Conditions and Development of Ali Site, Tibet

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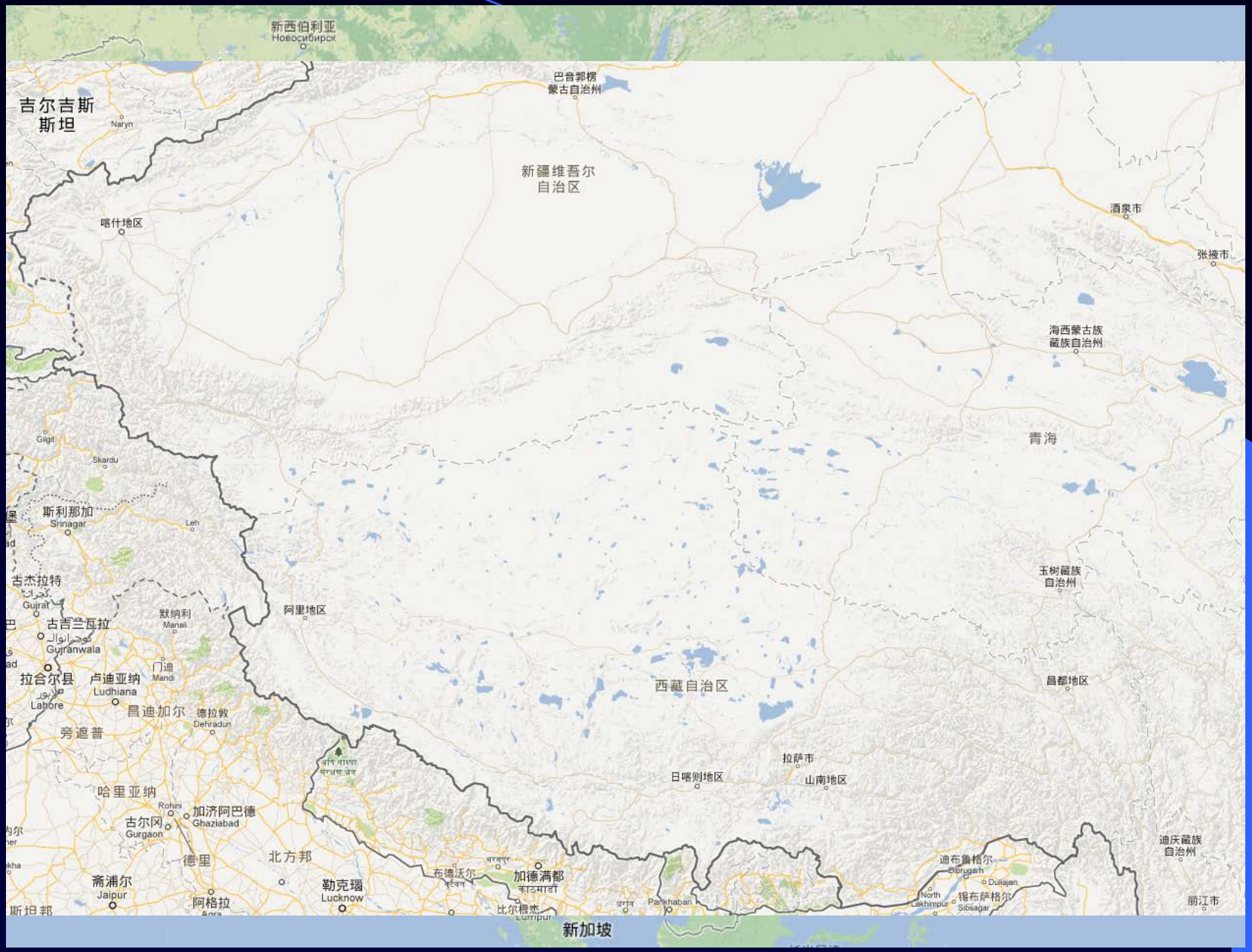
NAOC

9th East Asian Meeting on Astronomy, 2013-10-17 @ Taiwan

Where is Ali


新西伯利亚
Новосибирск
吉尔吉斯斯坦
Naryn
巴音郭楞蒙古自治州
新疆维吾尔自治区
喀什地区
酒泉市
张掖市
海西蒙古族藏族自治州
Gilgit
Skardu
青海
斯利那加
Srinagar
Leh
古杰拉特
Gujrat
默纳利
Manali
阿里地区
玉树藏族自治州
古吉兰瓦拉
Gujranwala
拉合尔县
Lahore
卢迪亚纳
Ludhiana
门迪
Mandi
西藏自治区
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昌迪加尔
德拉敦
Dehradun
旁遮普
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Dibrugarh
Dulajan
斋浦尔
Jaipur
勒克瑙
Lucknow
加德满都
Pankhaban
North Lakhimpur
锡布萨格尔
Sibsagar
丽江市
阿格拉
新加坡

Why we select Ali area

—— a result of 10 year site survey over China

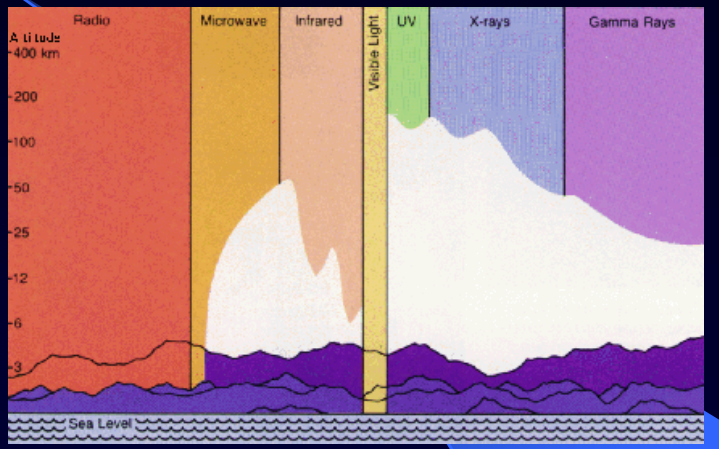
Remote study	Large field survey -> area selection	2003-2004
Local survey	Local conditions -> candidate sites	2003-2004
Site monitoring-1	Identification, site characterization	2005-2006
	Remote, exploring, evaluating, instrument	2007-2008
Site monitoring-2	upgrading, second phase monitoring	2009-2010
Observing base	Detailed site characterization; Observation & operation	2010-2011

