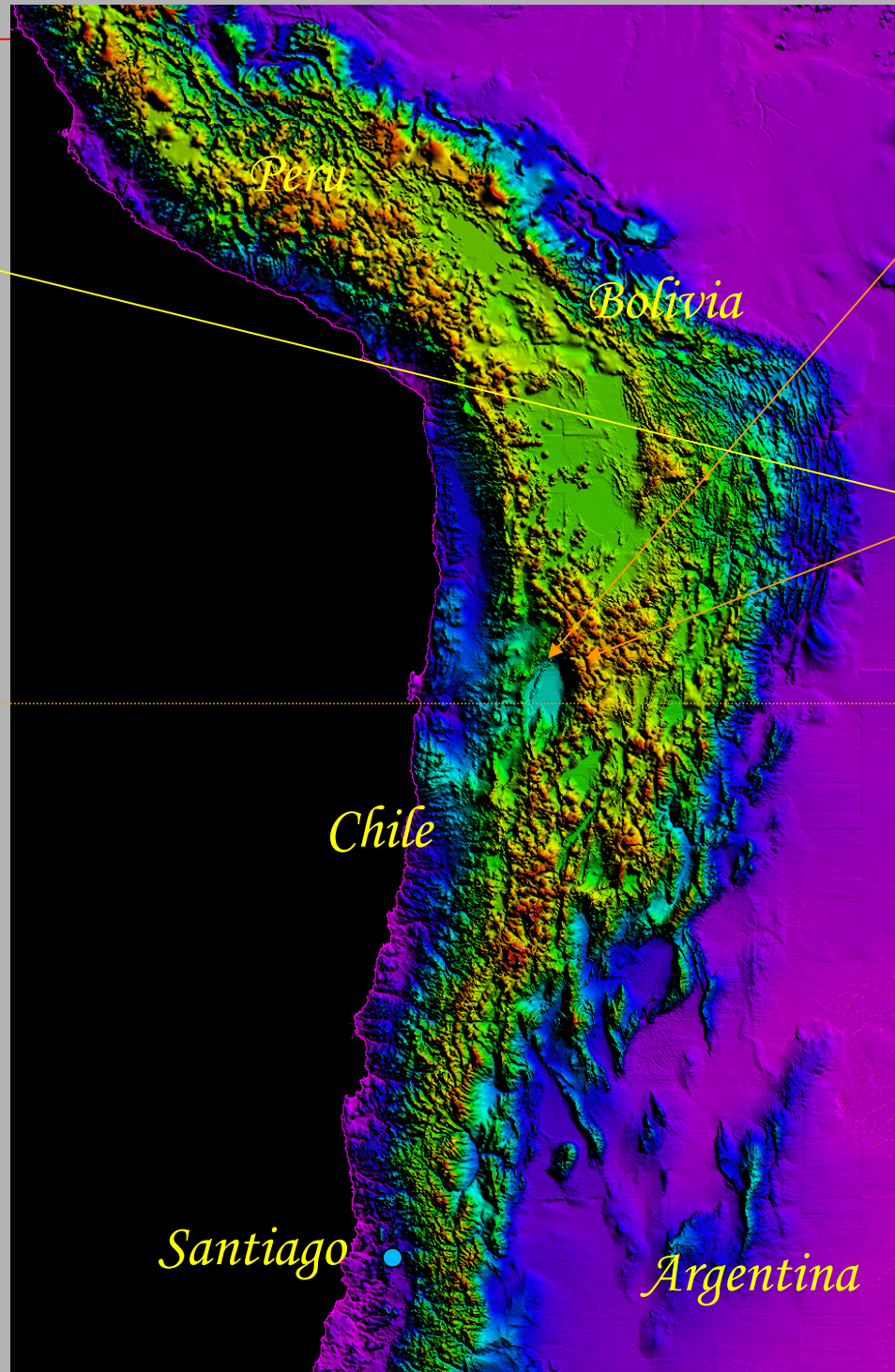
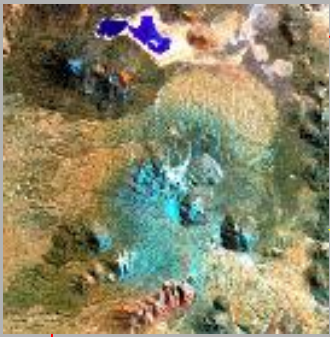


The Chajnantor Region



Salar de Atacama

Chajnantor Plateau

Tropic of Capricorn

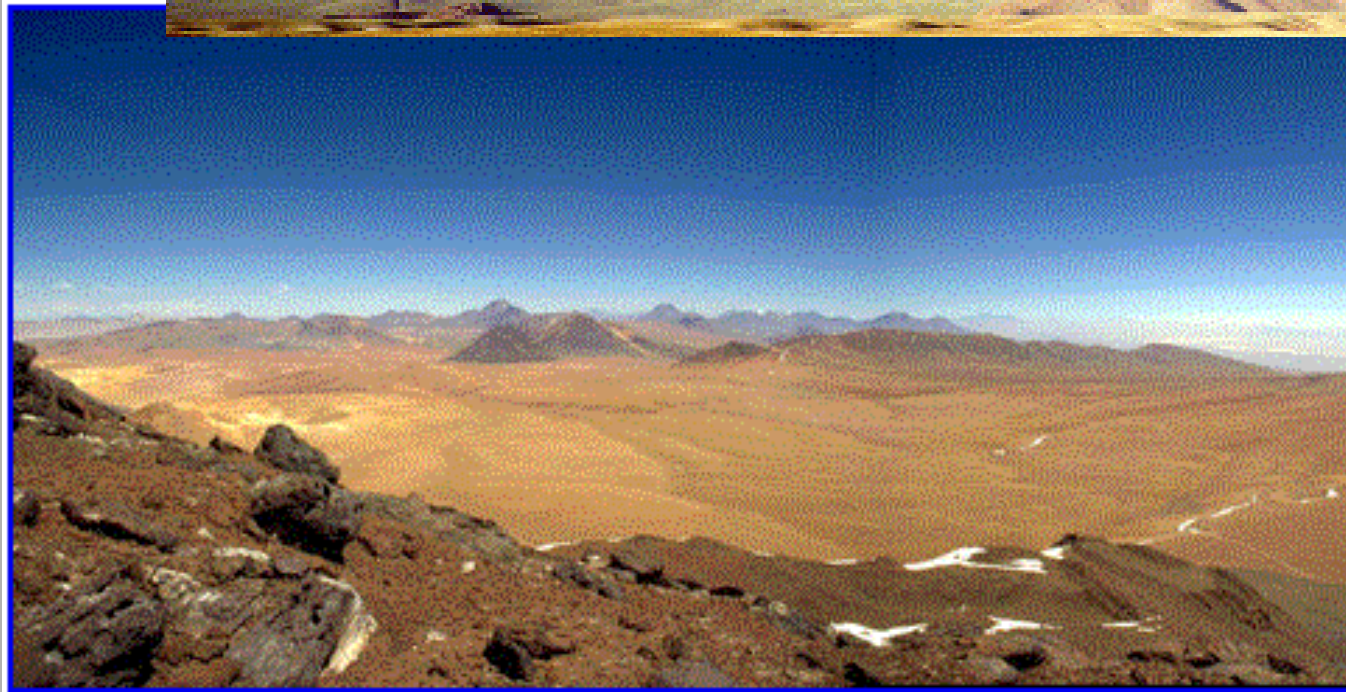
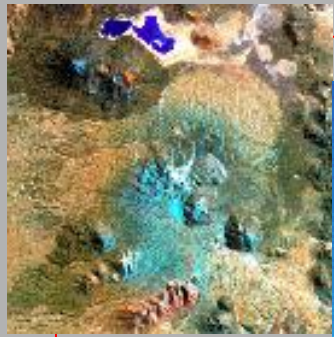
Peru

