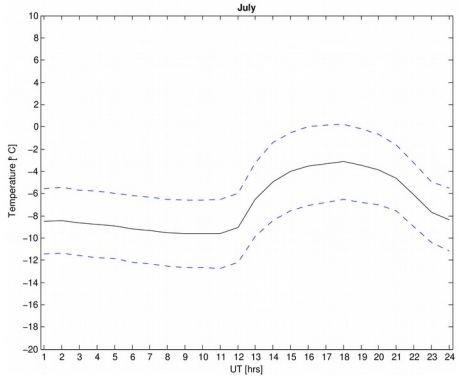

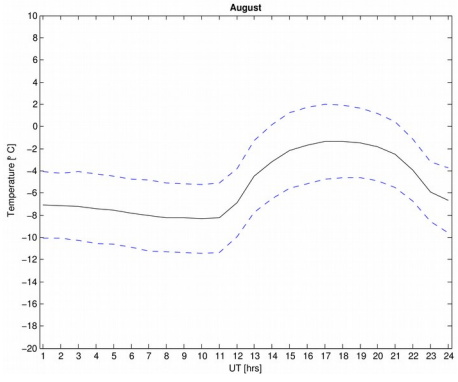

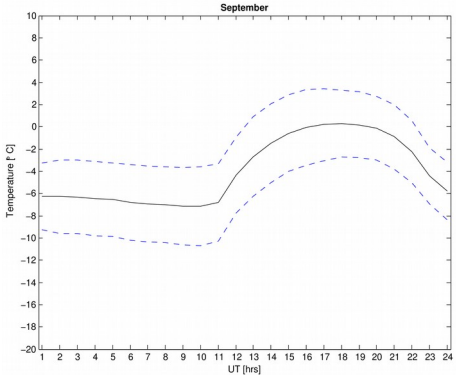

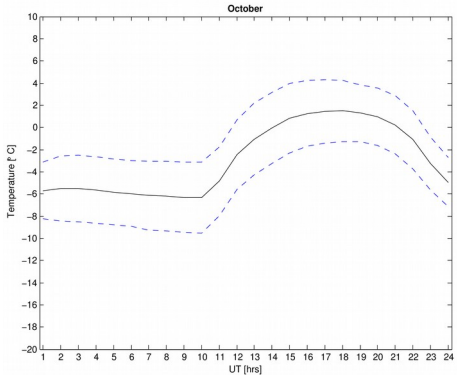

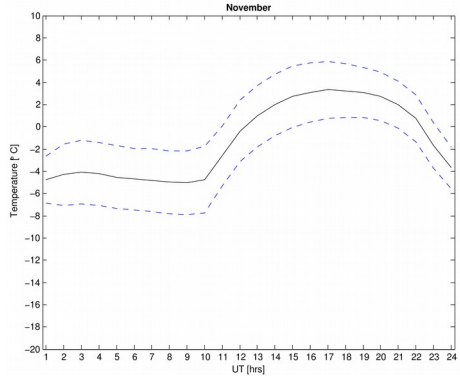

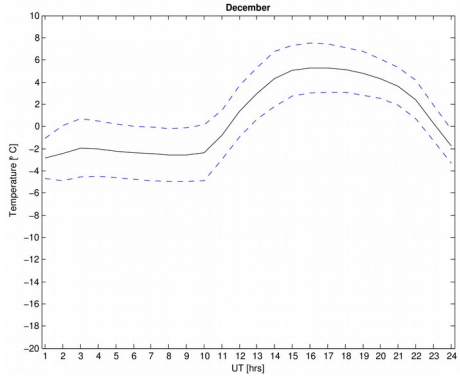

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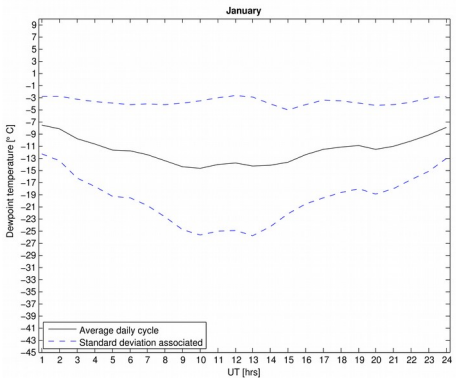