Potential advantages in Ali area

High altitude,

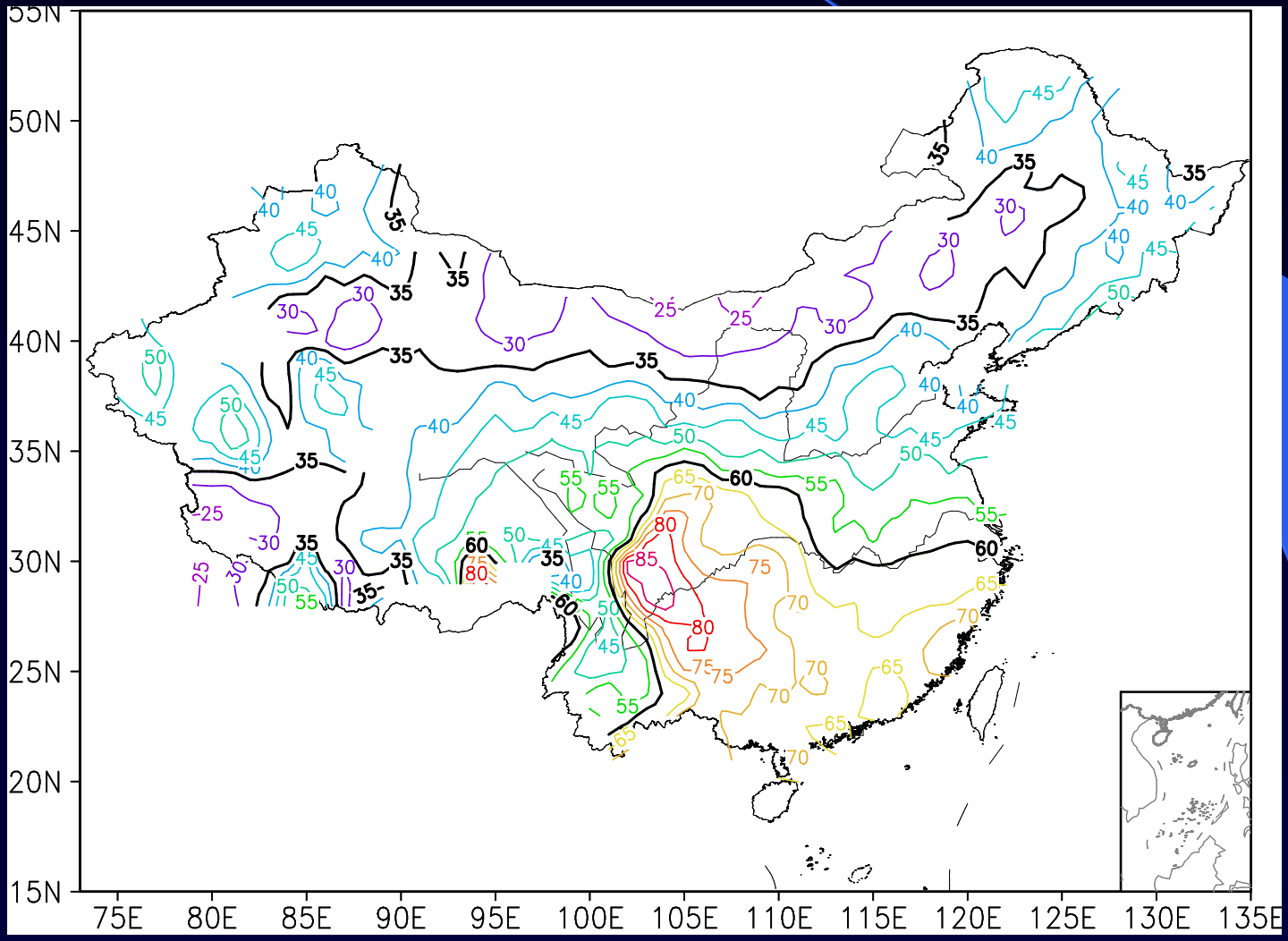
- Turbulence weakened with altitude
- Scattering, absorption, & emission decreasing with altitude