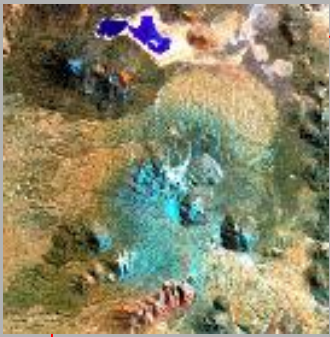
Bolivia

Chile

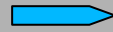


Santiago

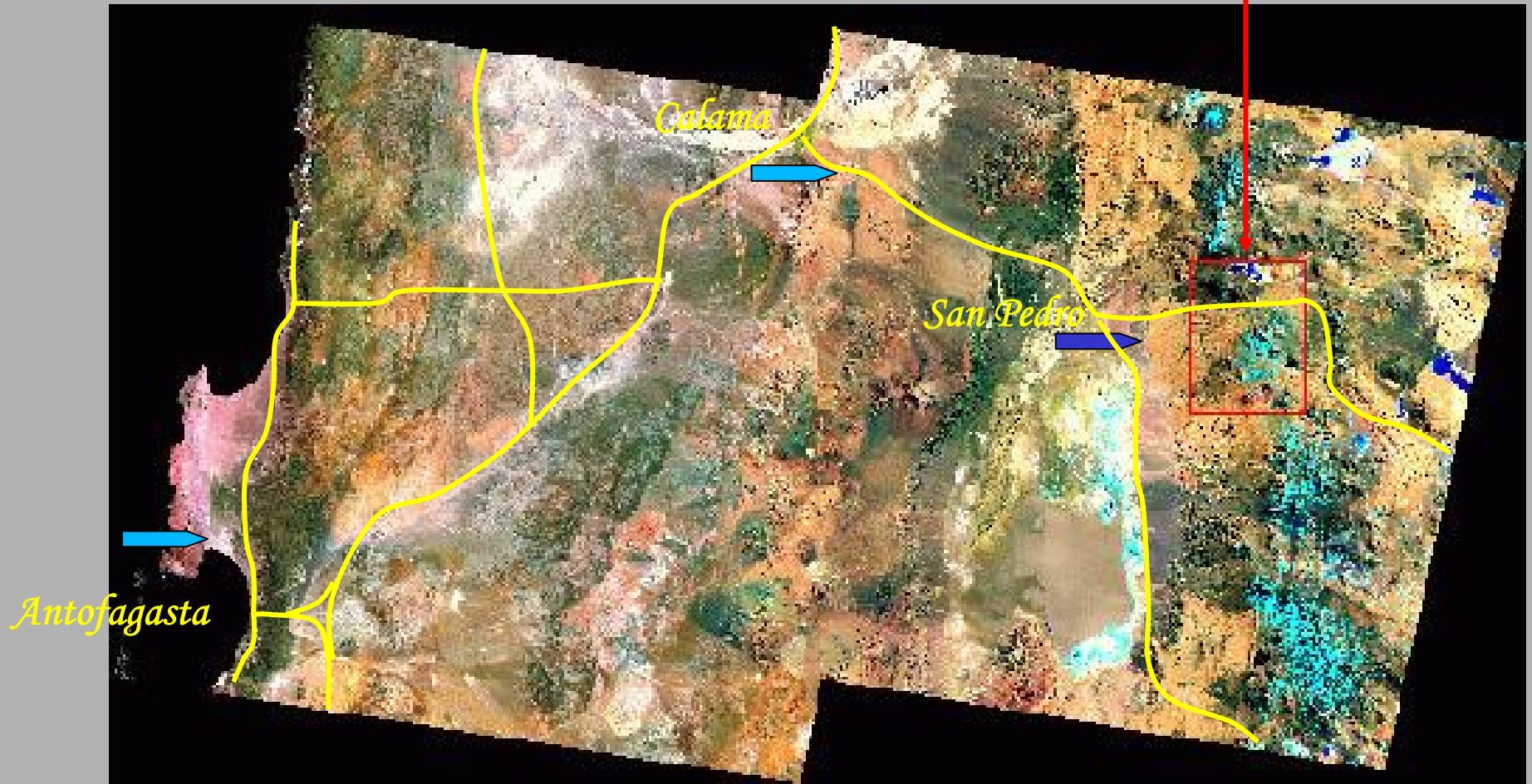
Argentina



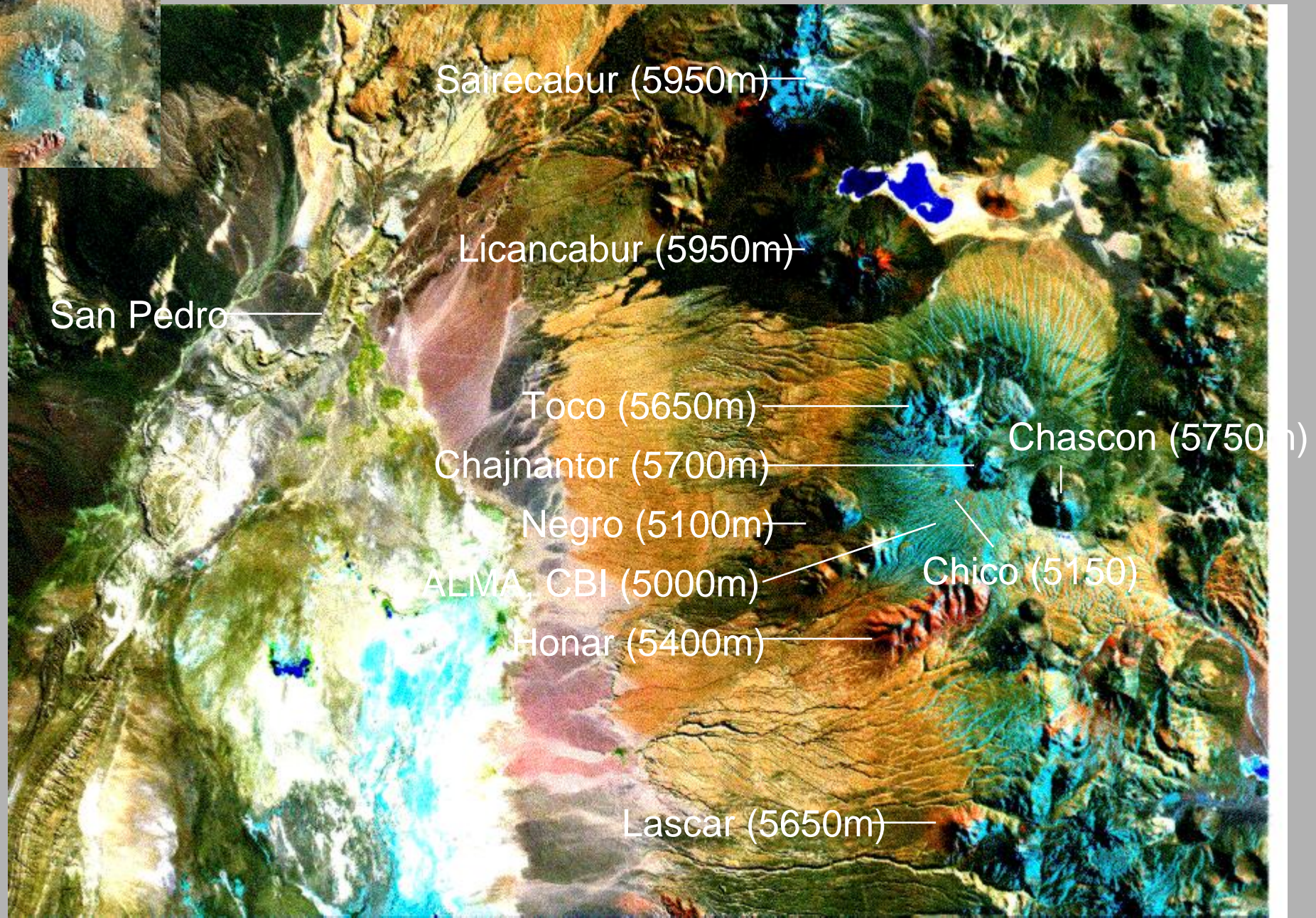
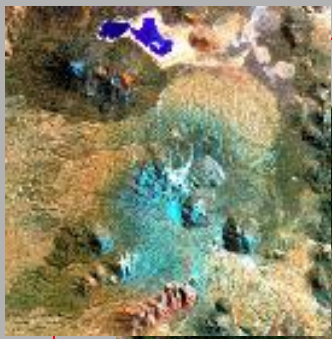


← *National Science Preserve*

-  Airport
-  Landing strip
-  Paved highway



← 300 km →



Sairecabur (5950m)

Licancabur (5950m)

San Pedro

Toco (5650m)

Chascon (5750m)

Chajnantor (5700m)

Negro (5100m)

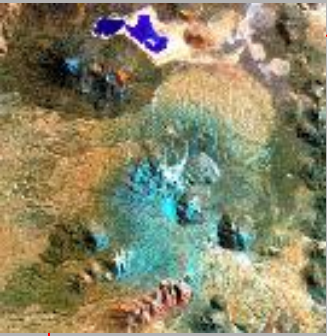
Chico (5150)

ALMA, CBI (5000m)

Honar (5400m)

Lascar (5650m)

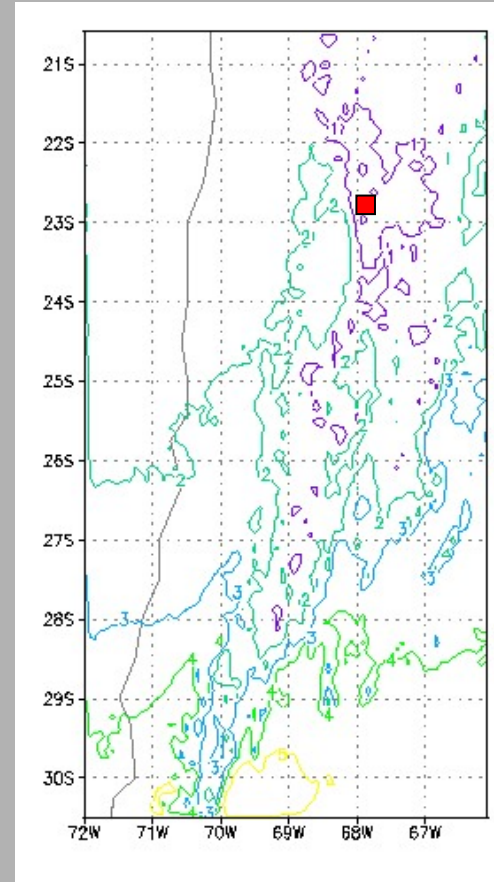
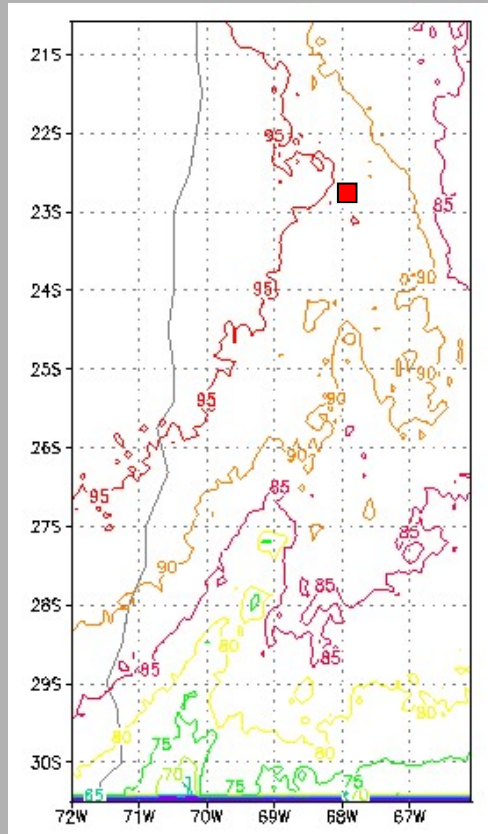
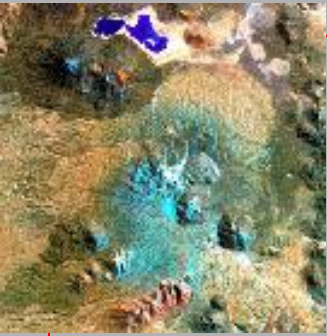
Thanks to Jennifer Yu, Bryan Isacks & Jeremy Darling



- Cloud Cover
- Precipitable Water Vapor
- Weather (Temp, Wind)
- Dust Content
- Geology, Volcanism
- Access
- Distance from services
- AZ blockage

Site Survey Concerns:

From Satellite (GOES) IR data...



**Percentile of clear nights
Above 7500 m** **PWV above 7500 m**

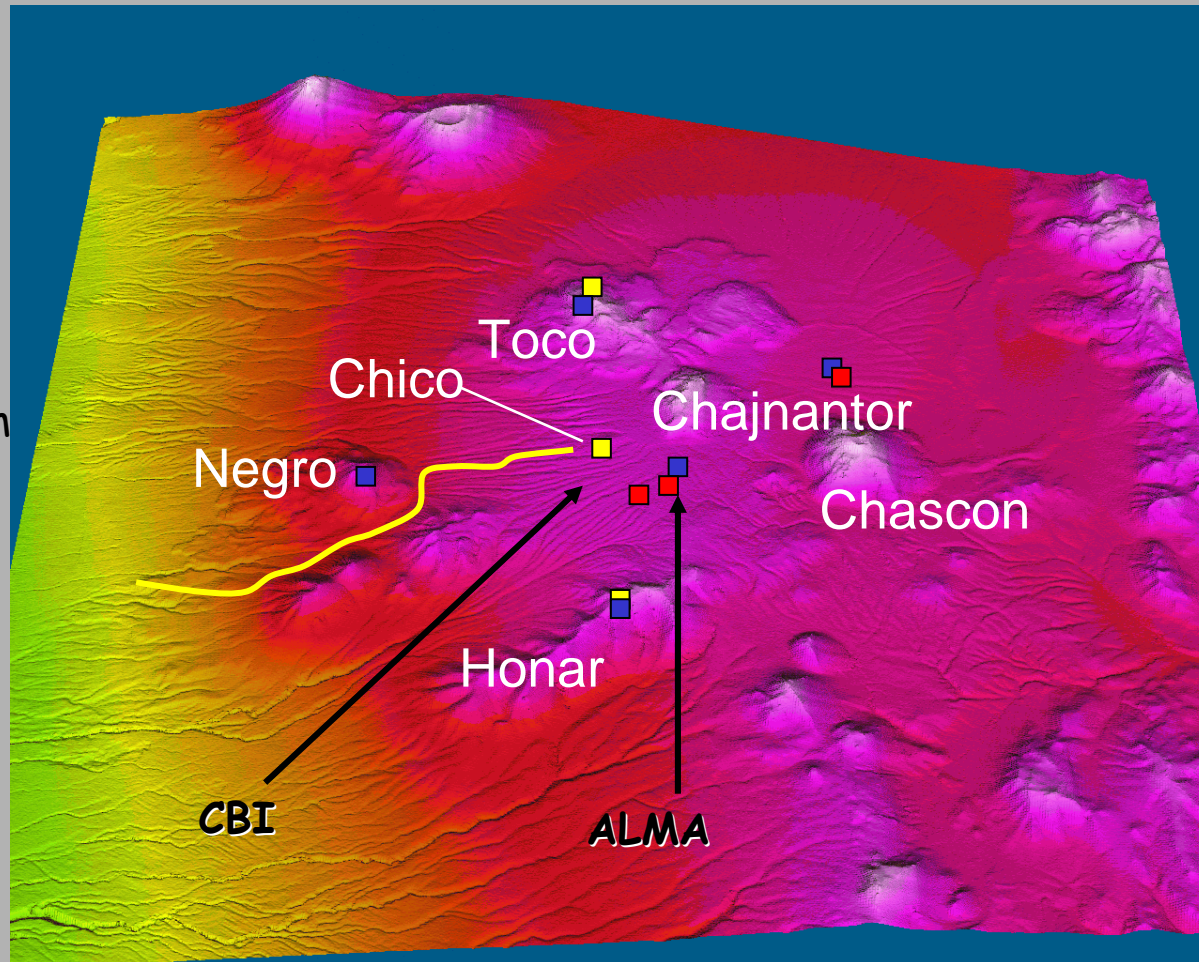
(A. Erasmus 2001)