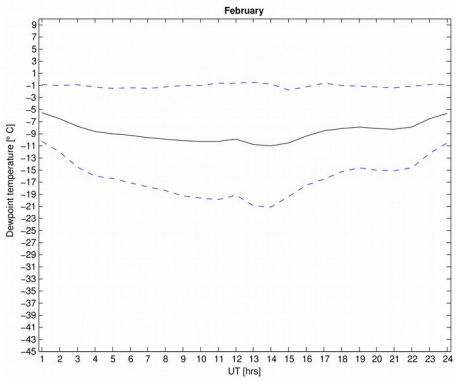

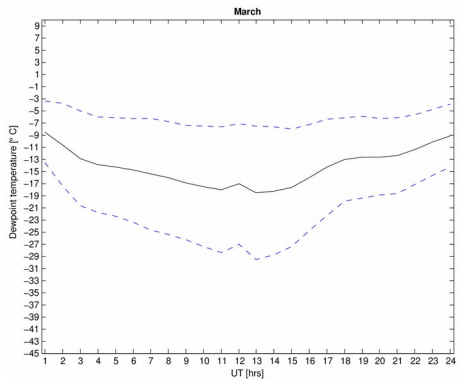

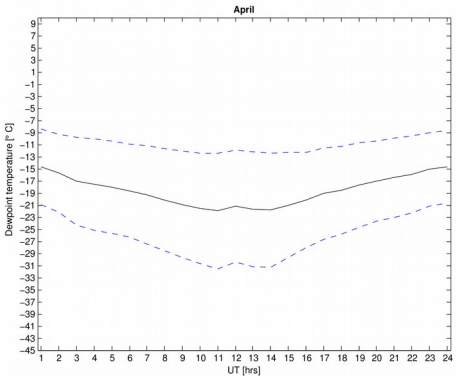

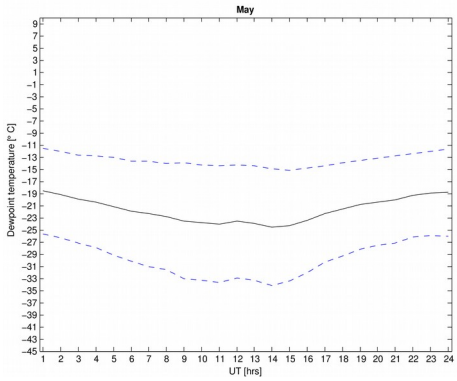

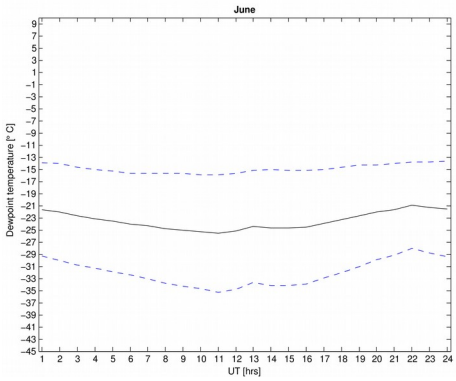

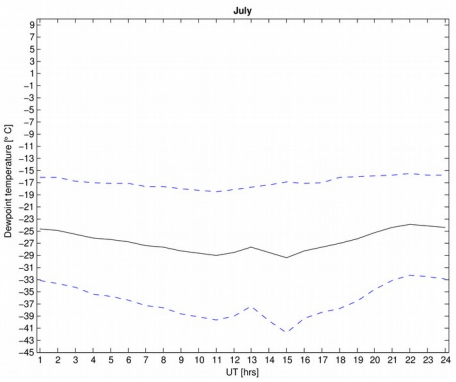

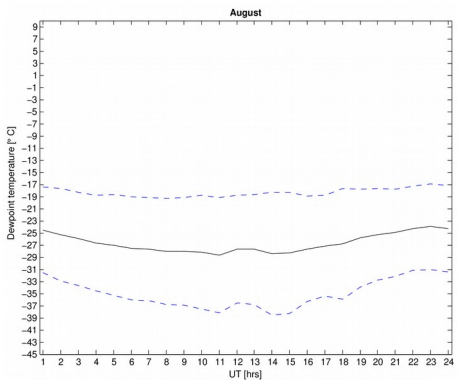