Air clean, dilute, cold, dry, dark



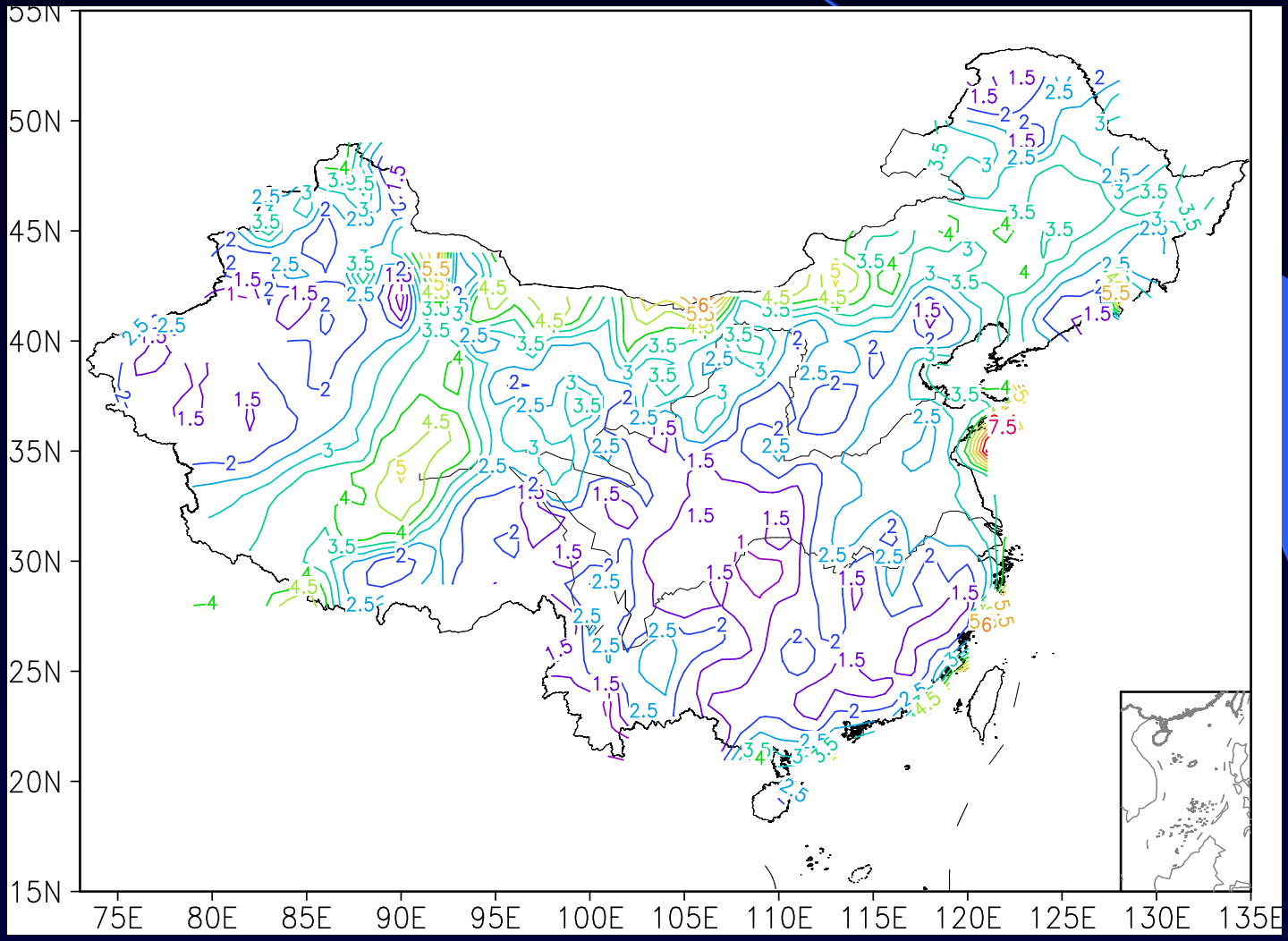
Potential advantages in Ali area

1961~2008 average 02:00 cloudiness



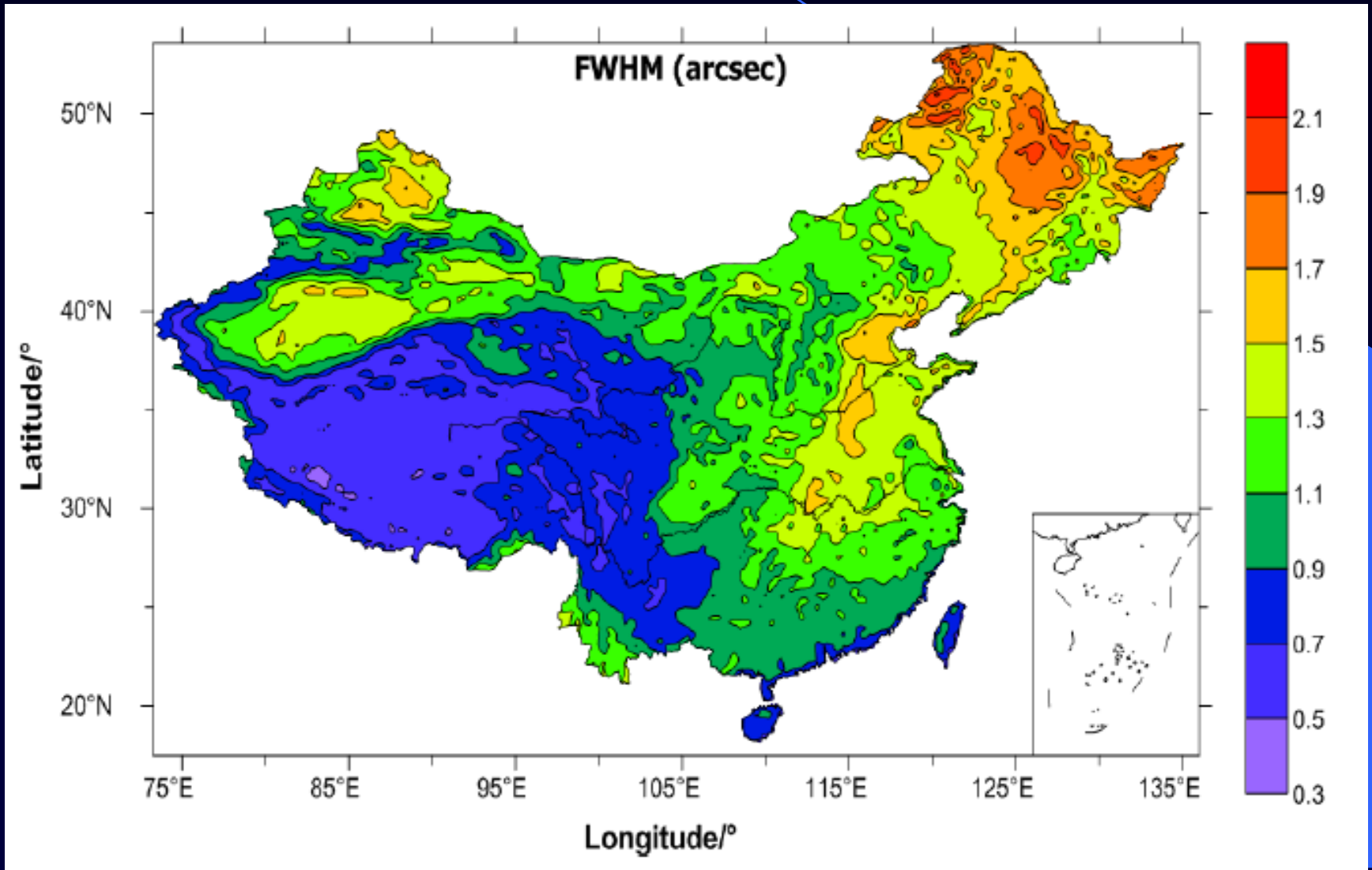
Potential advantages in Ali area

1961~2008 average ground wind speed

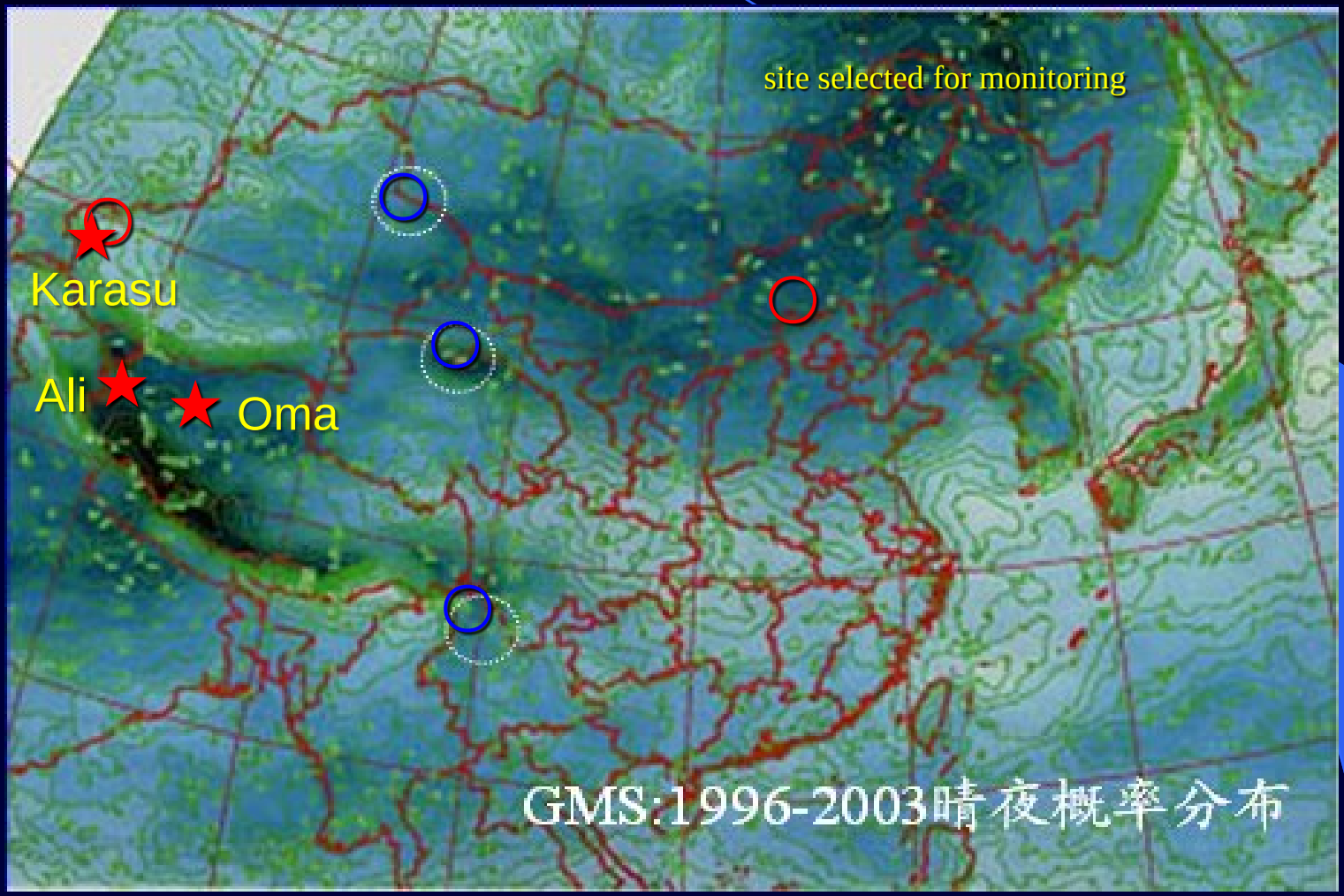


Potential advantages in Ali area

2010 average seeing over China



The site survey in western China



广域监测：张北，北塔山，德令哈，喀什，高美古；一年以上监测资料比较验证.

Site monitoring at Karasu, Pamirs

Site monitoring at Oma, Ali

Comparison of meteorological parameters

with Mauna Kea, Paranal, La Silla

	Oma	Kalasu	Paranal	La Silla	Mauna Kea
median speed (m/s)	6.4	5.8	6.6	4.6	4.0
wind direction	W/NW	W	N	N	SE
ave. temperature(℃)	-1.9	-5.1	10	11	3.3
ave. pressure (hPa)	551.4	589.8	750	-	621.3
ave. humidity (%)	36	55	16	39	30

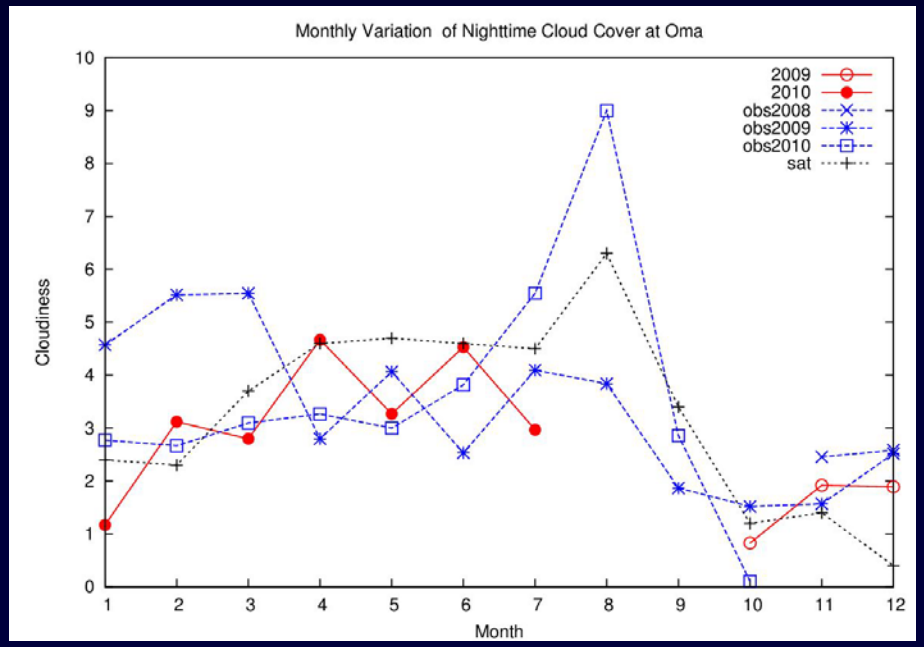
site	ave. speed	max. speed	main direct.	ave. speed night	max. speed night	main direct. night	nights / rate ⩾4hr & ⩾11m/s
Mauna Kea	4.9	25.8	SE	5.0	25.4	SE	41 / 11.2%
Oma	7.6	34.7	W	6.7	25.2	NNW	61 / 13%
Karasu	6.3	23.3	SW	6.3	21.2	SW	43 / 11%

