

# **Report of the March '2002 Atacama Site Testing Campaign**

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## **a) Introduction**

Between March 14<sup>th</sup> and April 1<sup>st</sup> 2002, a seeing measurement campaign was developed in the Plain of Chajnantor, in the highland of Atacama, Chile, promoted and mostly supported by the department of Astronomy of the University of Cornell, in the collaboration with the University of Texas and the IATE group of the Observatorio Astronómico of the Universidad Nacional de Córdoba.

### **a.1) Proposed Objectives**

The objectives originally proposed for this campaign were to carry out comparative and simultaneous measurements of seeing, during at least 7-8 nights, in the Cerro Chico (5100 m) and in the West border of the summit of Toco (5570 m) and to download the data registered by the weather stations installed in the cerros Toco and Negro. If for any reason the measurements in Toco, could not be carried out, the measurements should be carried out in Cerro Honar (5450 m).

### **a.2) Achieved Objectives**

Simultaneous measurements of seeing were carried out during 9 nights, in the Cerro Chico and Honar, due to the impossibility of installing a DIMM in the summit of Cerro Toco due the strong snowfalls produced during the days 17 and 18 of March.

The night of March 22<sup>nd</sup> data were not obtained in Cerro Chico, due to operation and software difficulties, and in the night of March 27<sup>th</sup>, scarce data could only be obtained in Cerro Chico and none in Cerro Honar due to strong winds that made impossible the operation of the DIMM's (windspeed more than 40 Km/h).



**Toco at the morning of March 19<sup>th</sup>.**



**L.Keller downloading data of Toco's weather station.**

We had to hike the summit of Toco to download the data of the weather station because of the impossibility of making remotely. It was not possible to obtain the data registered in the station of Cerro Negro because we couldn't settle down the remote contact neither hike it.

### **a.3) Participants**

The expedition was integrated by Luke Keller of Cornell (03/14 to 03/18), Matt Richter of Texas, (03/15 to 03/24), Joe Tuffts of Texas, (03/21 to 04/01), Carlos Valotto of Cornell and of Córdoba, (03/15 to 03/29), Mariano Dominguez, Rubén Vrech of Córdoba, (03/15 to 04/01) and Pablo Recabarren (03/14 to 04/01).

On March 23<sup>rd</sup> Riccardo Giovanelli and Fred Young arrived to San Pedro. They were in atacama till March 25. They were carrying out a visit for diverse places of astronomical interest in the country.



**M.Richter, C.Valotto, R.Vrech and L.Keller with “Annie” and Rusty  
in Casa de Don Tomás Hotel**



**R.Vrech, M.Domínguez, C.Valotto, P.Recabarren and J.Tuffts eating a barbacoa.**

## **b) Development of the Campaign**

### **b.1) Weather Stations.**

Among the days 15 to 17 Luke Keller intended to download the data of the meteorological stations of Cerros Toco and Negro, being observed that in the case of Toco they could take the data using the utility Hyper Terminal of Windows, but in a manual way, by packages that required confirmation in each exhibited screen and not in a continuous and automatic way. This procedure was too slow, so we decided to ascend the mountain to connect the computer directly to the unit of control of the weather station. The same thing was verified with the station of Negro Cerro but we had not time to hike that summit.

The first achieved task was the downloading of the Toco weather station data. To do that we had to ascend to the summit on Sunday 17. The ascent was carried out without inconveniences, but when we descended an important electric storm took place, which produced a strong snowy during the night.

We decided to carry out the downloading of Negro's data using the manual procedure of Hyper Terminal, but due to their slowness it was preferred to wait to some moment of the campaign in which there were free time to do that, presumably toward the end of the running.

In the last days of the campaign (days 30 and 31) we tried to download the data of Negro and Toco but it was not possible, neither with Hyper Terminal utility, probably for damages that took place in the stations after day 17, during the electric storm.

We verified that it was possible to receive the data that the station of Toco acquired every 15 minutes, in real time, but we couldn't do a normal communication session.

At this date The station of Negro, contrary to the Toco, didn't give any activity sign as in the firsts days of the campaign.

We tried to do several things to download those data but operation errors are not discarded.

We spoke with Bob Blum (CTIO) in San Pedro, who has to carry out a campaign in April, in order to try to download those data.

## **b.2) Seeing measurement.**

The main difficulty to do the original proposed schedule was the Bolivian Winter that was registered in the area at the beginning of the campaign that was prolonged until the day 20th. During these days it took place a strong accumulation of snow that didn't allow us to access the Cerro Toco, and it also hindered the access to Cerro Chico neither displacements on the Plateau.