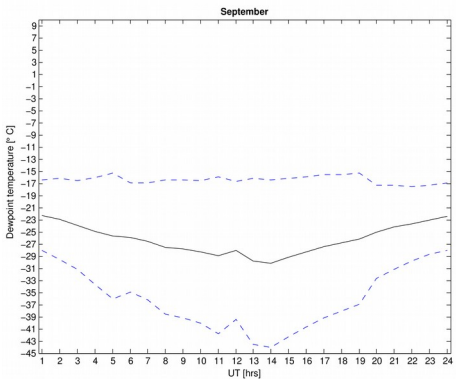

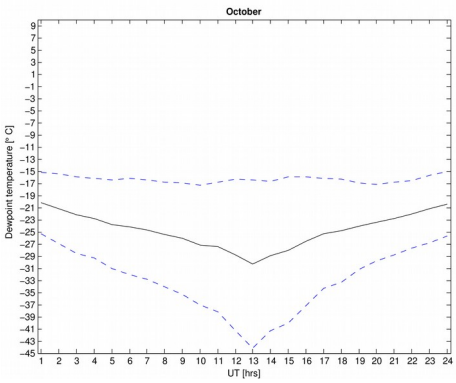

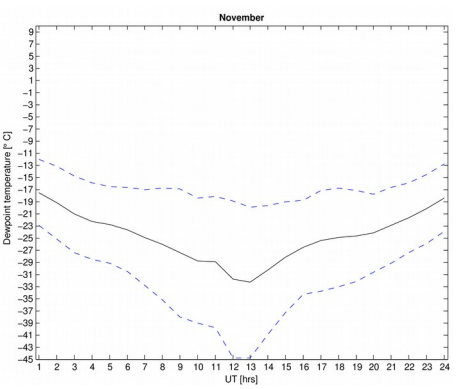

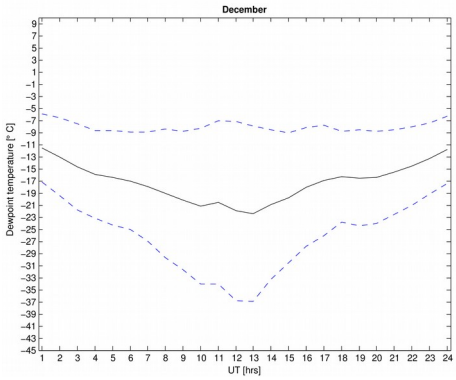

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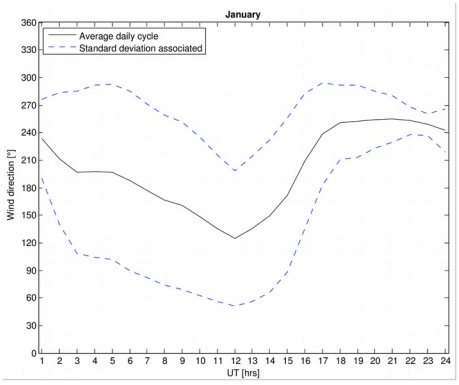