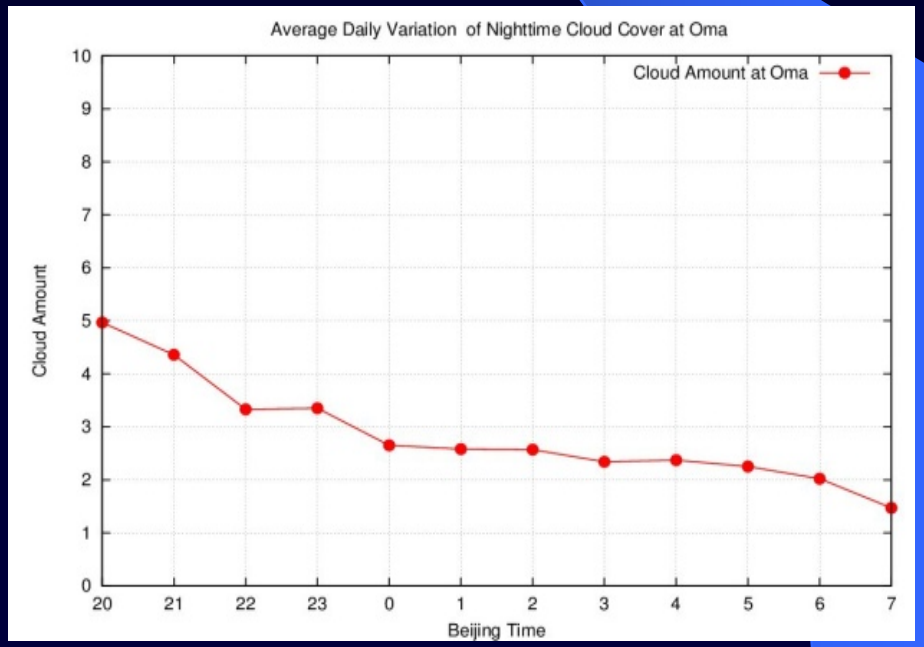
The high wind speed in plateau may not be so severe

Site monitoring at Oma site

Cloud Cover at night

method	mean	median	C<1	C<4	C<7	C⩾7	nights	period
imaging	2.7	0.0	60.7%	71.5%	74.5%	25.5%	205	091028-100714
visual	3.3	3.0	41.0%	66.8%	74.9%	25.1%	641	081120-101018
visual	3.5	2.0	37.3%	61.4%	72.5%	27.5%	347	050812-061229

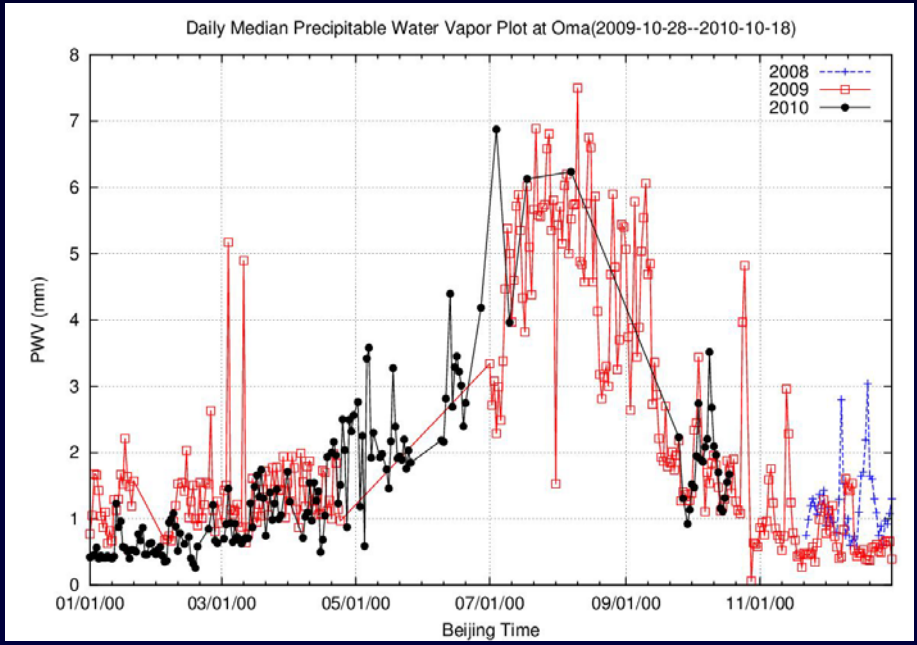


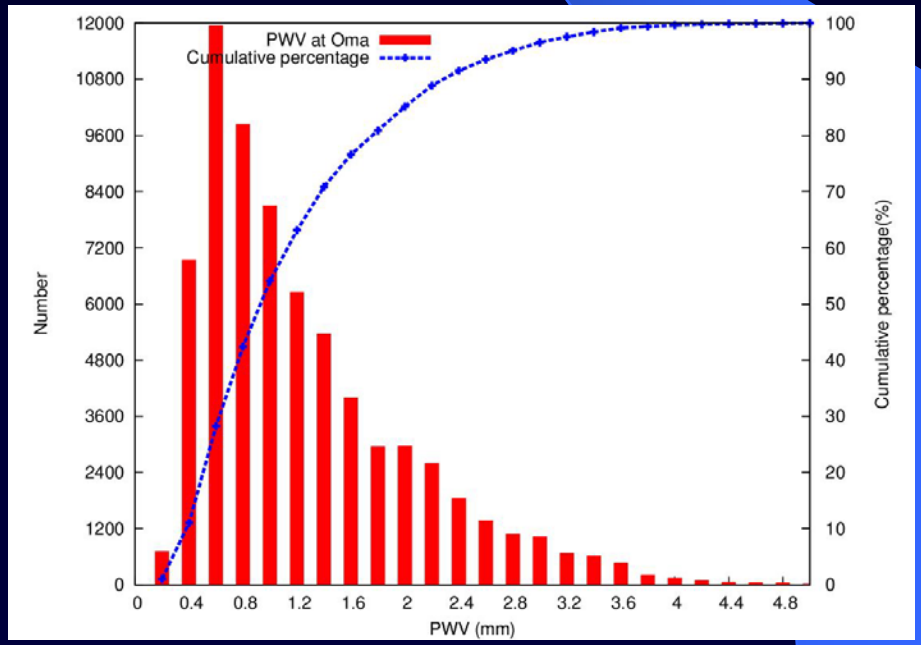


Site monitoring at Oma site

Precipitable Water Vapor

mean	median	PWV<0.5mm	<1.0mm	<1.5mm	<2.0mm	days	period
2.1mm	1.5mm	1.07%	21.7%	48.6%	64.6%	255	081122-091025
1.35mm	0.94mm	18.7%	53.1%	73.0%	84.2%	228	091028-101018
1.39mm	0.97mm						all data sets





Site monitoring at Oma site

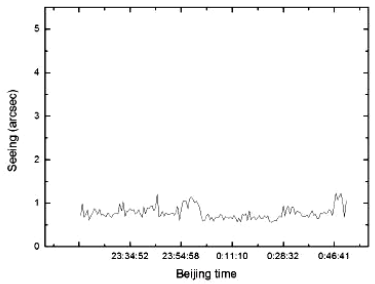
DIMM Seeing

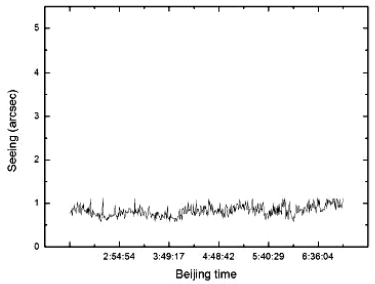
2006 Aug.-Sept. 12 nights
median 0.74”

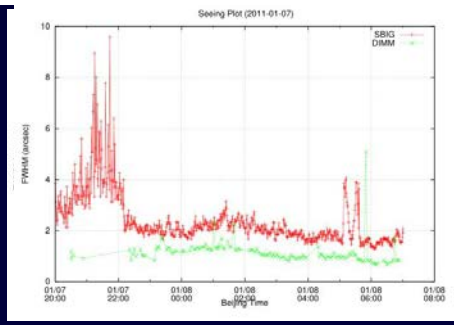
SBIG Polaris Seeing

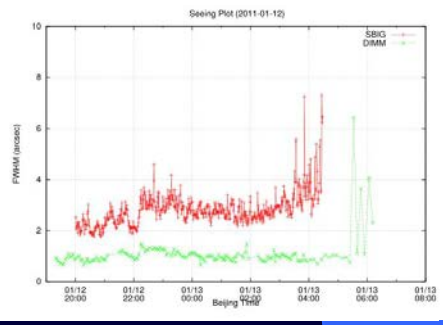
2009.10-2010.12 , 300 nights
calibrated to be in 0.65”-0.7”