Awaiting an improvement in the climatic condition, both Dims goes down to San Pedro to verify their good operation and to train people who didn't know how to operate them.

Other activities were to fill oxygen bottles, to prepare a screen to attenuate the action of winds in Toco and to organize cargos for the ascent to Toco.

On March 19 we tried to begin the ferrying of Toco but the snow didn't allows us to overcome the point known as "La Playa", at 5050 m of height on the Toco trail where it was found more than 30 cm of accumulated snow.

After that, we tried to go to Cerro Chico through Pampa La Bola but it was impossible to advance for the Chico secondary road, because of the accumulation of snow.

It was evident the necessity of having chains for snow and shovels in the trucks.

On March the 20<sup>th</sup> we installed a DIMM (Rusty) in Cerro Chico and we took the decision of carrying out the measurements in Honar and not in Toco, since the Toco option should take at least two more days to begin the seeing running.



**R.Vrech en “La Playa”**



**CBI building in Llano de Chajnantor.**



**Cerro Chico in the back.**

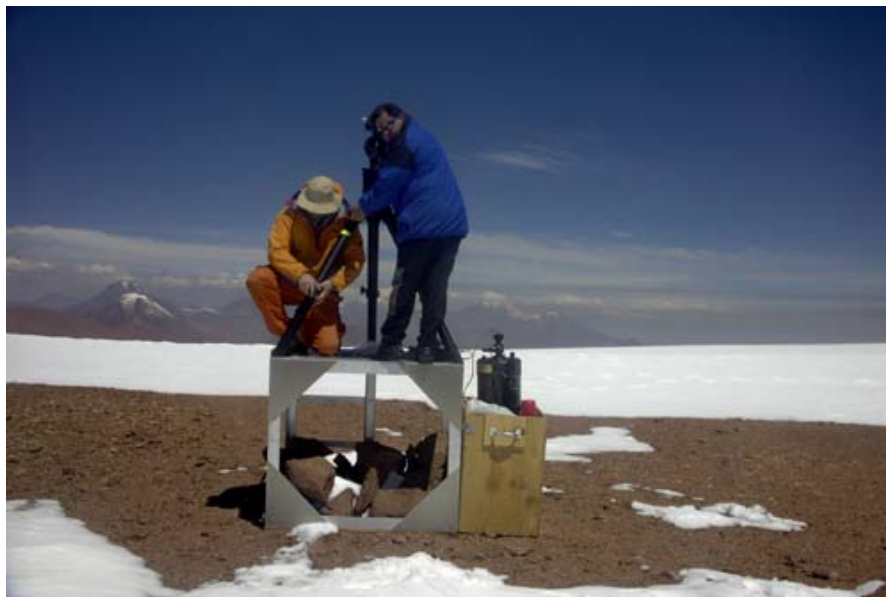


**Setting up Rusty, in Cerro Chico.**



**Trying to reach Honar's summit with the truck.**

Those days it was not possible to reach Honar's summit with the vehicles to install the other DIMM because of the snow, so we decided to install a tent to operate the DIMM.



**In the afternoon of March 21<sup>st</sup> the other DIMM (Annie) was set up in Honar and it began with the running.**

It was preferred not to put the wind generator in reason that the short distance between the tent and the parked vehicle allowed to transport charged batteries without difficulties. Batteries were charged in San Pedro and replaced every night. The small batteries of 18 Ah were very easy to transport.



We carried out simultaneous measurements of seeing in Cerros Honar and Chico from 03/22 (UT) to 03/30 (UT). Exceptionally, the night of the 22<sup>nd</sup>. it took data only in Honar, due a problem with the operation of the software in Chico and on March 27<sup>th</sup>. only scarce data in Chico, and none in Honar, due to the wind of 40 Km/h that disabled the task.

In the afternoon of the day 28<sup>th</sup> and due to the problem of the previous night it was decided to install the windscreen in Honar, although it was of doubtful utility because of the rotation of the winds during the night.



**Honar's camp at night. In the back, the windscreen.**

On the night of the 22<sup>nd</sup> was made the first intent of arriving to the summit of Honar with chains in the wheels, but the vehicle was beached in the snow and it had to be rescued in the morning with the collaboration of the team that worked in Chico. On the night of the 26<sup>th</sup> it arrived with the truck to the summit of Honar, then the work in Honar was alleviated substantially.