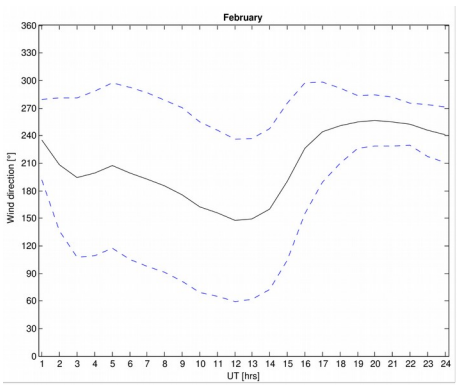

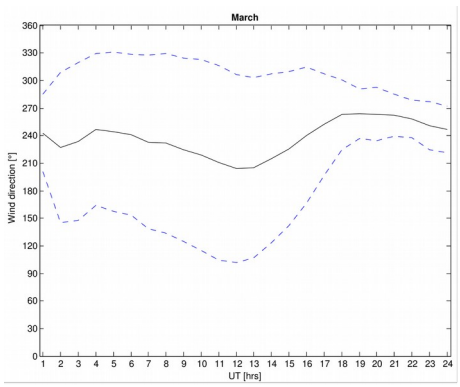

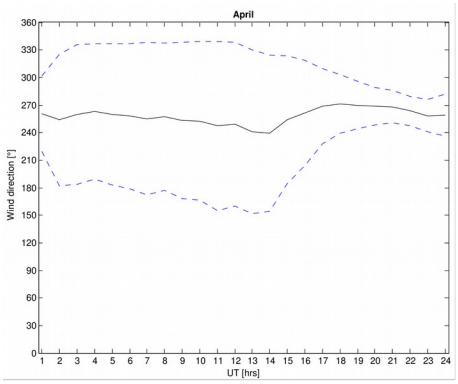

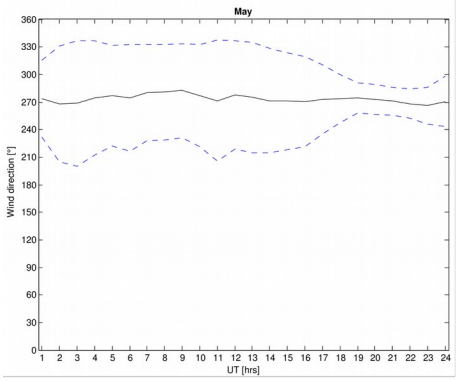

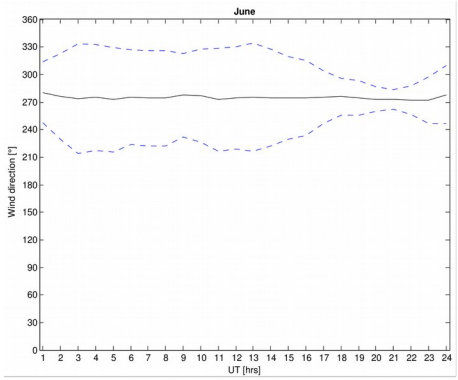

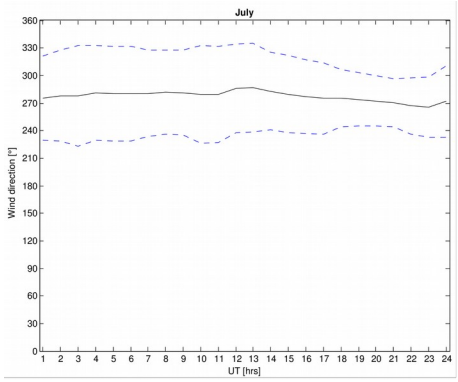

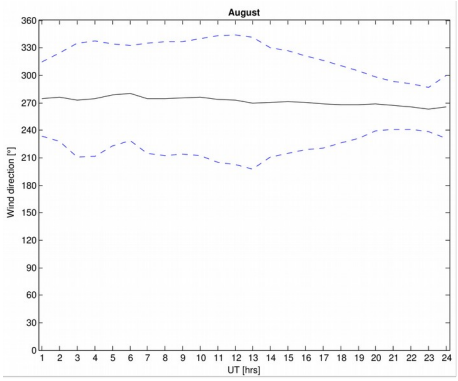

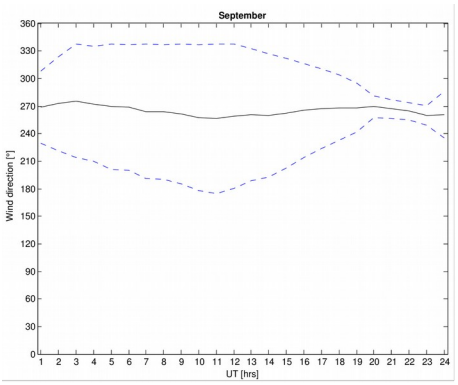

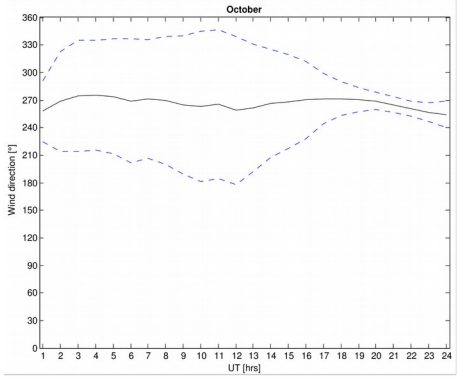