Parameters	Site				
	ORM	Mauna Kea	Armazones	Dome C	South Pole
Total seeing ε_0 (arcsec)	0.80	0.75	0.64	1.00	1.60
Isoplanatic angle θ_0 (arcsec)	1.93	2.69	2.04	6.90	3.23
Coherence time τ_0 (ms)	5.58	5.10	4.60	3.40	1.58
Coherence étendue G_0 (m^2 ms $arcsec^2$)	0.38	0.62	0.49	1.80	0.07
Reference to data	Vernin (2011)	Schöck (2009)	Schöck (2009)	Giordano (2012)	Marks (1999)









Ali site, nearby Ali central town

For site characterization and small telescopes

Topography	A NW-SE ridge, above 5000m
Meteorology	Cloudiness and wind speed may be better than Oma
Traffic conditions	Paved road and airport from Lhasa or Kashi
Road to summit	Simple constructed
Electric power& commun.	Pass-way on summit to the airport
Geology for construction	Bed rock underlying less than 1m, common solidity

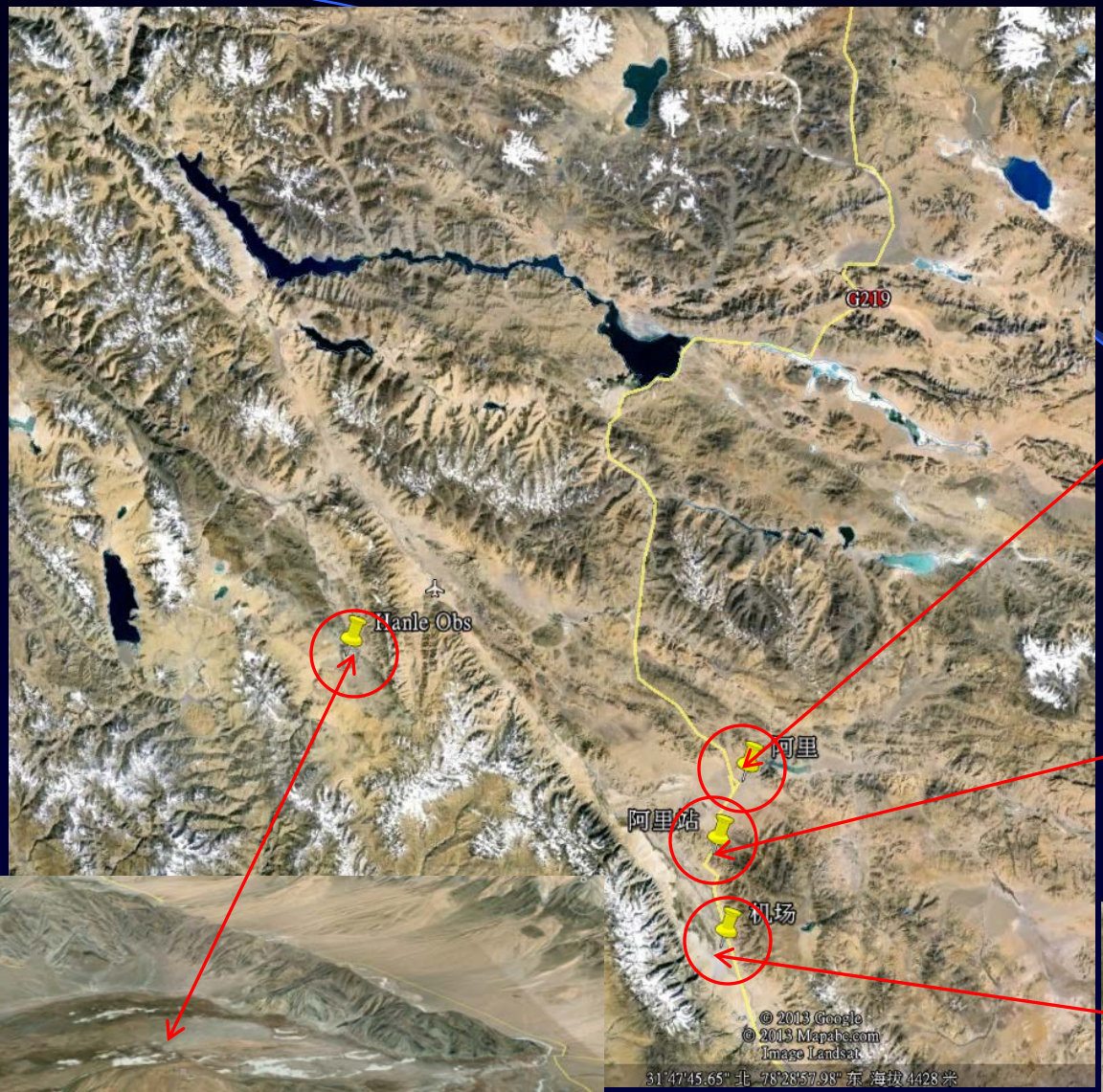

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Image Landsat
31°47'45.65" 北 78°28'57.98" 东 海拔 4428 米


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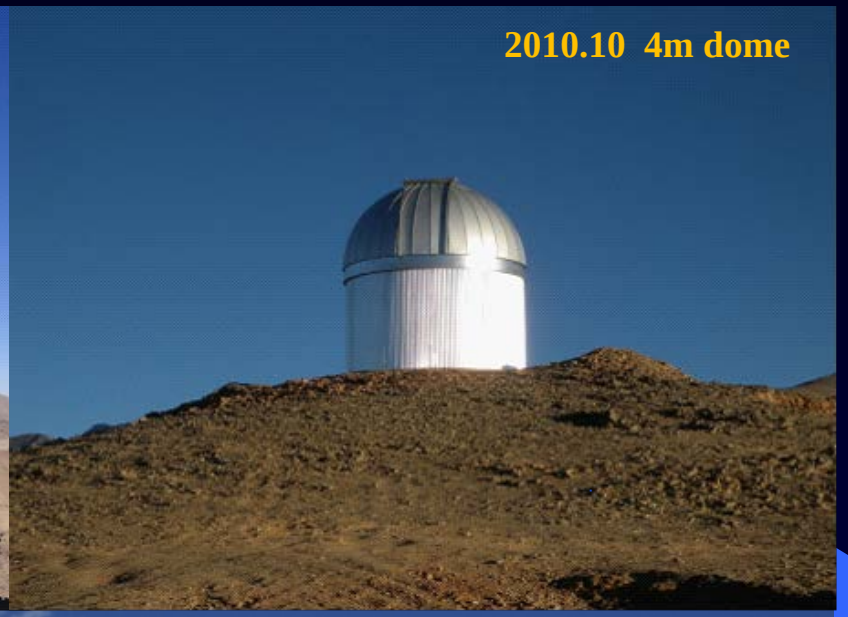
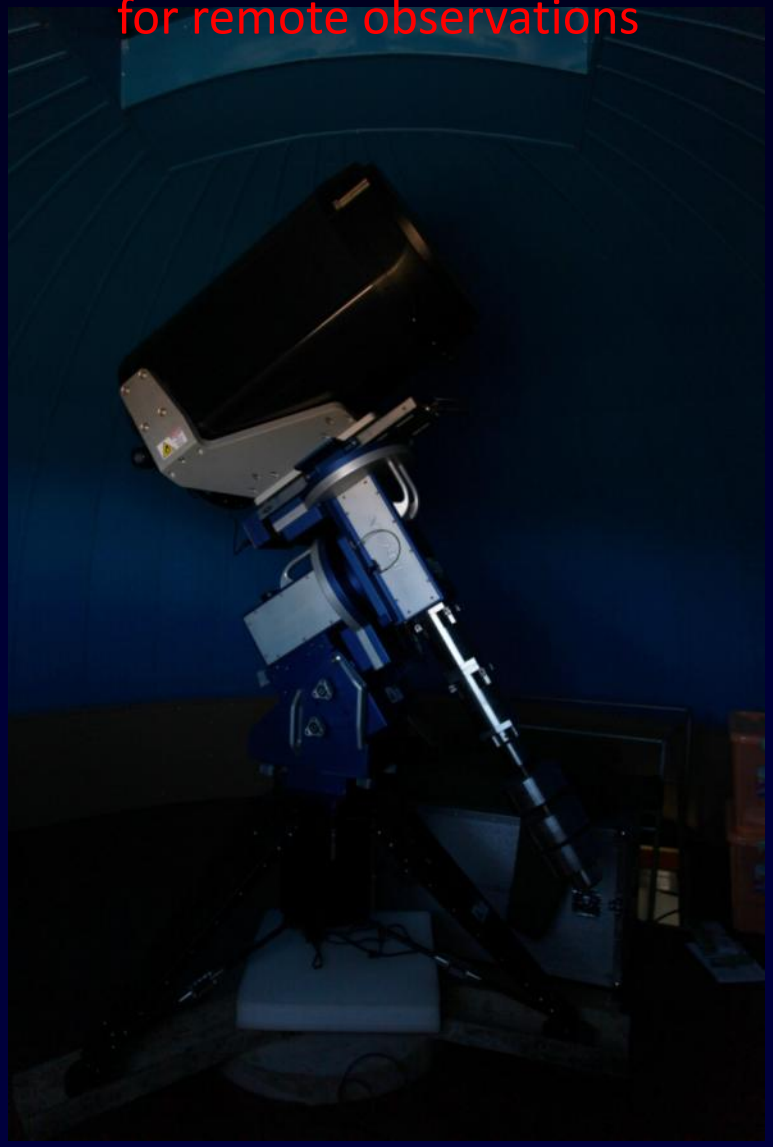
Ali site construction