Deployed test equipment

- Two portable seeing monitors (DIMMs)
(at C. Chico, C.Toco, C. Honar)

Elevations:

Honar 5400m
Negro 5150m
Chascon 5750m
Chajnantor 5700m
Toco 5650m
Chico 5150m
Plateau 5000M



- Weather Stations:

Cerro Toco
Cerro Honar
Cerro Negro
Plateau
Pampa La Bola

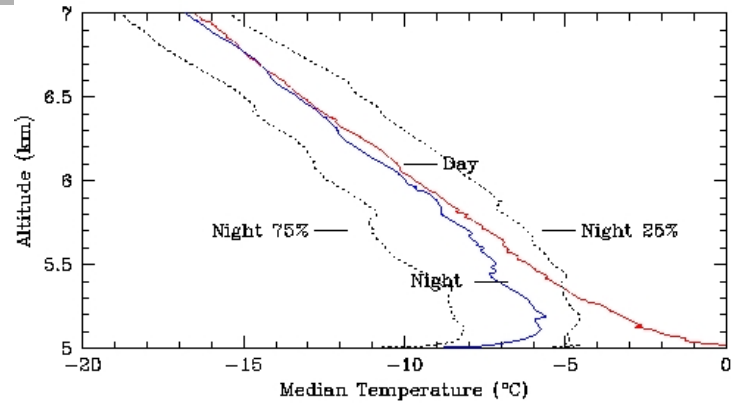
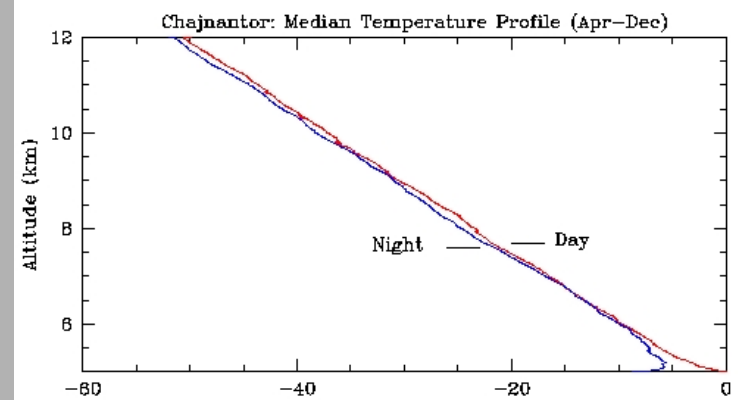
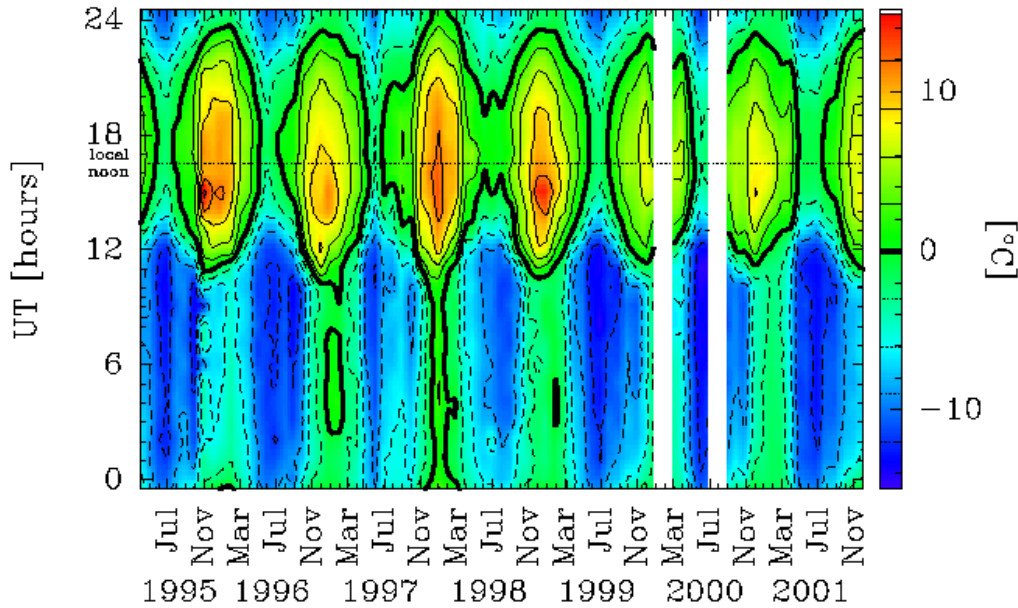
- Radiosonde launch facility
- Tipping radiometers (mm opacity), interferometers (phase stability), FTS at Plateau



...It's not too cold

At Plateau level (5000 m):

Chajnantor: Median Temperature



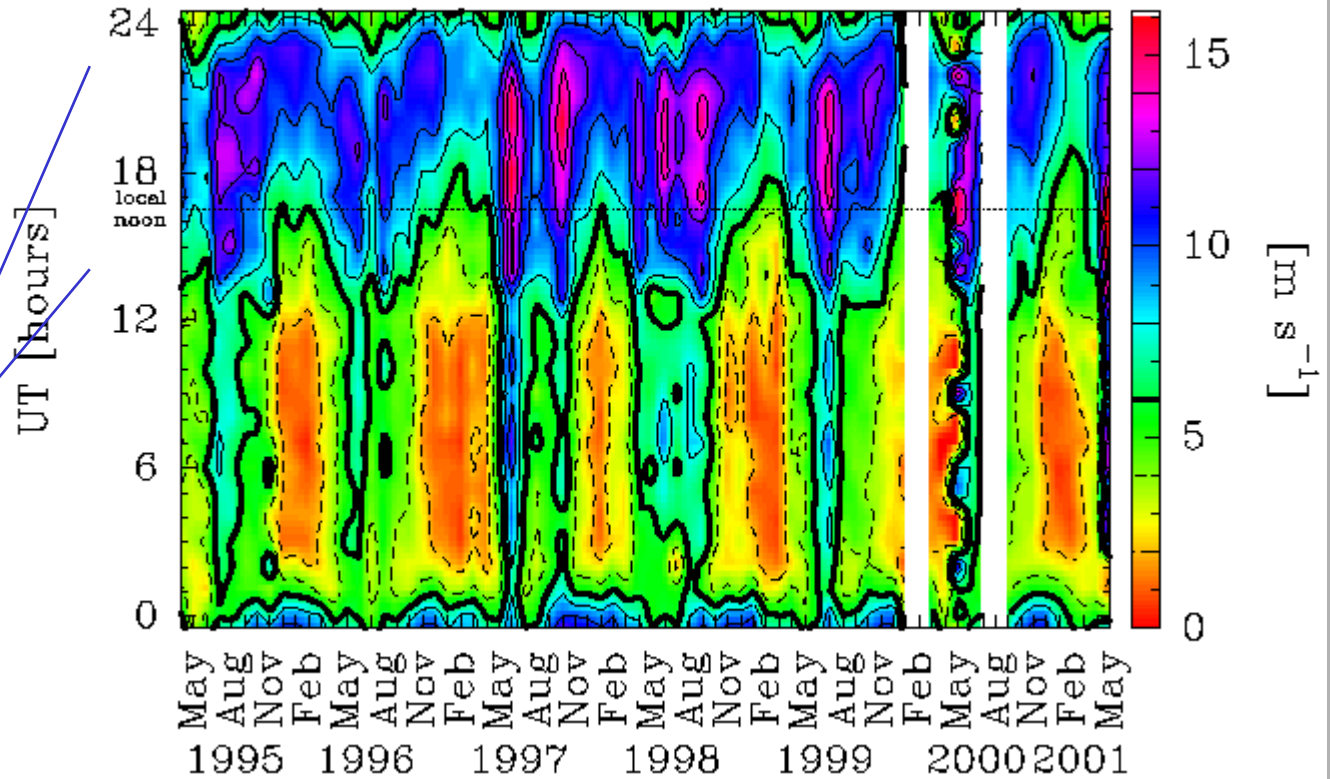
At 5400 m (Honar summit):

Summer (0-6h):	(-6, -4, -3)
Summer(12-18h):	(-1, +1, +3)
Winter (0-6h):	(-12, -10, -8)
Winter(12-18h):	(-10, -6, -4)

(25%, 50%, 75%)

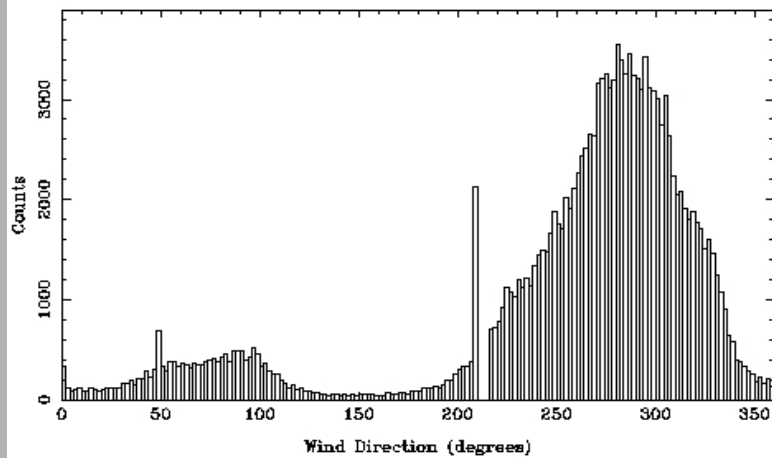


Chajnantor: Median Wind Speed



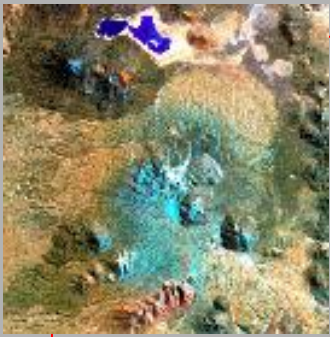
It's windy:
Especially between
11 am and 6 pm...
and in Winter