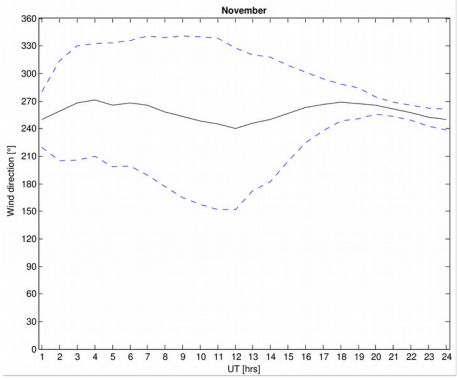

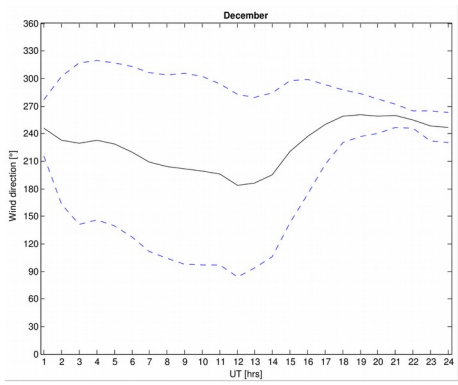

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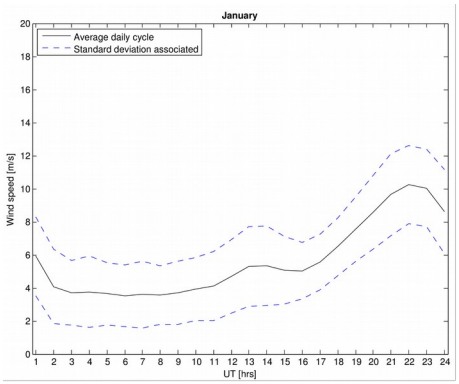
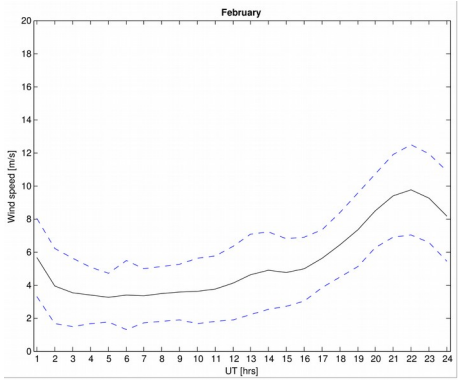
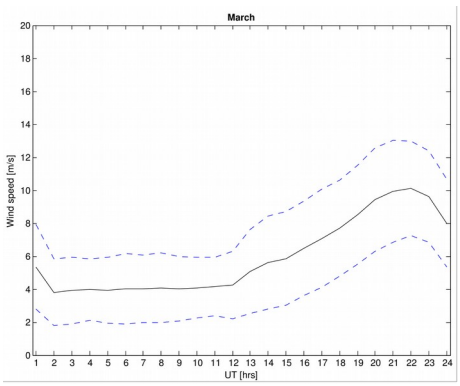
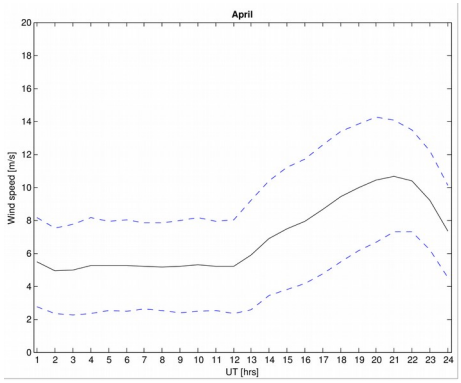
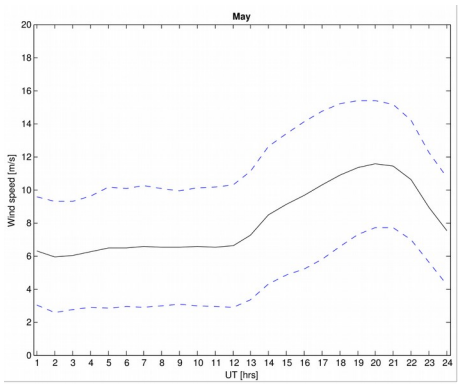
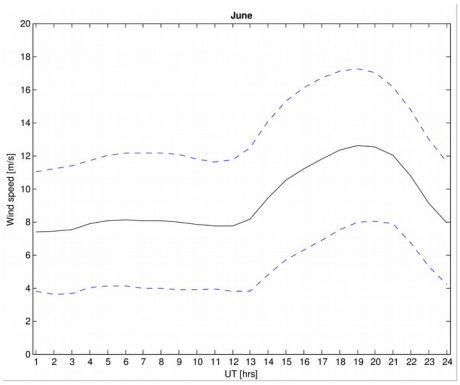