The seeing averages for night were:

<b>Day</b>	<b>site</b>	<b>seeing average</b>	<b>registered hours</b>
03/22	Chico	-	-
	Honar	.87 "	2 hours
03/23	Chico	.89 "	7 hours
	Honar	.67 "	6 hours
03/24	Chico	.76 "	8 hours
	Honar	.64 "	7 hours
03/25	Chico	.56 "	8 hours
	Honar	.47 "	8 hours
03/26	Chico	.68 "	9 hours
	Honar	.52 "	8 hours
03/27	Chico	1.05 "	2 hours
	Honar	-	-
03/28	Chico	.58 "	9 hours
	Honar	.76 "	9 hours
03/29	Chico	.72 "	9 hours
	Honar	.74 "	7 hours
03/30	Chico	.64 "	5 hours
	Honar	.80 "	5 hours

### **b.3) The Equipment.**

#### **b.3.1) The DIMM's.**

The most frequent inconveniences DIMM's had were troubles with wires or in the connectors, mainly of Rusty. We strongly recommend to replace the camera cables and of serial communication in this DIMM. The pads of manual control should be replaced in both DIMM's. It is also convenient to redo the supply cables of Rusty.

Regarding the software of the DIMM's it is suggested to dedicate efforts in order to upgrade it to work in an more adequate and modern environment, like Windows, and to solve the problems that it has when closing the data files and with the entrances in dead loops, that frequently happens if there is wind and there are difficulties for the determination of the centroides of the images of the stars.

It is observed that when the program enters in one of those loops the system loses the possibility to upgrade the time, then the files have non upgraded times. In most of the cases this is not noticed by the operator which can restart the program without noticing that the time is wrong.

The importance is stressed of frequently controlling the date upgrade and hour in the computers, at least every time that the operator restarts the program.

Regarding the supply power of Annie, used in Honar, it was satisfactory the employment of previously charged batteries. The consumption of the system allows the use of a battery of 36 Ah or two of 18 Ah during 8/9 hours, with the condition of maintaining them properly heated inside the tent. we concluded that unless it is indispensable, this system is preferable instead of using the wind generator employed in the campaign of October 2001.

We did a mock of the wind generator in the area of the container, in the plateau and it functions well. It is possible that some of the problems with this system is that some times winds are not enough to give adequate charge to the batteries.

The carried out measurements of consumption of the system indicate that the feeding of the telescope takes around 0.9-1.1 Amp, and 2.5-3 Amp. the IBM Laptop.

The HP Omnibook Laptop takes not more than 1.8 Amp. The consumptions of laptops depends strongly on the type of activity they do (Hard disk operation, screen ., Floppys, etc).

### **b.3.2) Windscreen.**

This device was dedicated to be an employee in the summit of Cerro Toco, but finally it was assembled in Honar. It didn't give the prospective results since it was not assembled appropriately.

It consists on a mesh type cloth, sustained by wooden piles. For future campaigns it seeks advice an assembly of more covering that the one used in this. Generally, the wind rotates during the night between the N and the W, then is important the structure has to cover about 200 grades at least, around the DIMM, with their center oriented to NW.

## **c. Logistics.**

### **c.1) The lodging.**

It is important to keep in mind in future campaigns the possibility of being housed in the private house of Don Tomas Poblete. This offers the possibility to have a space of comfortable and centralized work, that which is very convenient mainly when it is necessary to carry out mocks, trainings, repairs and assemblies in San Pedro.

It is also comfortable to have a cheap Internet service. A bill exists under a server of ESO that allows this type of connections with a "0600" telephone number type that the administration of the Hotel considers free of charge. It is important to foresee that many servers need the utility "secure shell" as connection protocol.

### **c.2) Vehicles.**

It was very important to have chosen the company Hertz to rent the trucks. Trucks were in very good conditions for those heavy tasks. Hertz has personal competent to solve so much technical and administrative problems.

During this campaign, through the company OCEGTEL, two kits of chains for the snow with sizes of Toyota Hillux wheels have been acquired, which have been kept in the container of Cornell, nevertheless it should be know that is possible to rent the trucks with these elements provided by the company at low cost in case of being necessary.



**Toyota Hilux with chains.**

### **c.3) OCEGTEL Company.**

It was requested to the company OCEGTEL to carry out some purchases to bill to the University of Cornell among what is counted the wood, mesh cloth, wire, nails to make the windscreen, 2 batteries of 18 Ah each and two kits of two chains each for Toyota Hillux.

### **c.4) The team.**

The team worked with enthusiasm, with a high grade of professionalism and excellent spirit of collaboration.

The job was organized in two teams of two persons and a 5<sup>th</sup> person restoring each night, then each participant had one free night each five.

About human body response to the height, a daily control was taken based on the 'Lake-Louis' test. It is possible observe that most of the uneasiness caused by the work in height happened during the first week. These uneasiness consisted on headaches, nauseas and difficulty to breath after physical efforts.