Ali site construction

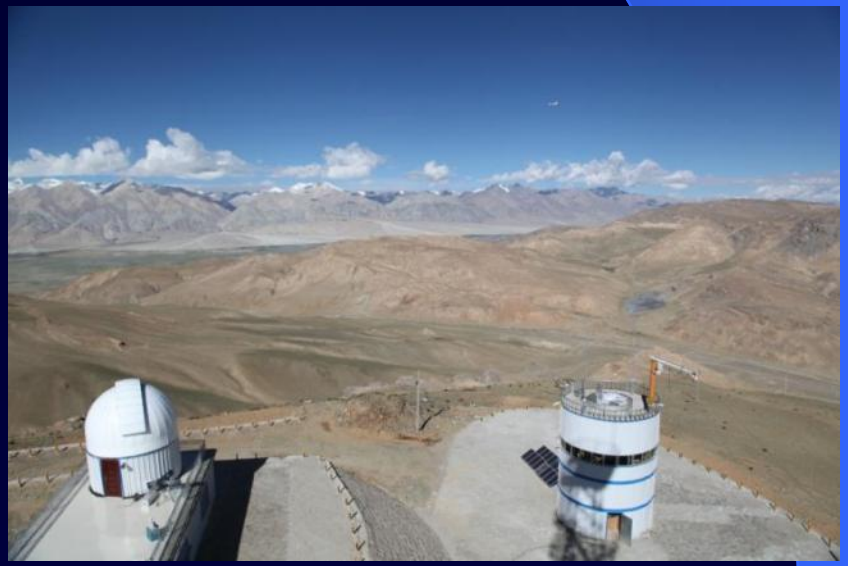
Ali site construction

50cm Telescope
for remote observations



40cm Telescope for SCIDAR

Ali site construction

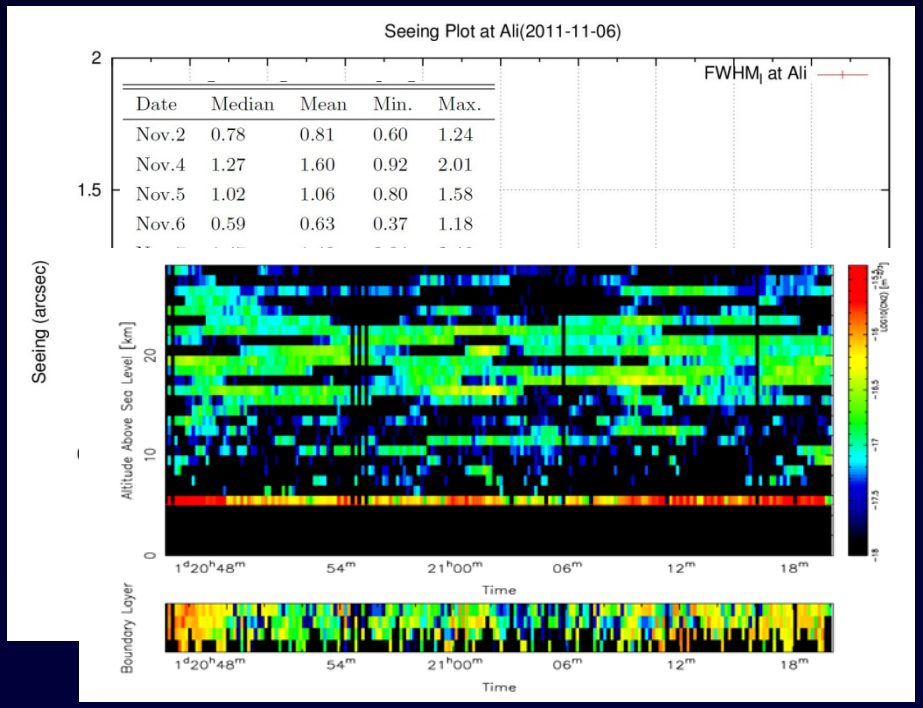


Ali site conditions

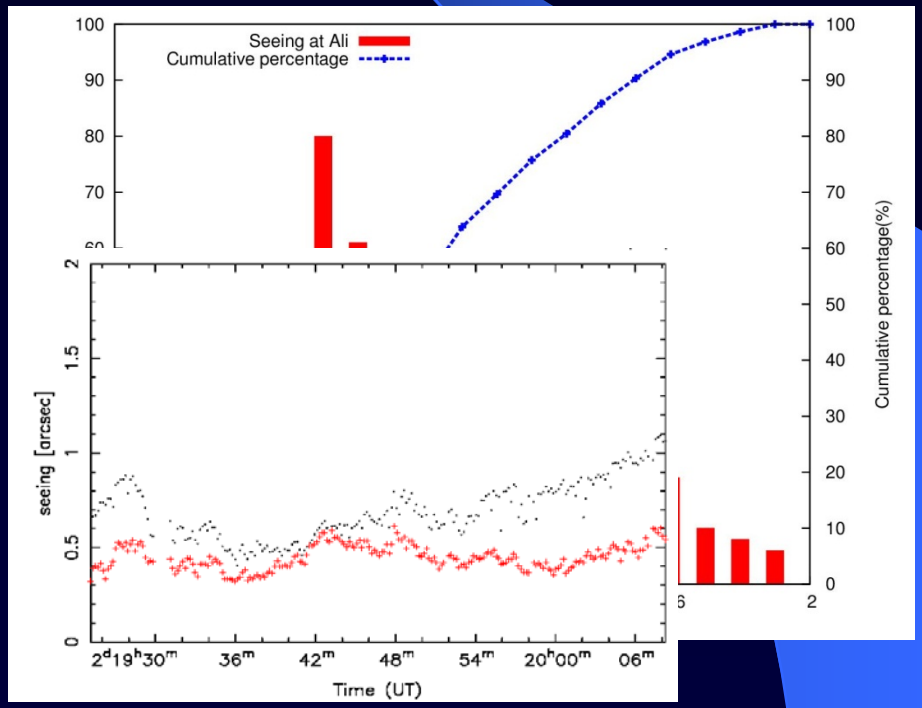
DIMM seeing during the campaign in 2011.11

Five nights: mean 0.9” median 0.8”

the best night: mean 0.63” median 0.59” lowest 0.37”



Date	Median	Mean	Min.	Max.
Nov.2	0.78	0.81	0.60	1.24
Nov.4	1.27	1.60	0.92	2.01
Nov.5	1.02	1.06	0.80	1.58
Nov.6	0.59	0.63	0.37	1.18