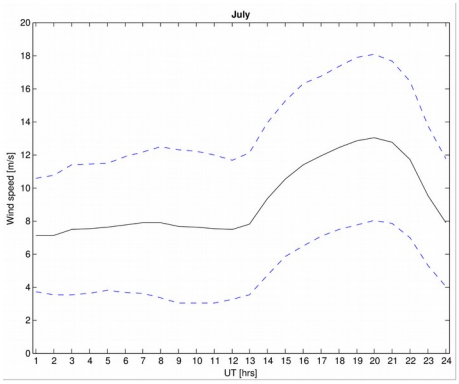


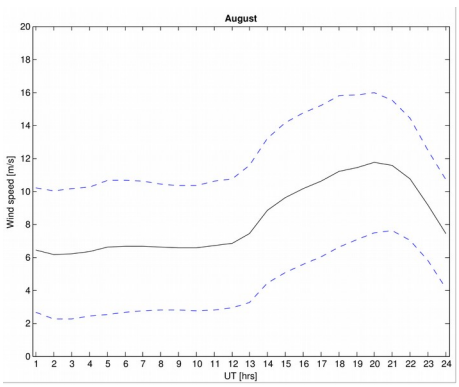


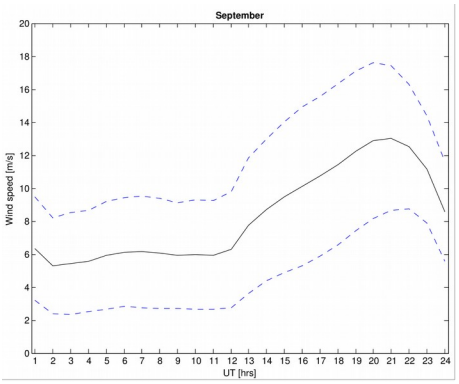


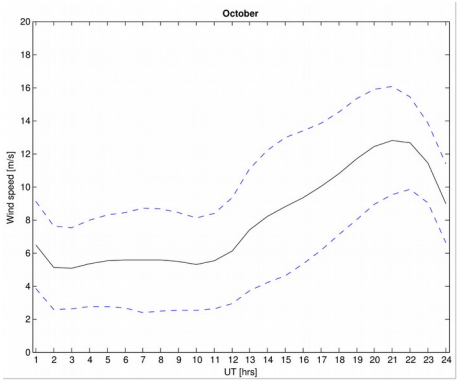


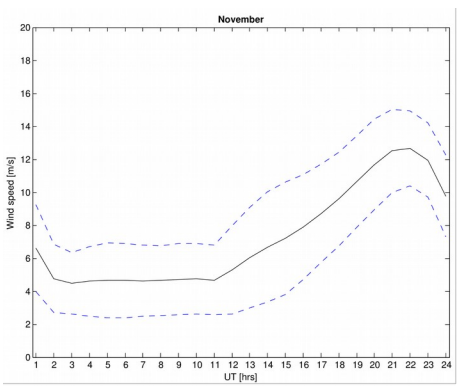


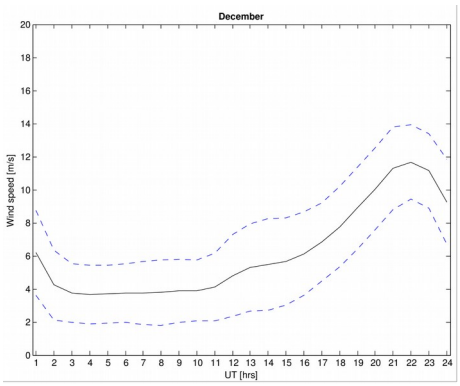




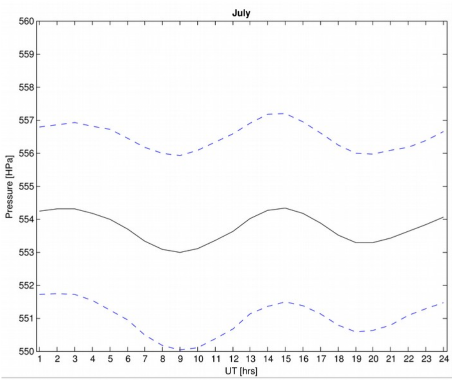


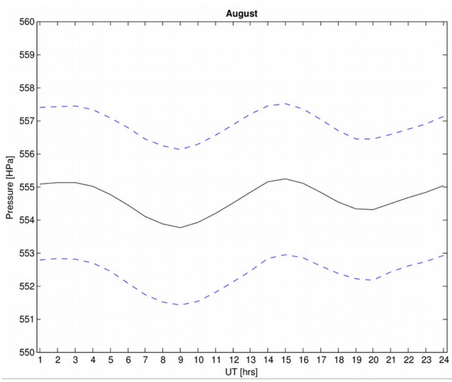


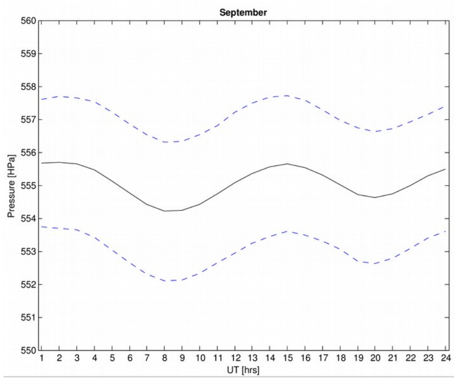