Only in one occasion one of the members, in Honar, had more aggressive symptoms as vomits and necessity of oxygen. It was not necessary to stop the work and the problem was controlled without inconveniences, disappearing the symptoms almost completely, just by going down to the level of the Plateau.

## **d. Conclusions**

Although it was not possible to do the original objective of measuring in the summit of Toco, it is considered that the general objectives of the campaign were achieved, in spite of the inconvenience that represented the bad climatic condition of the first week.

It is observed that cerro Honar presented better conditions that Chico until the storm of the 27<sup>th</sup>, after which this tendency was reverted.

The weather instruments of hand allowed to take readings with which it is possible to show off certain correlations, mainly among temperature, humidity and the seeing values, as is expectable.

Regarding the weather stations, it is recommended for the next campaign, to prevent time to ascend to Cerro Negro to verify "in-place" the state of the station, the same as in Toco. The necessity of having time to ascend Negro is stressed, since its accessibility is much committed that Toco.

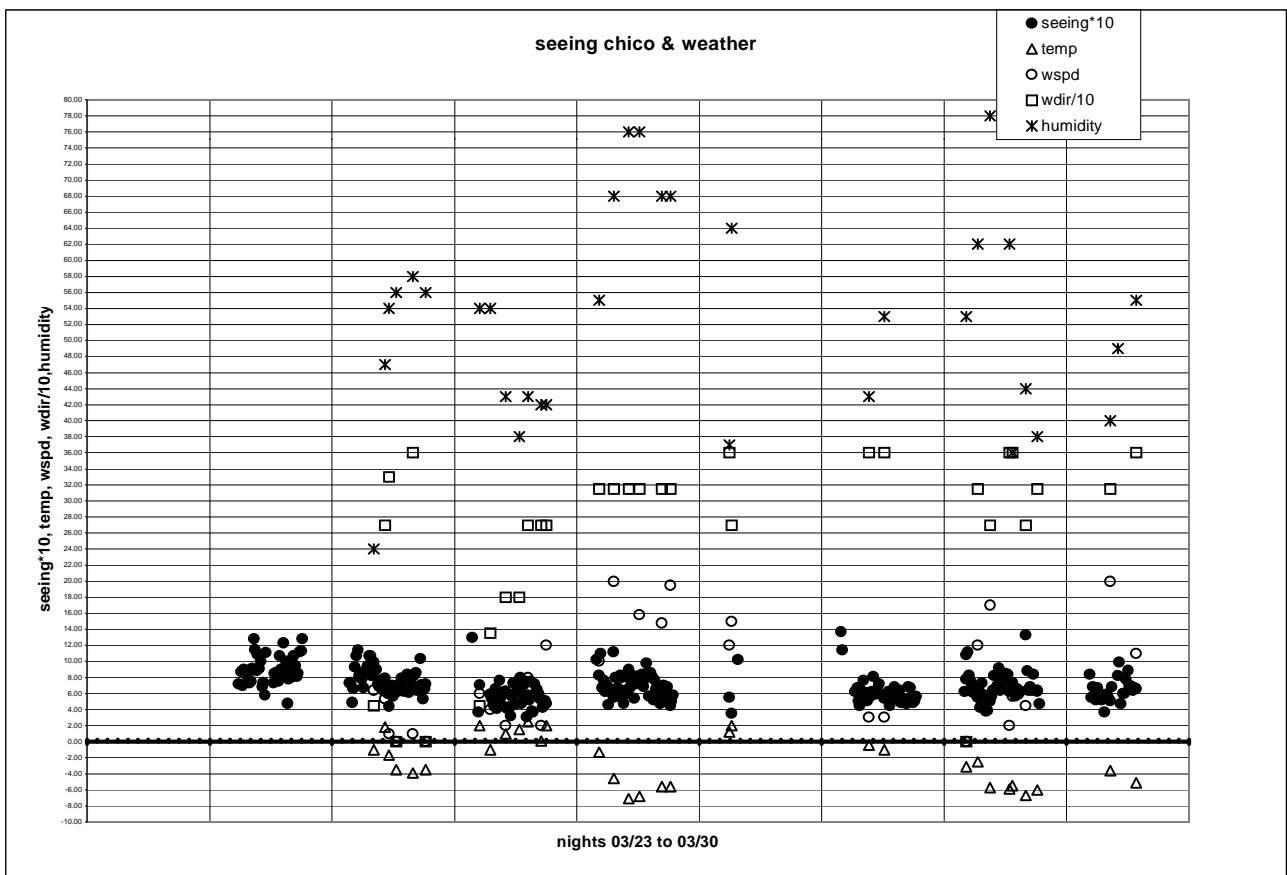
It should be kept in mind that the occurrence of electric storms is a serious inconvenience for the security of the devices installed in the summits that surround to the plain of Chajnantor.