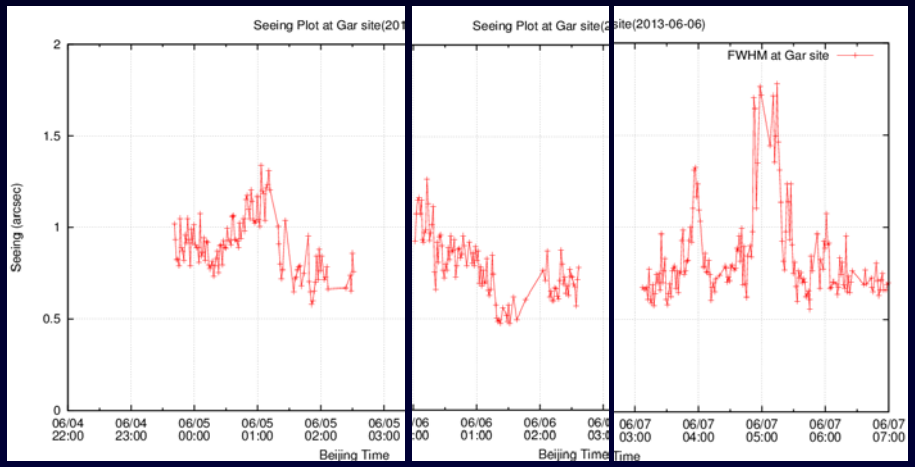


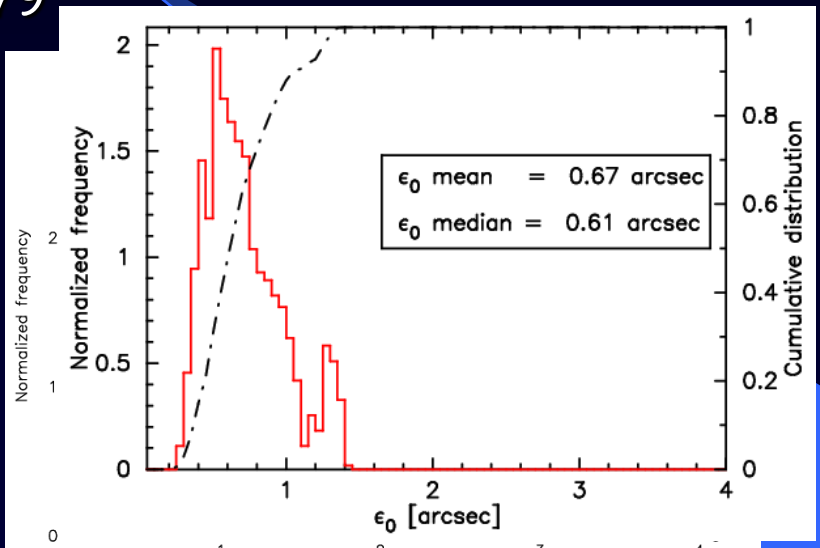
C_N^2 : $3x10^{-15}$ ~ $3x10^{-17}$ $m^{-2/3}$; seeing 0.5”-1.0”, free atm. ~ 0.5”

Ali site conditions

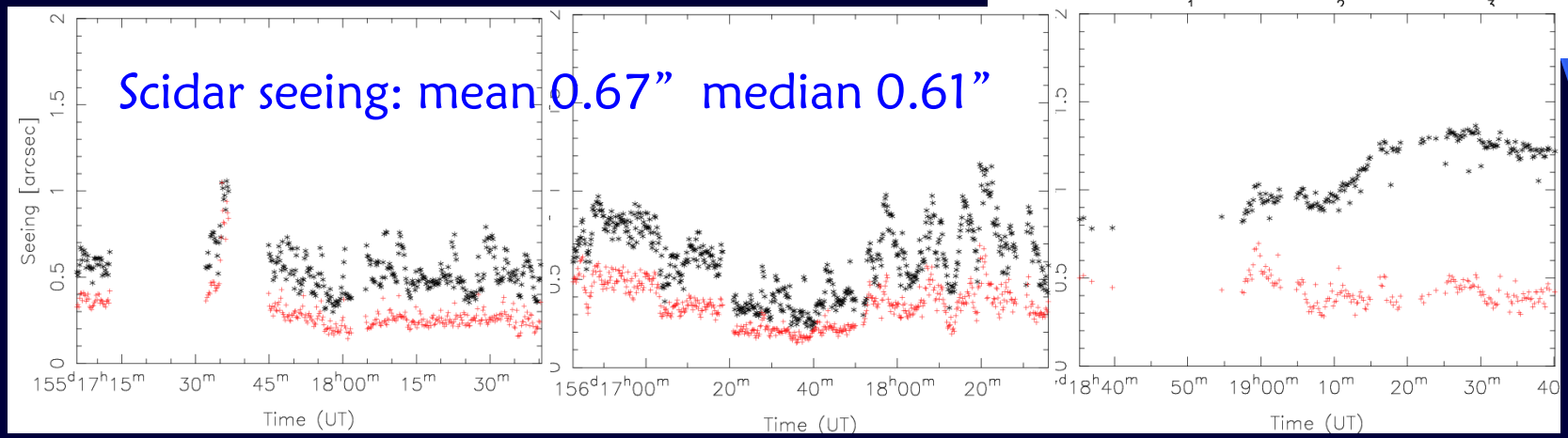
DIMM seeing during the campaign in 2013.6

three nights: mean 0.85” median 0.79”





Scidar seeing: mean 0.67” median 0.61”



Further work on site development

EACOA review in April 2012

Recommendations

- monitoring should be continued at least another two years

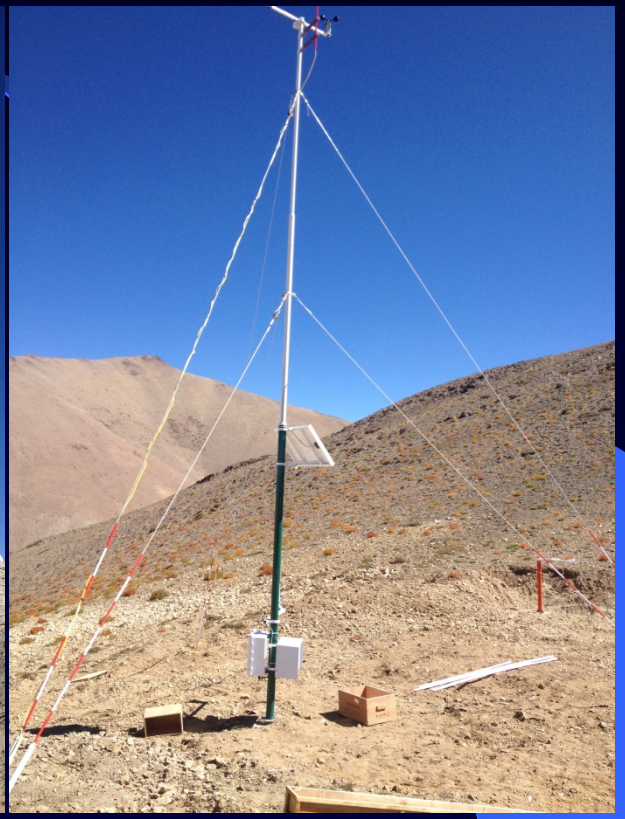
- more international comparisons with standard instruments