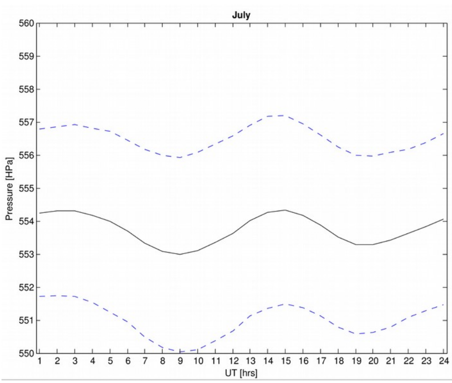


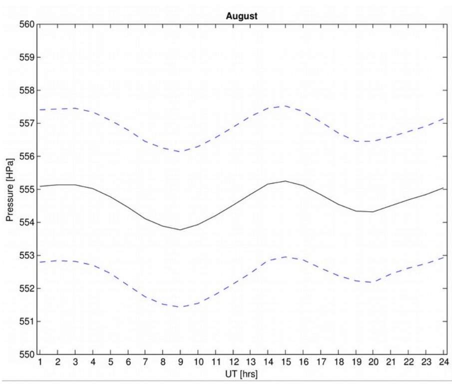
2.6 Pressure

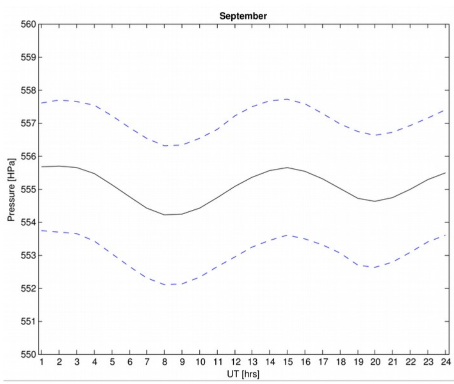

July
Pressure [HPa]
UT [hrs]

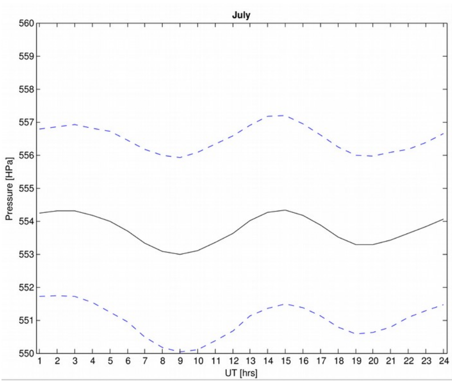

August
Pressure [HPa]
UT [hrs]

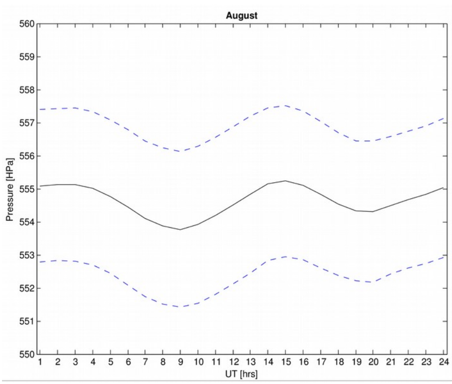

September
Pressure [HPa]
UT [hrs]

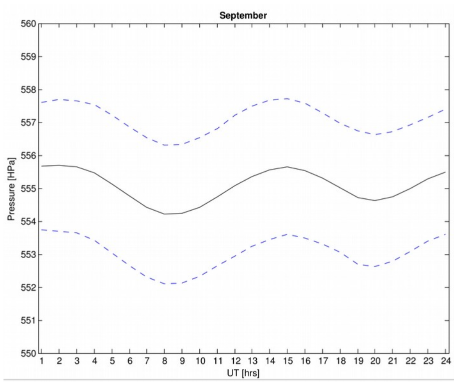

July
Pressure [HPa]
UT [hrs]