Chajnantor: 1995 April to 1999 November

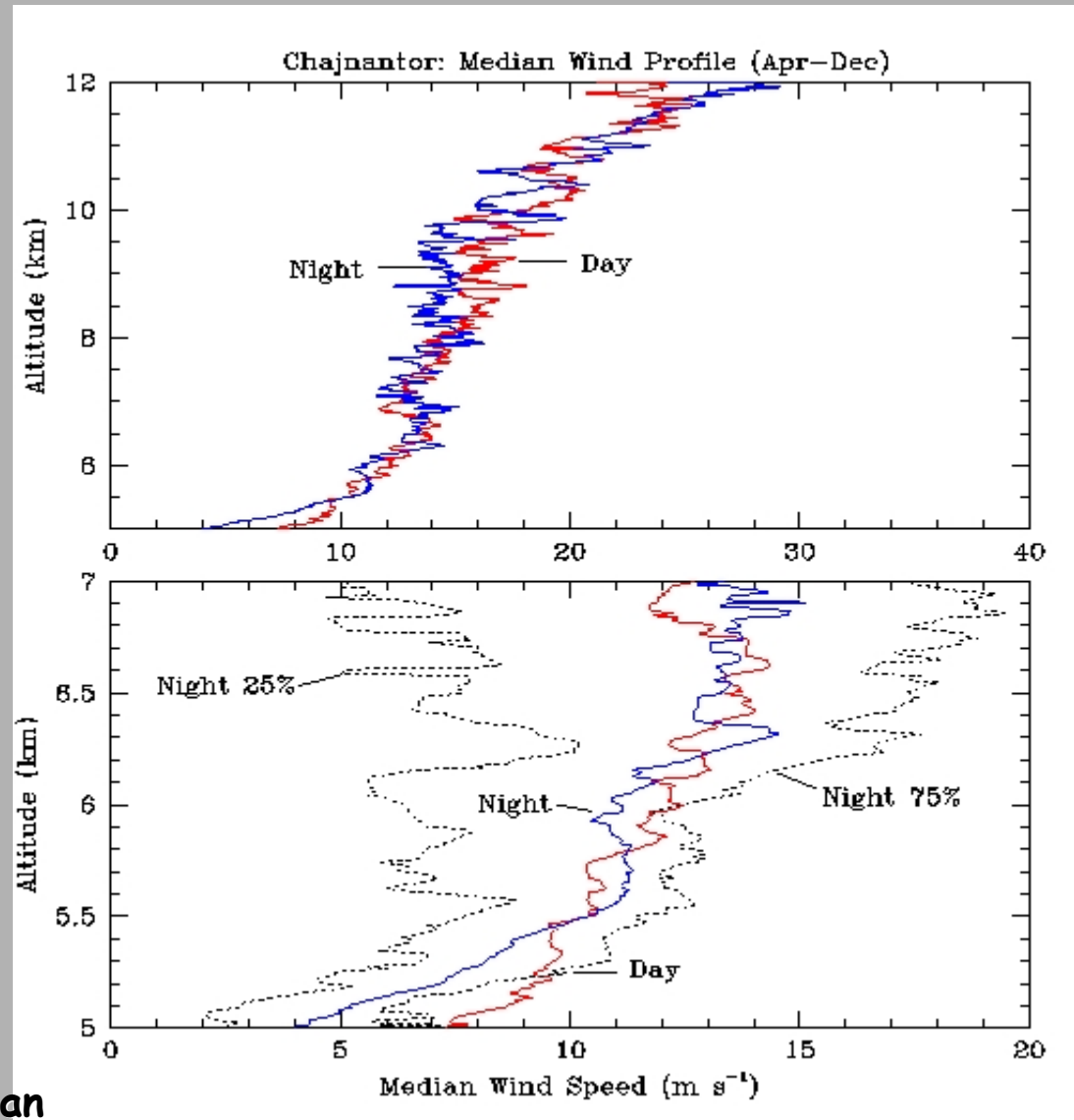


At Plateau level (5000 m)

... and it generally blows
from the West



From
Radiosonde Data:



We should expect the median wind speed to increase about 1.0 m/s per 100 m elevation above the Plateau

According to radiosonde data, we should expect the following year-averaged wind speeds:

25% 50% 75%

	25%	50%	75%	
At 5000m	3	5	7	m/s
At 5400m	7	9	11	m/s
At 5600m	8	11	13	m/s

Over 14 months, the weather station on Cerro Honar (5400m) yields: (6, 9, 11) m/s, in agreement w/sondes.

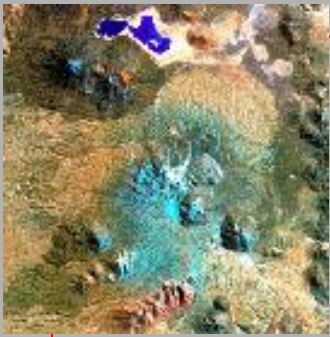
Separating by season, for Honar we have
(5, 7, 9) m/s for Summer semester
(7, 10, 13) m/s for Winter semester

For Toco (5650m), the weather data between 1Nov01 and 17Mar02 (Summer) yield:
(5, 9, 14) m/s

Again, in agreement with expectation from sondes.



By increasing the elevation, a toll is paid in terms of increasing wind speed

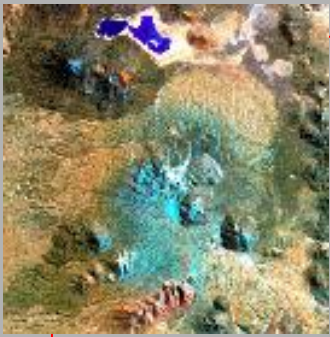


Jointly with NRAO, ESO and SAO, we have carried out a **radiosonde** launch campaign.

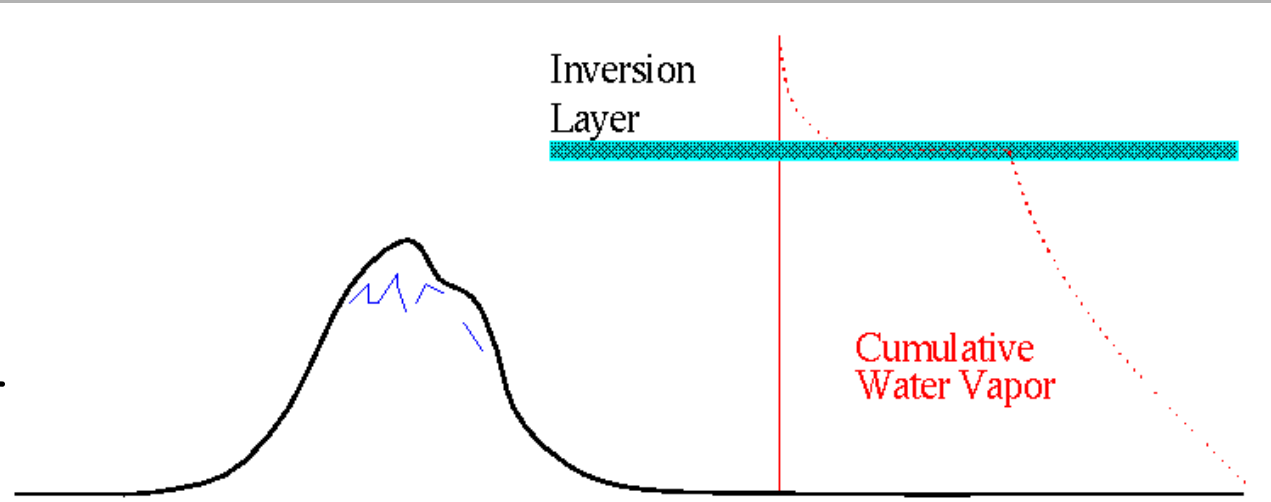
About 150 sondes have been launched, spanning all seasons, all times of day and weather conditions.

Sondes produce vertical profiles of the atmospheric parameters (T, p, RH, wind speed and direction) with a height resolution of about 5 m.

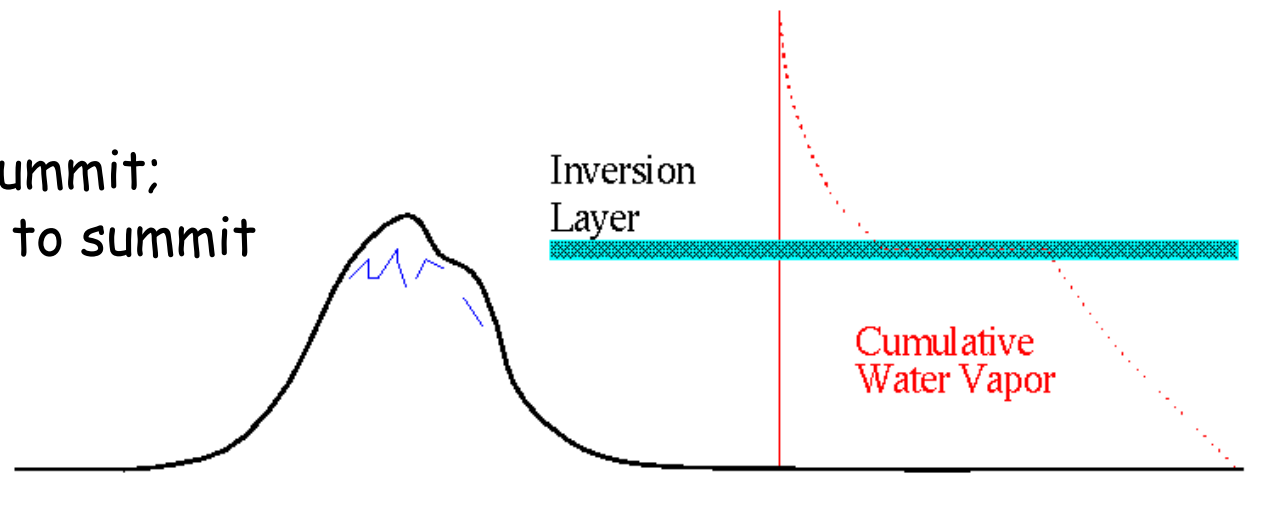
Of particular interest are the occurrence of temperature inversion layers, related to the vertical distribution of Water Vapor, and the temporal variations of that parameter.



A little gain in PWV by going to summit



B most PWV below summit; great gain by going to summit



T-inversion layers form above extended plateaus. Much of the PWV gets trapped under them. Is it worth focusing on surrounding summits? YES! if case B occurs a fair fraction of the time.

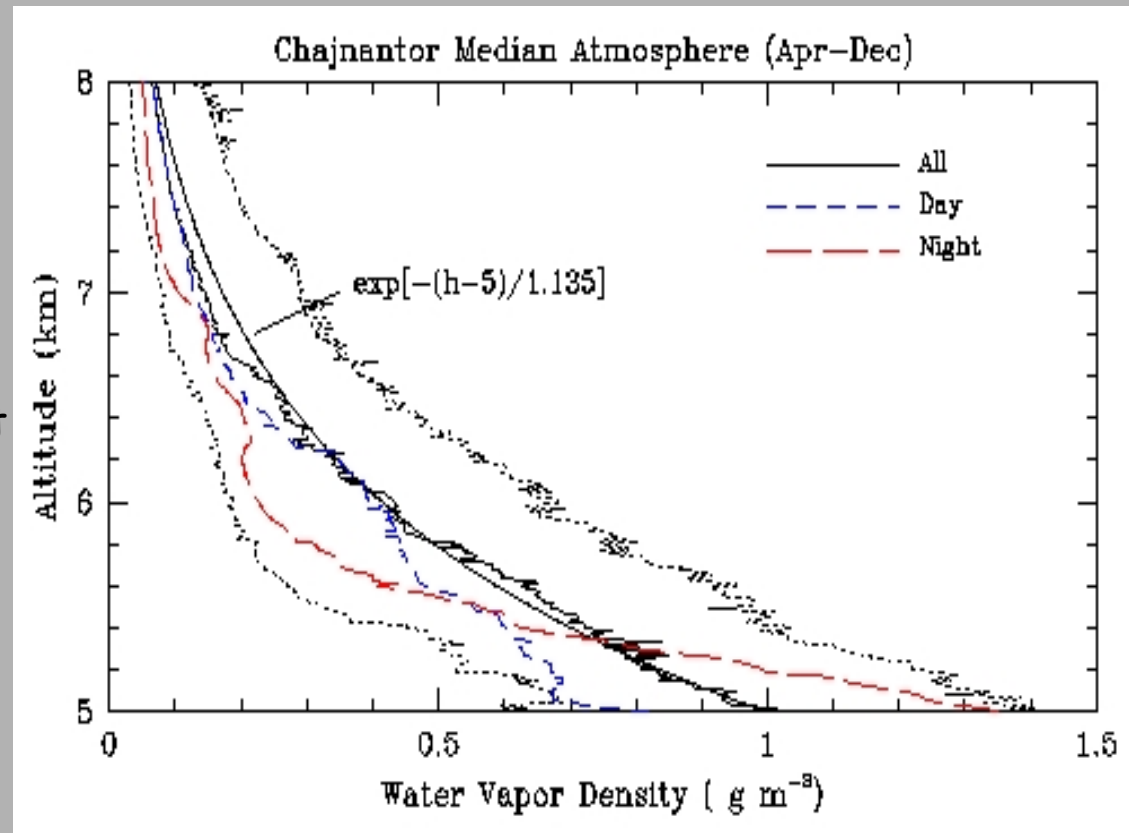


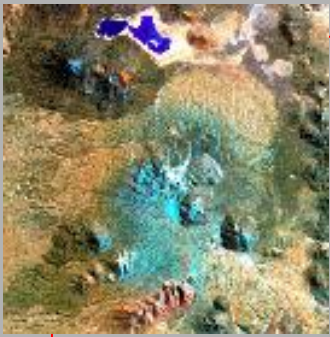
Median WV Distribution over Chajnantor

From radiosondes:

The median WV scale height
Is $h=1.135$ km

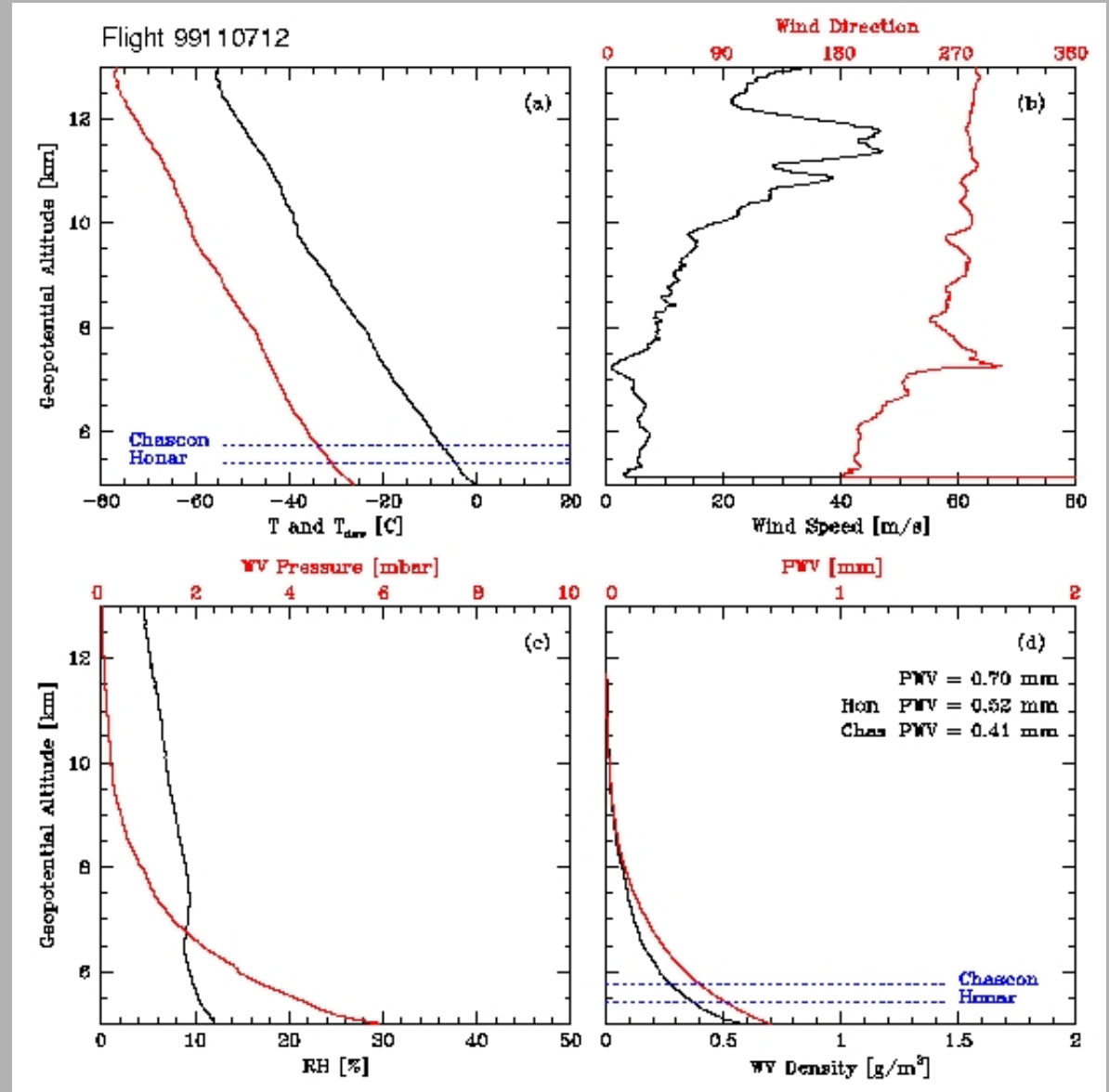
However, it becomes
shallower at night...

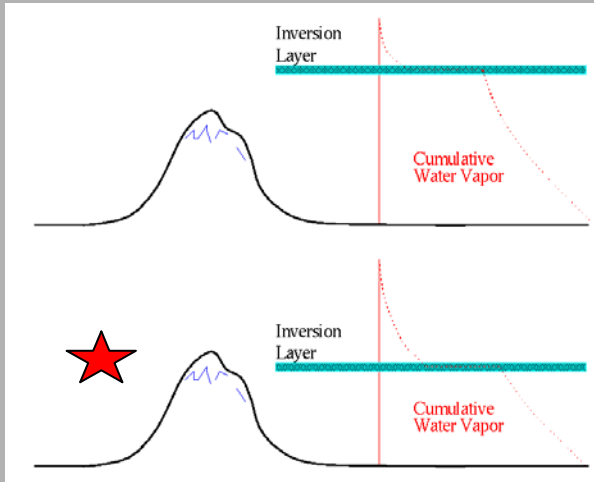
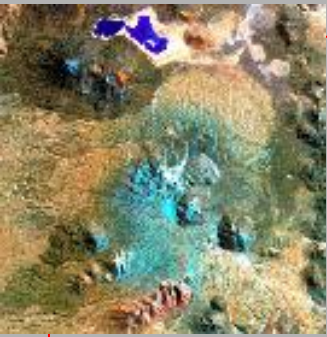




A morning launch:

Dry (PWV=0.70 mm),
no inversion layer

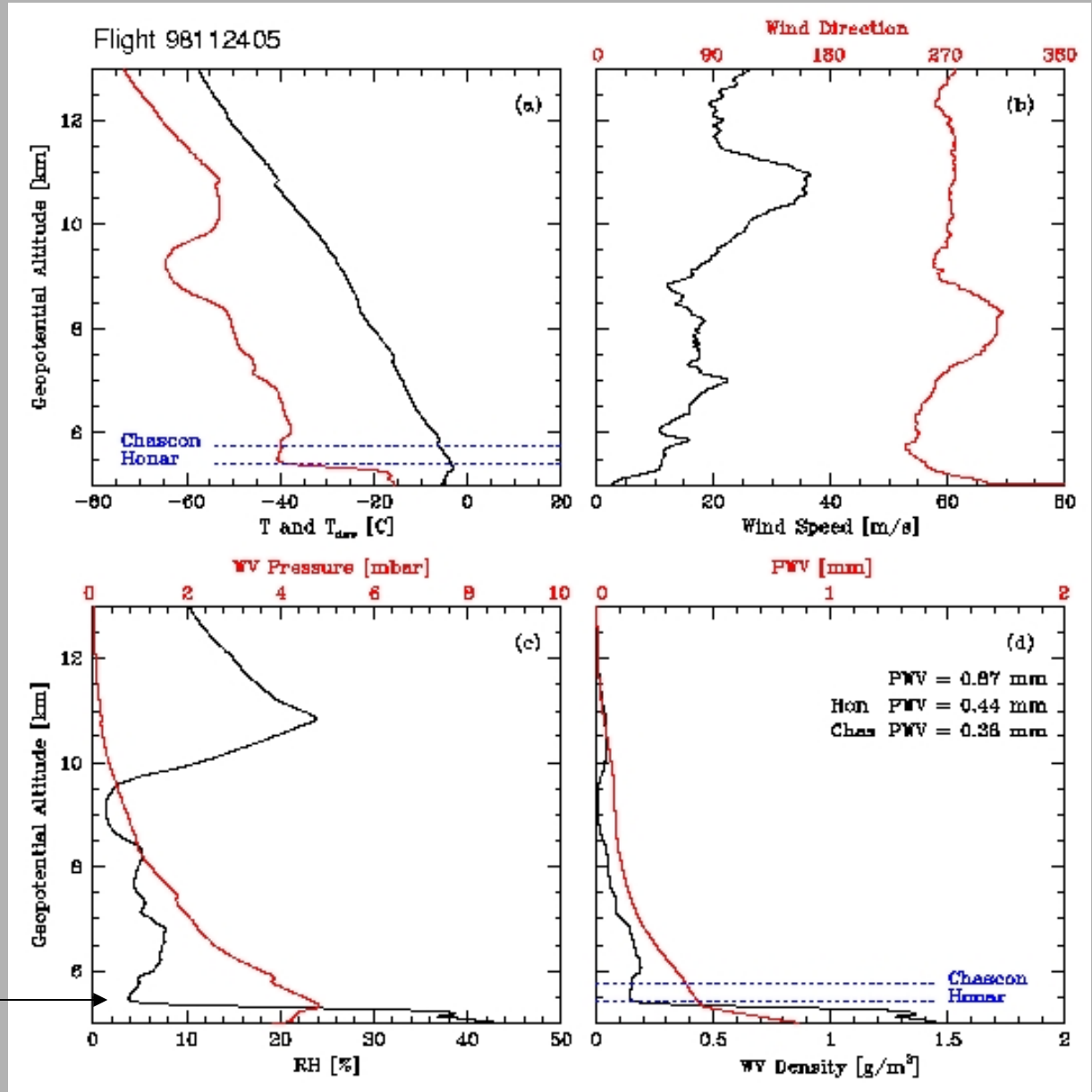




A night launch:

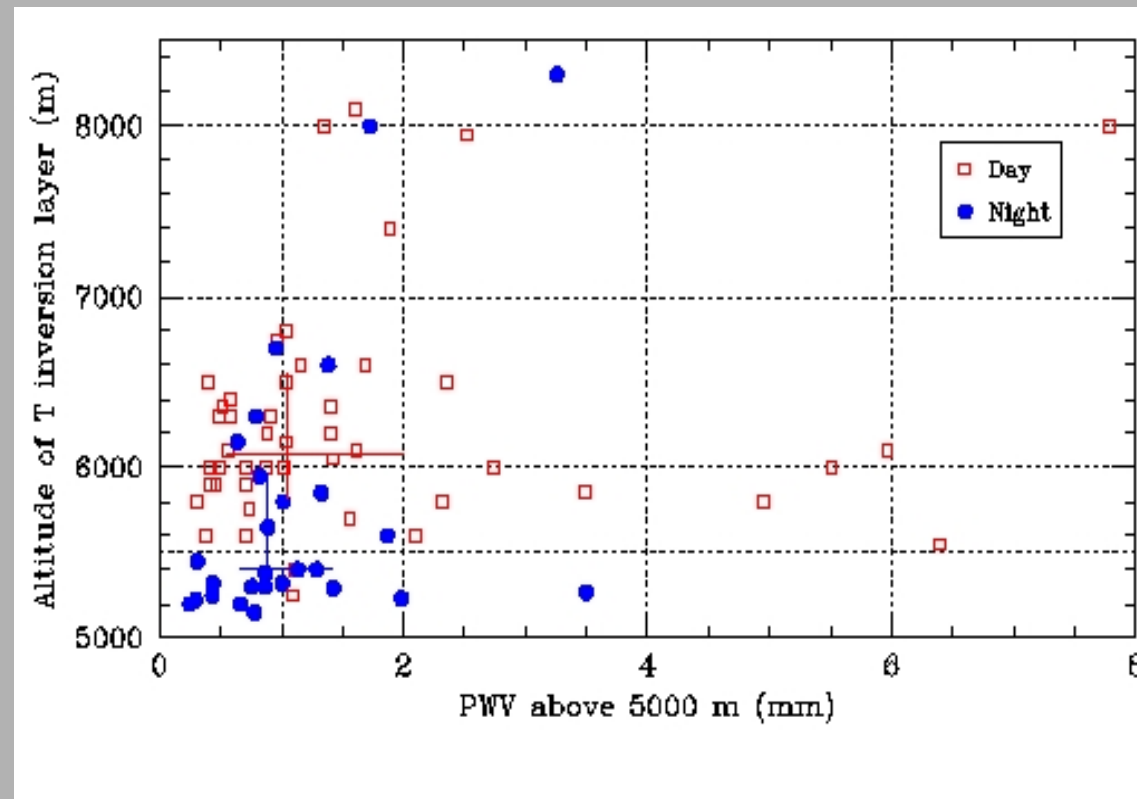
Dry (PWV=0.87 mm),
inversion layer at 5.3 km

PWV at summit less than
half that at plateau level.