- nearby summits should be further studied

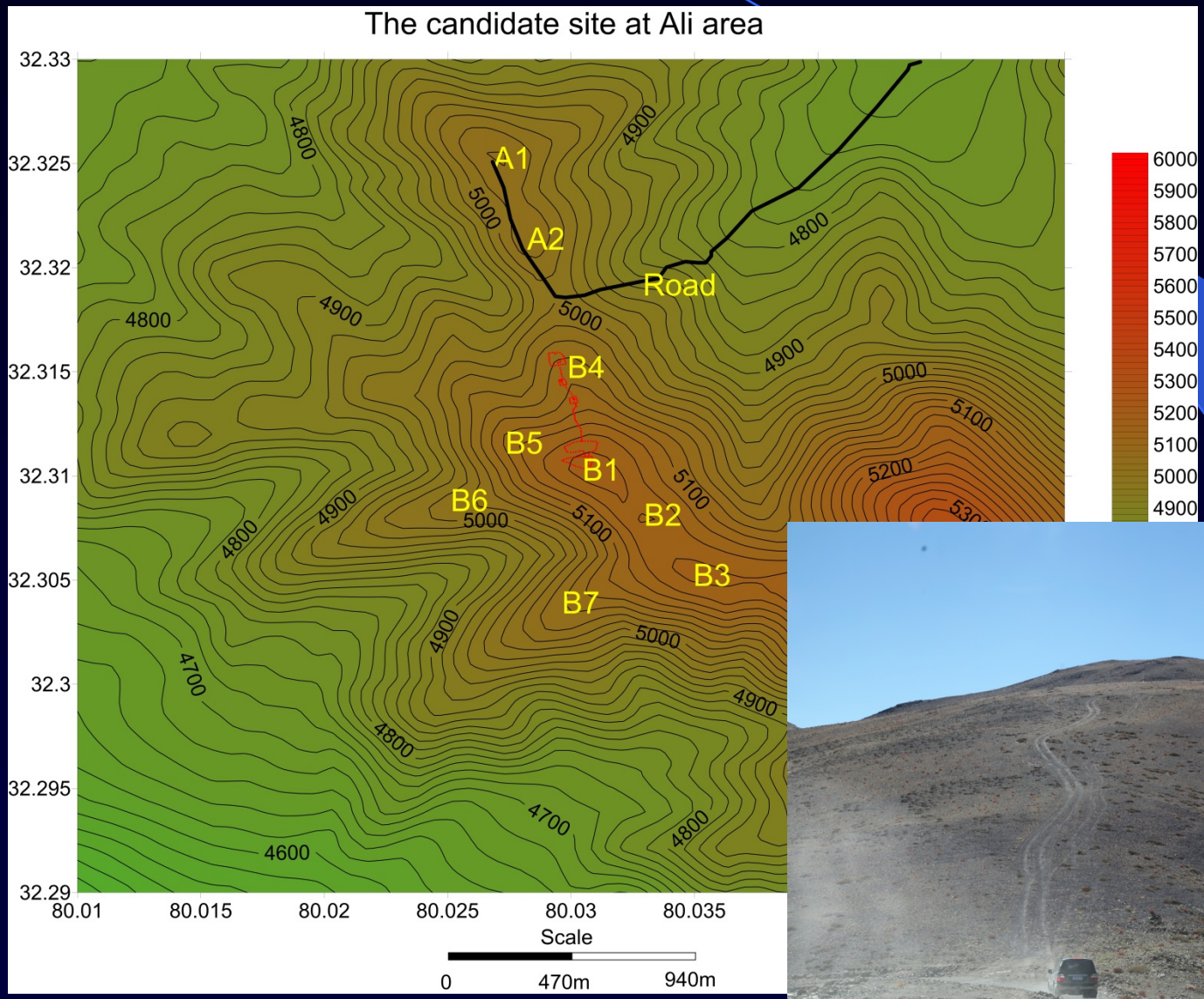
Site Testing Instruments for Ali Site

Item	Instrument
Weather condition	Vaisala:WXT510 CAWS620
Sky condition	MIR Cloud Mon Vis. all-sky camera
Dust	TSI:DustTrak8520
Water Vapor	Sun photometer RPG Tau meter
Turbulence thru all Atmosphere	DIMM & MASS
Turbulence Profile	SCIDAR
Surface Layer Turbulence	CT2 sensors on tower
Turbulence in upper layer	SNODAR
Turbulence Profile	50cm scope & instruments
Housing	electric power/ O_2 supply
Base offices	?

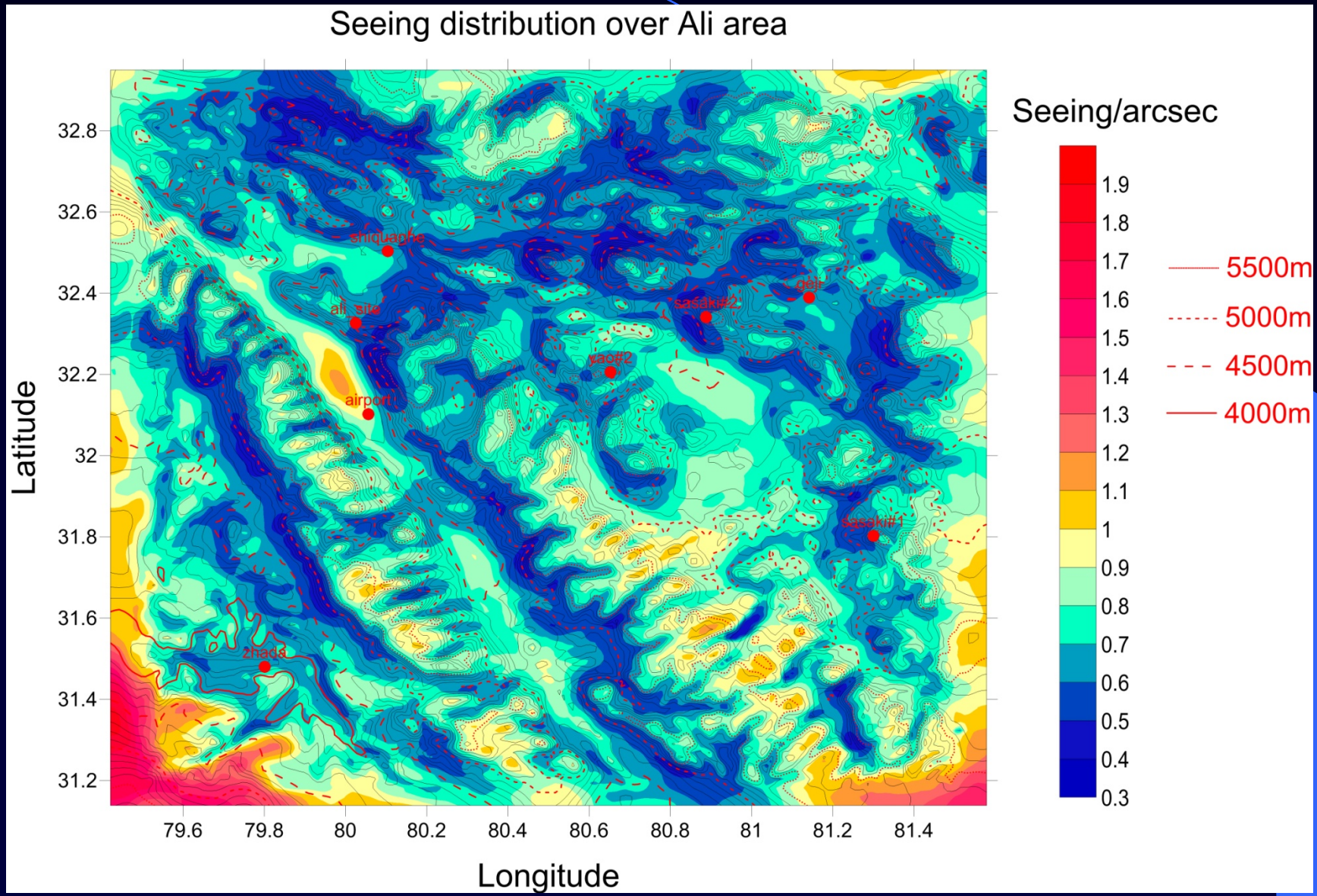
Further work on site development



Further work on site development



Further site search within Ali area



Proposed telescope plans on Ali site

- 15cm telescope of Taiwan Univ. (in operation)
- NAOC 50cm telescope (in operation)
- NAOC 50cm photometric telescope (ongoing project)
- Beijing Planetarium 50cm telescope (installation completed)
- BJP 1m telescope (ongoing project)
- Hiroshima University 50cm telescope (HInOTORI: ongoing project)
- PMO 2.5m wide field telescope (under discussion)

There are potential interests for putting telescopes by astronomers in Japan, Korea, Taiwan, and Thailand.

Further work on site development

- Announcement of opportunities for telescope plans on Ali site, to enhance cooperation among Asian regions

- Proposal to organize Site Committee under EACOA, to advise Ali site development, and to decide individual telescope location plans

Summary

- Ali area can be the best over EA region for astronomical observations, as a result of 10 year site survey in China.
- Ali site, selected and constructed for detailed characterization and small telescopes, is being prepared to make continuous monitoring for two years.
- Ali site has electric power, internet connection, rather good accessibility, and possible expansion to the east;
  a list of small telescope plans has been proposed.
- We encourage telescope projects on Ali site, and propose to organize Site Committee under EACOA


Thank you
Welcome to Ali
for instruction and cooperation