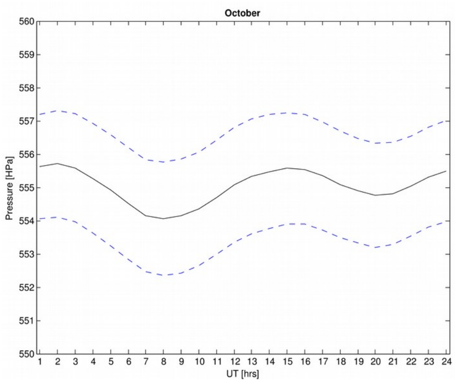

August
Pressure [HPa]
UT [hrs]

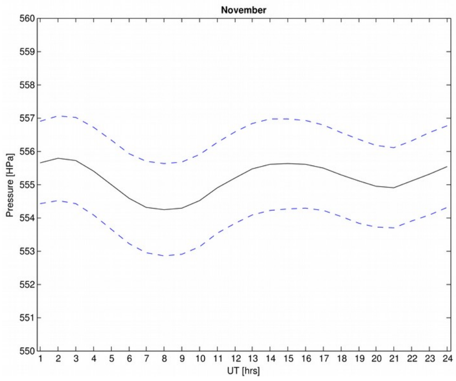

September
Pressure [HPa]
UT [hrs]

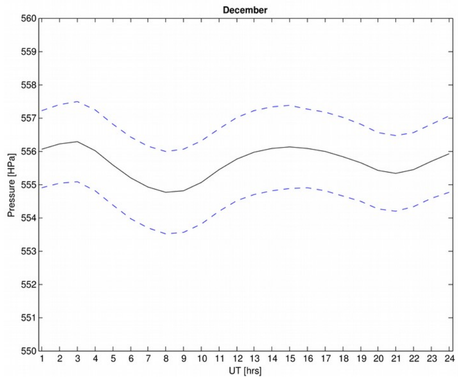

July
Pressure [HPa]
UT [hrs]


August
Pressure [HPa]
UT [hrs]


September
Pressure [HPa]
UT [hrs]


October
Pressure [HPa]
UT [hrs]


November
Pressure [HPa]
UT [hrs]


December
Pressure [HPa]
UT [hrs]

3 Conclusions

The relative humidity shows more variability during January, February, March and December which are the months affected by the high-plateau winter. In every month, it is possible to see that approximately at sunrise, there is a decrease of the percentage of relative humidity, which finds its minimum at noon. Then, this value increases slowly until evening, about 7 pm, after which it begins to increase faster. On the other hand, in these graphs, we cannot observe values of 100% relative humidity, which corresponds to a condition that allows the condensation of water. Therefore, we can say that these events are isolated and they are lost when observing the average-daily cycle.

In the case of the temperature, the lowest values and variability are seen in the months of June, July and August, which correspond to the SH winter. The highest temperatures are developed in January, February, March and December, according to the summer season. On the other hand, in every month there is an increase of the temperature at sunrise, which stays the same after noon. Then, it decreases approximately again in the evening, about 7 pm.

Regarding the dewpoint temperature, a high variability is seen in the months of October, November and December. The lowest values are developed during the winter corresponding to the SH and the highest during the months of January, February and March.

In the month-to-month comparison of temperature and dewpoint temperature graphics, we can see that the room temperature does not reach to dewpoint temperature. Whereby as in the relative humidity, when observing the average daily cycle, possible rain events are lost.

When observing the figures of the wind direction, we can see that in December, January, February and March, the wind direction is noticeably variable during the day. This situation is different for the rest of the months, where the winds come approximately from a constant direction and correspond predominantly to East winds (270°) with a variability that includes from South winds (180°), until North winds (360°). On the other hand, we can see that in every month, in the evening (between 5 - 8 pm), the variability related to the standard deviation decreases in comparison to the rest of the day.

The figures corresponding to wind speed, show a clear increase after noon, where approximately in the evening (about 5 - 7 pm) can be found the highest values. In addition, between the months of April and October, the variability with respect to the standard deviation is higher than the other months. During January, February and March, we can see lower terminal velocities, where in addition, a second maximum of smaller magnitude can be mentioned, which is developed before noon.

Item 2.6 shows that the pressure also varies in very small magnitudes during the day and during the month. A clear cycle throughout the day can be seen, which presents two minimums and two maximums, the latter placed approximately at midnight and noon. The values corresponding to the rank between which the pressure oscillates during the day, are greater during the summer, then they slightly decrease until the months of winter (SH), after which the values increase slowly again. Regarding the variability related to the standard deviation, during the summer is very low, not thus in the SH winter.