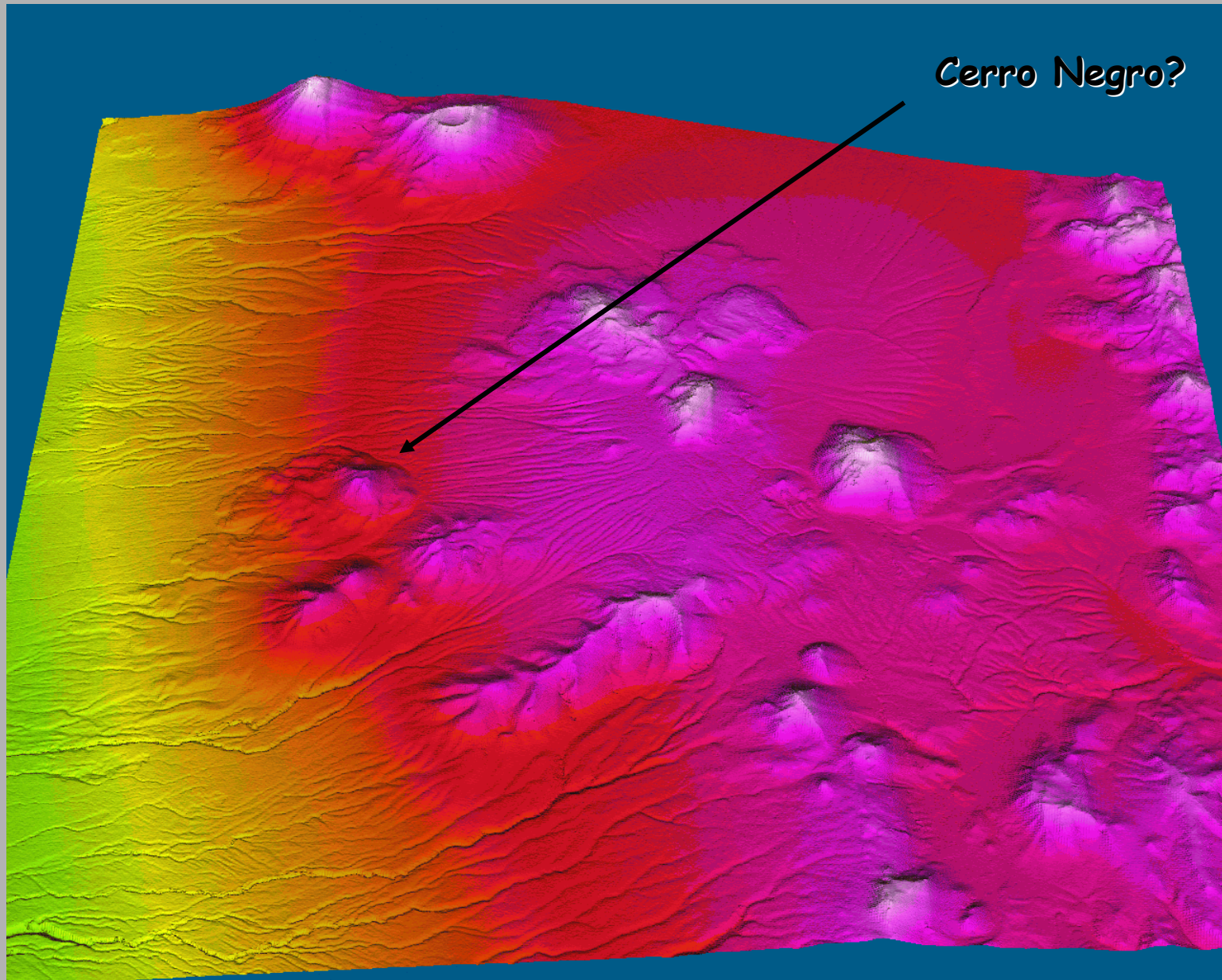


Altitude of T-inversion layer falls at night



Site at elevation of ~500 m above Plateau will have significantly lower PWV and IR transparency.

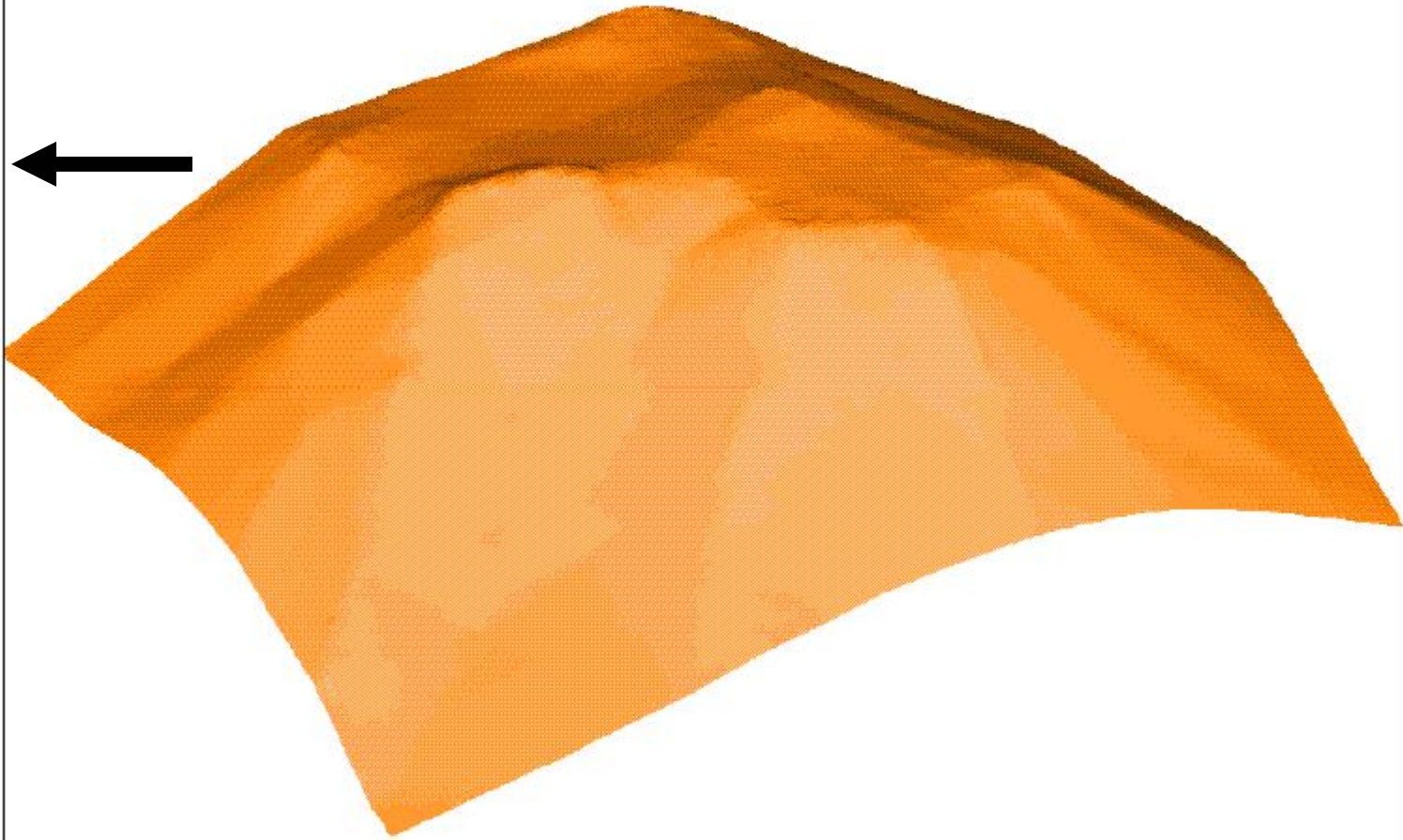
Site





Negro peak (10m)

WEST

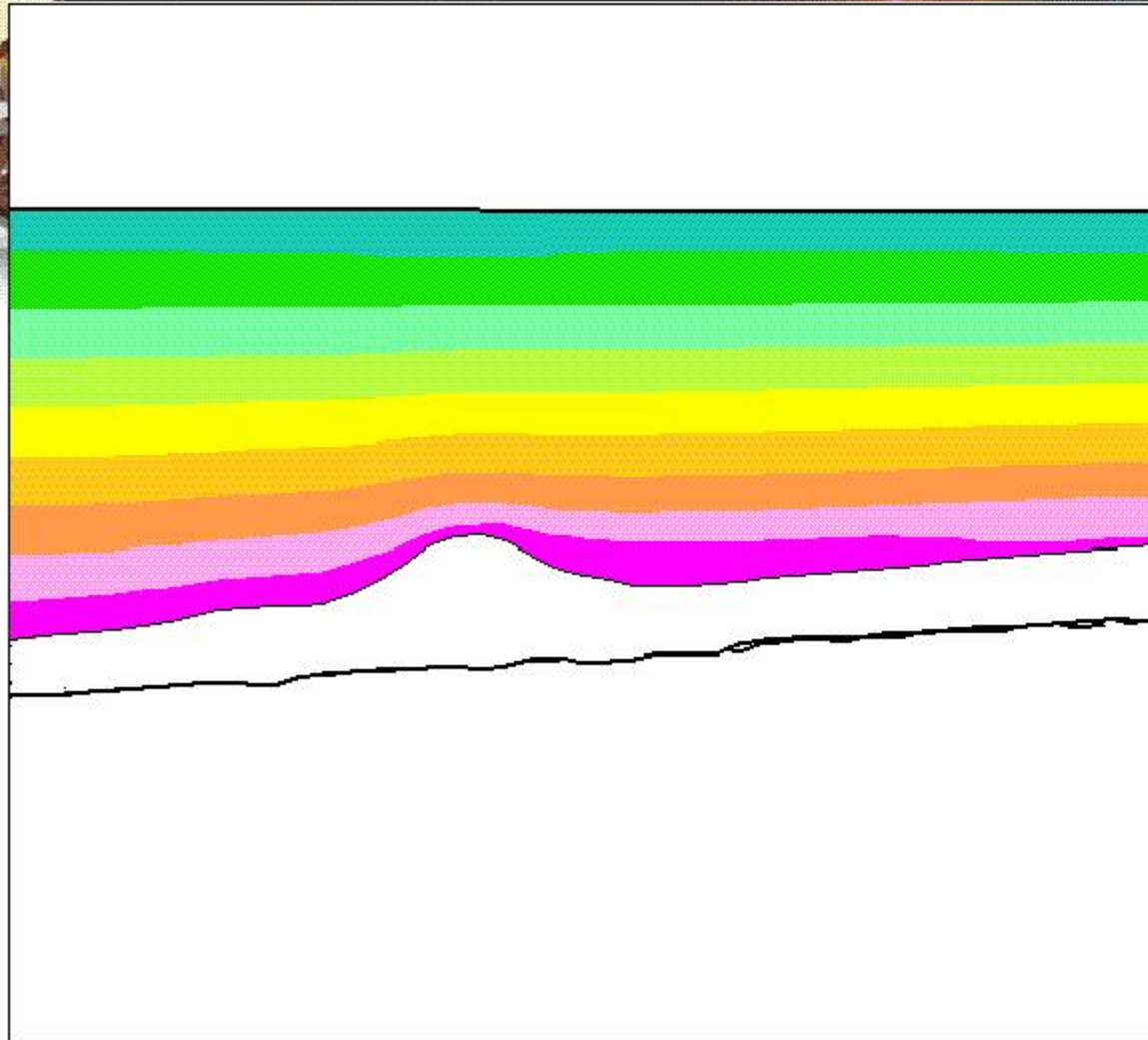








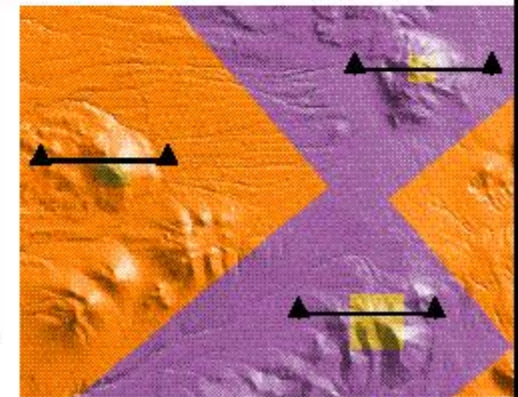
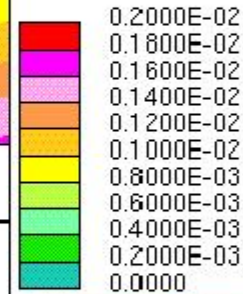
SP W 240m, water vapor, Negro