It is important to obtain evidences about the efficiency of the lightning rod installed in Toco in order to extend or not their use to Cerro Negro and others devices in summits.

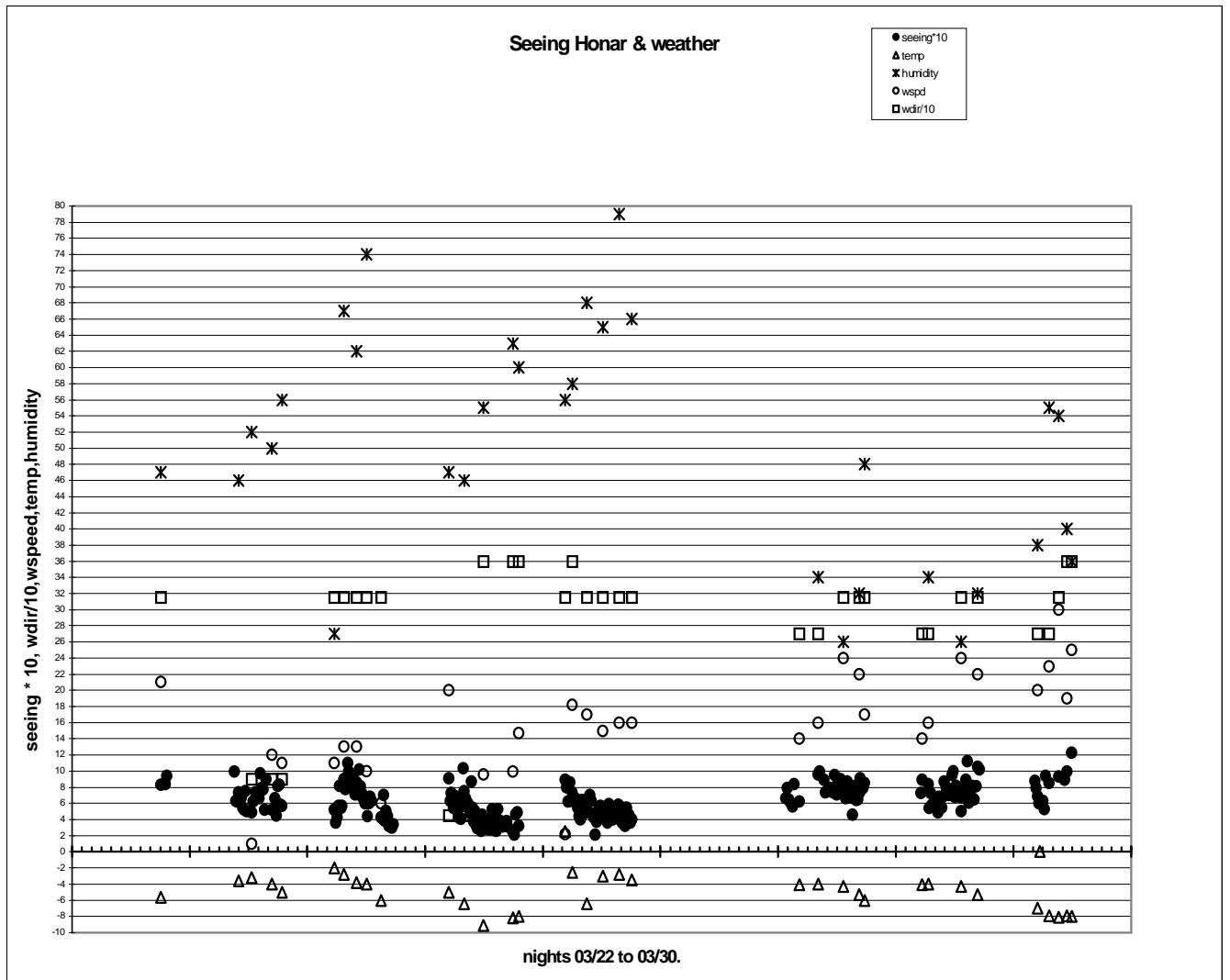
It should also be foreseen enough time to check the DIMM's calibration and to verify the configuration of the masks.

The nexts graphics show seeing values (x10) from 03/22 to 03/30, wind direction (/10), (N=36.0°, W=27.0°, etc.), humidity in %, wind speed and temperatures in °C.

### Cerro Chico



# Cerro Honar



In the graphics we can see that seeing goes better if temperatures, humidity and wind speed goes low, as it is expected, but correlations between seeing and wind direction are not so clear.