PRO*AM 3.10

4-FEB-03
SC 1-STEAM_H2O

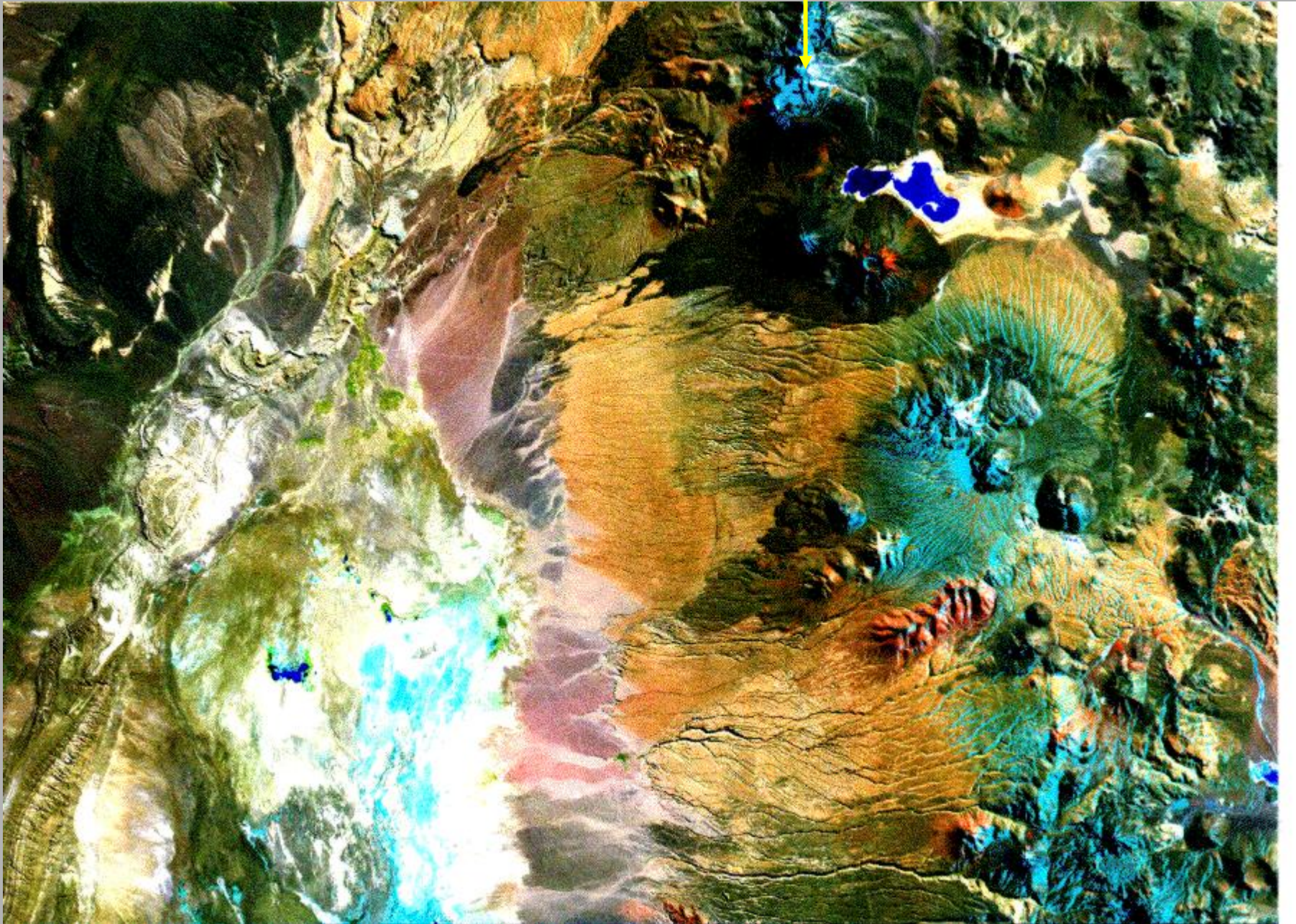
ITER = 229
LOCAL MX= 0.1975E-02
LOCAL MN= 0.1234E-03



Credit: K. Vogiatzis

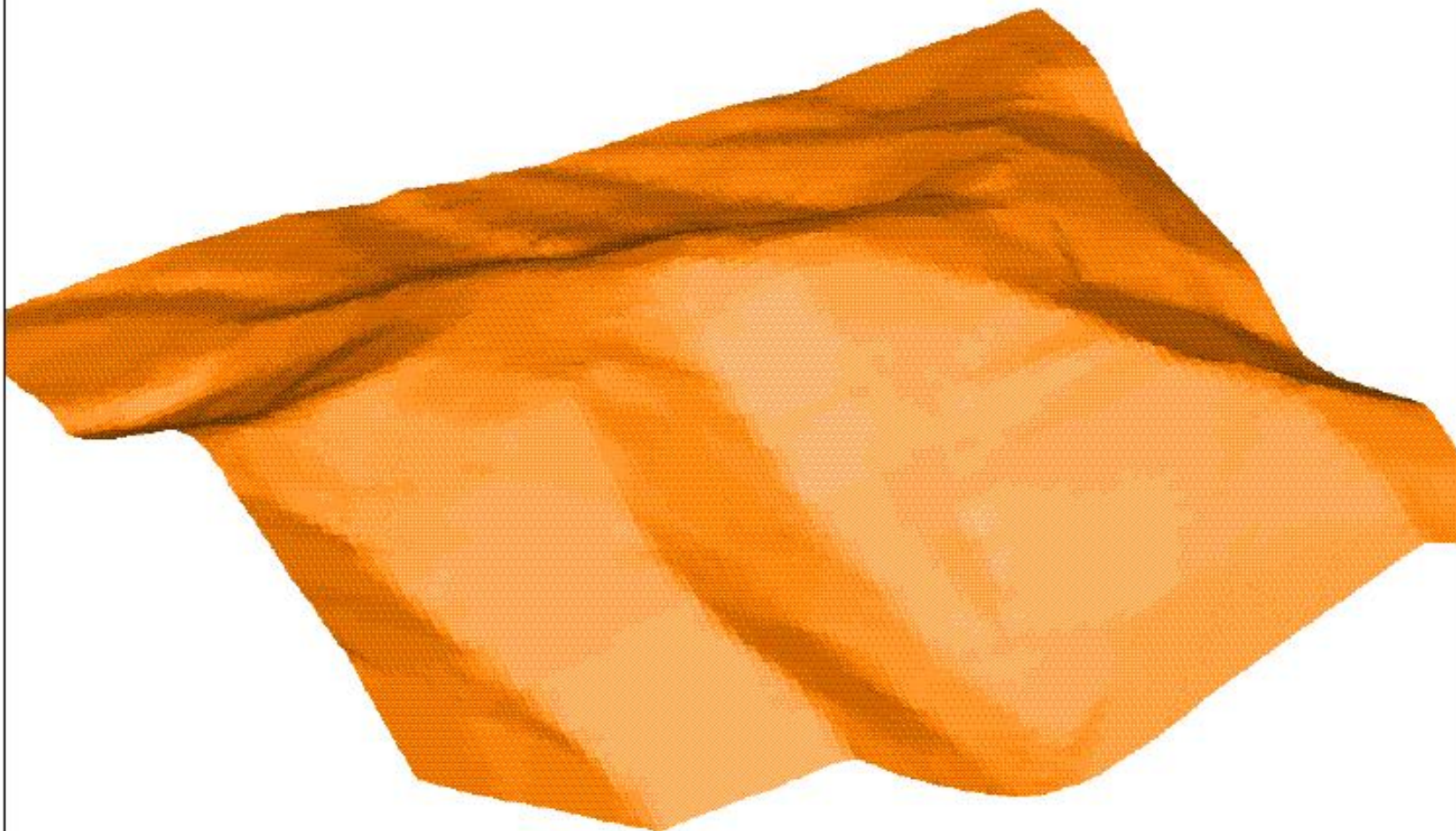


Sairecabur (5950), Sairecabur Plateau (5550)

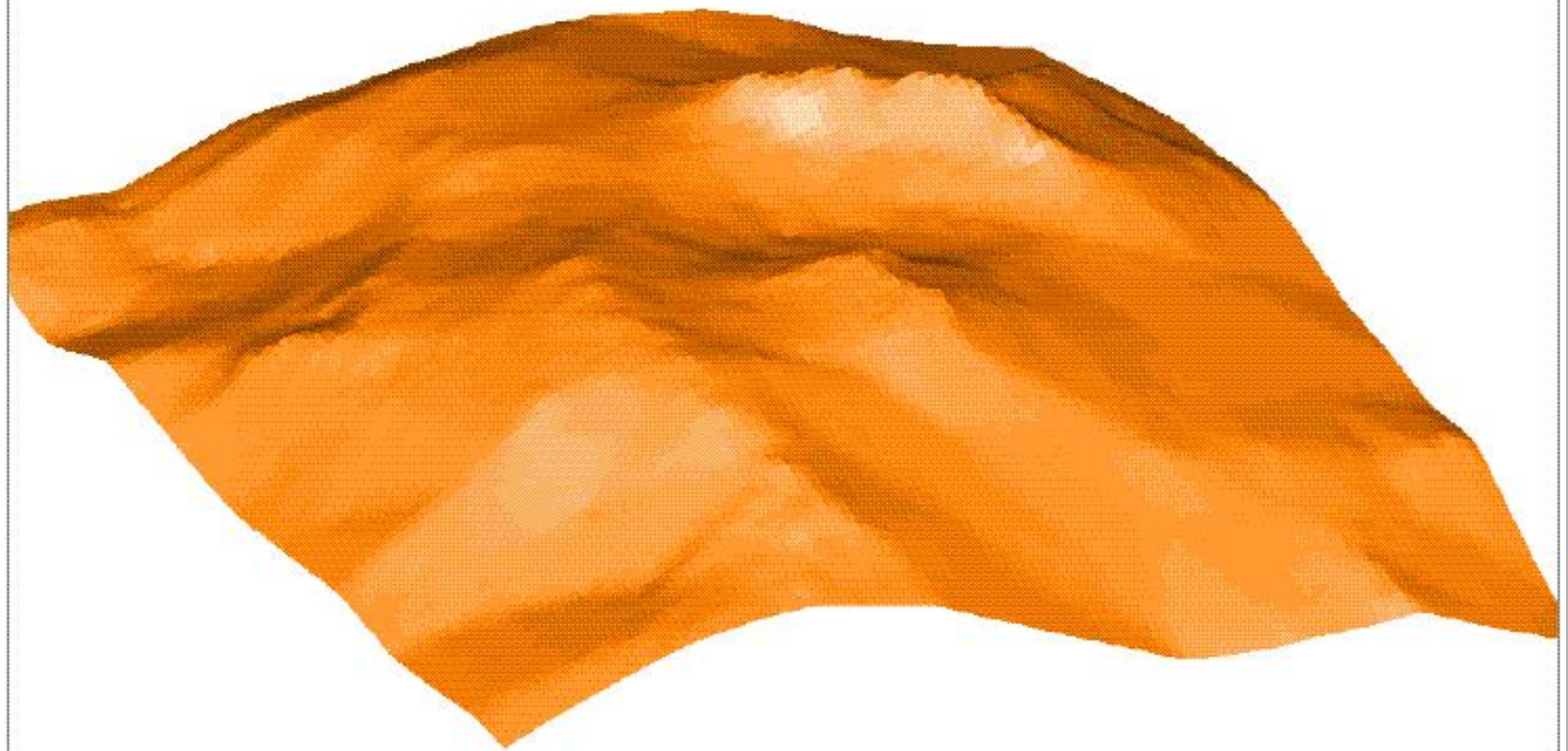


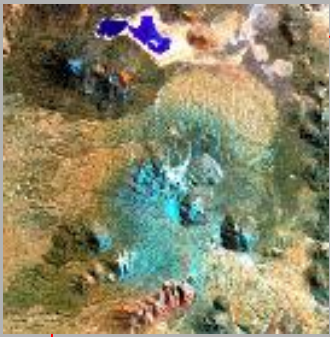


Honar peak (20m)

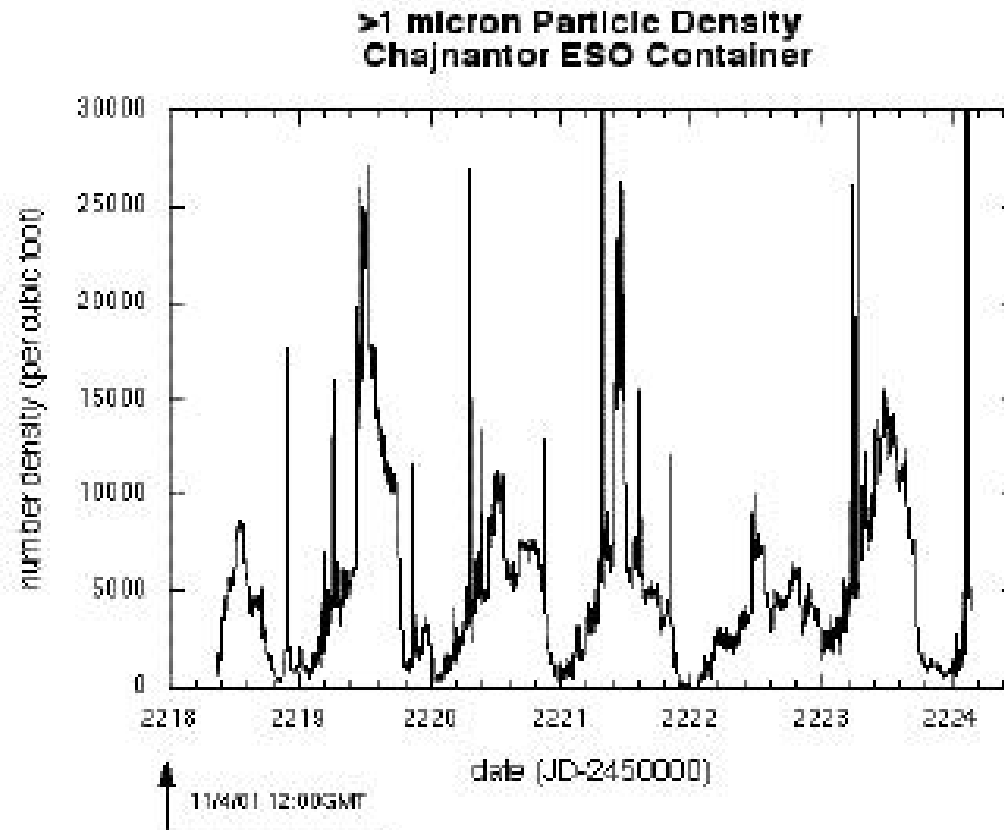


Chajnantor peak (10m)





Dust content in the atmosphere

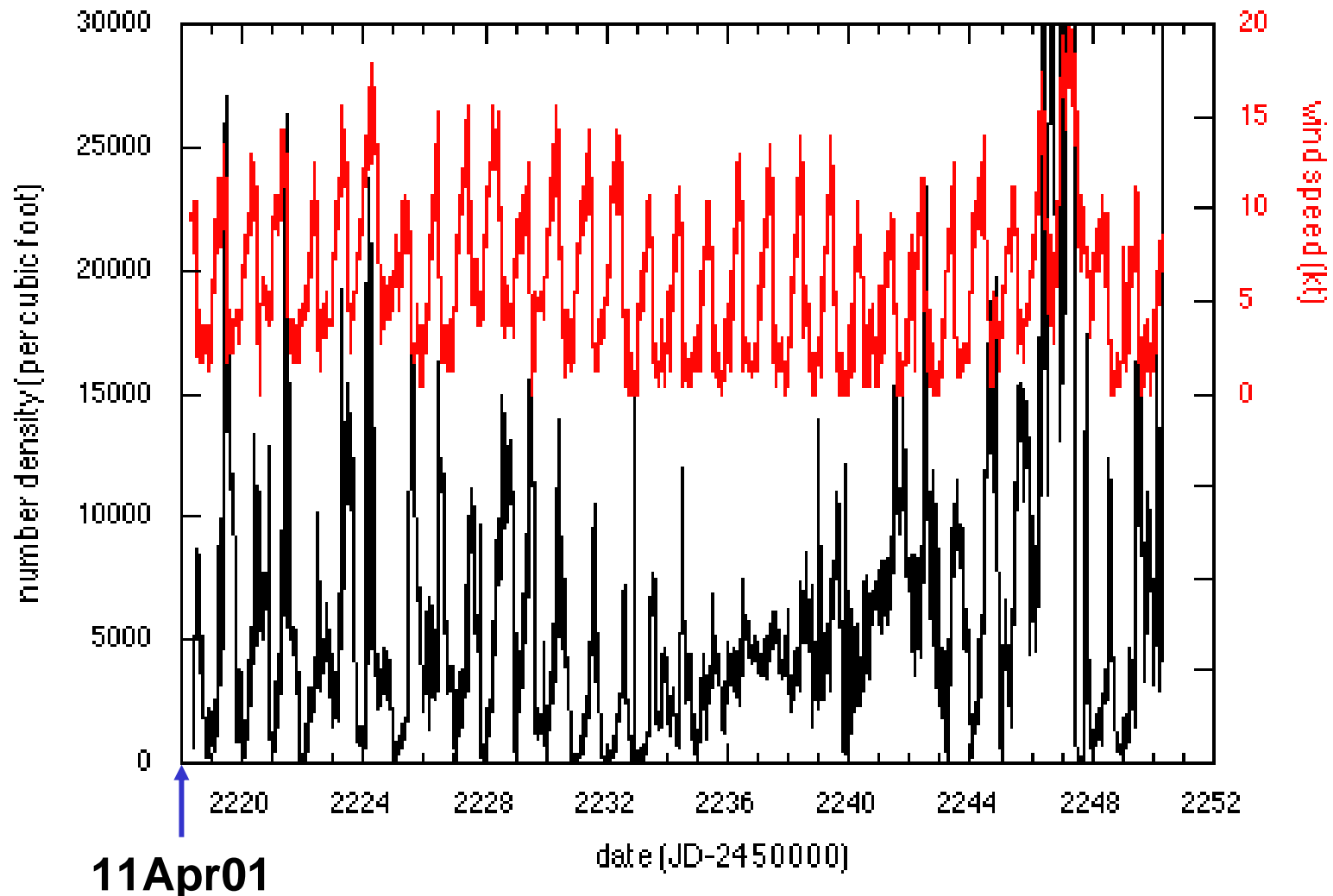


>1 μ m channel data is shown versus JD. Particulate concentration shows strong diurnal variation over a range of x20. At maximum, it approaches that seen routinely at Mt. Locke. At minimum, it is equivalent to a class 1000 clean room! FYI, adopted Apache Point closure limit (7% time lost) is at 16000 on this plot.

(That's McDonald Observatory...)

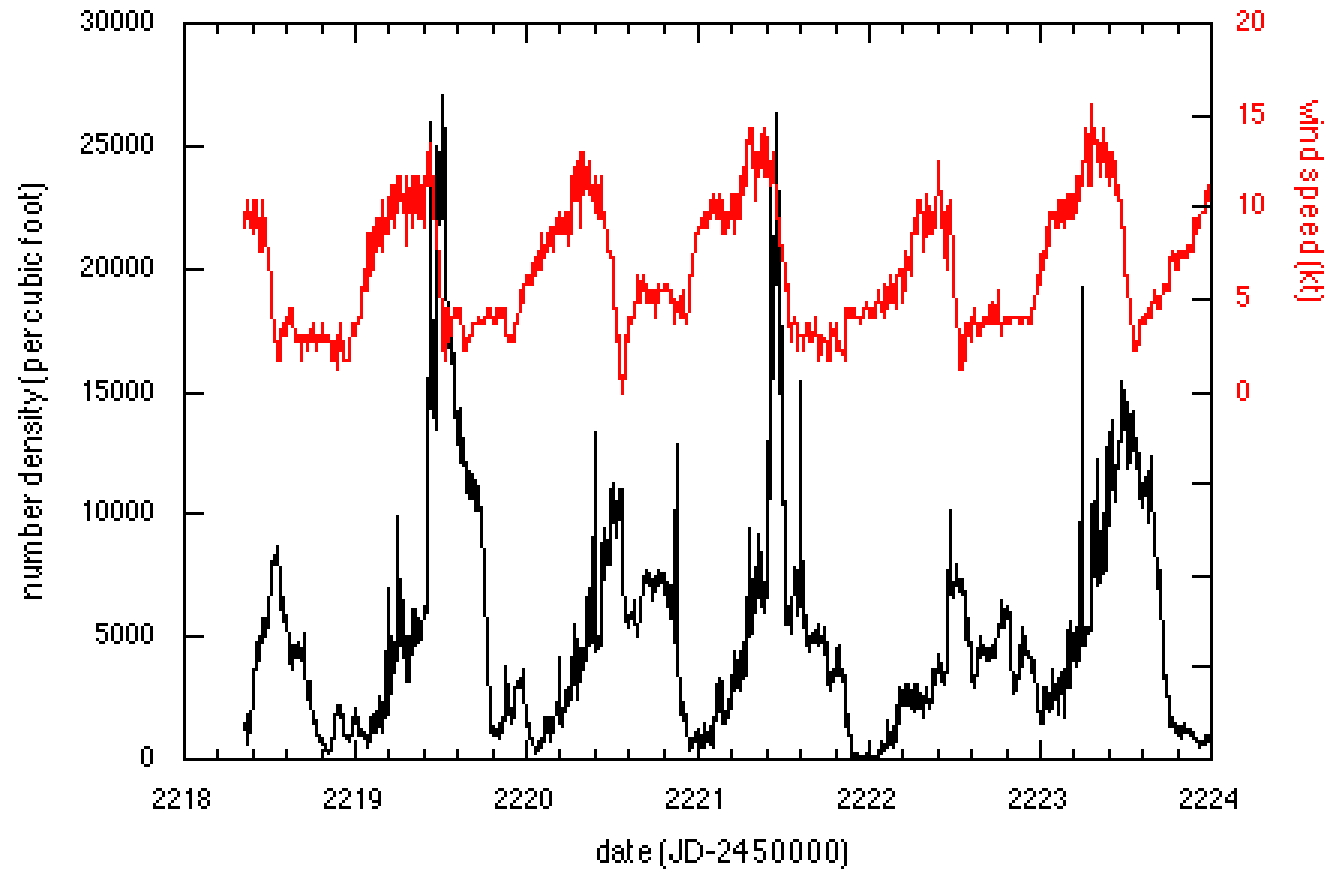
(source: Dan Lester, U.Texas)

>1 micron Particle Density Chajnantor ESO Container versus ESO wind speed



Measurements made with MetOne (see www.metone.com) dust monitor, sensitive to 0.1-0.5 μ m particle size. The device, analogous to that operating at McDonald Observatory, was installed at the ESO container at the Chajnantor Plateau (5000m) by Dan Lester.

>1 micron Particle Density Chajnantor ESO Container versus ESO wind speed



The dust density is regulated by the wind's diurnal cycle, which it lags by a few hours