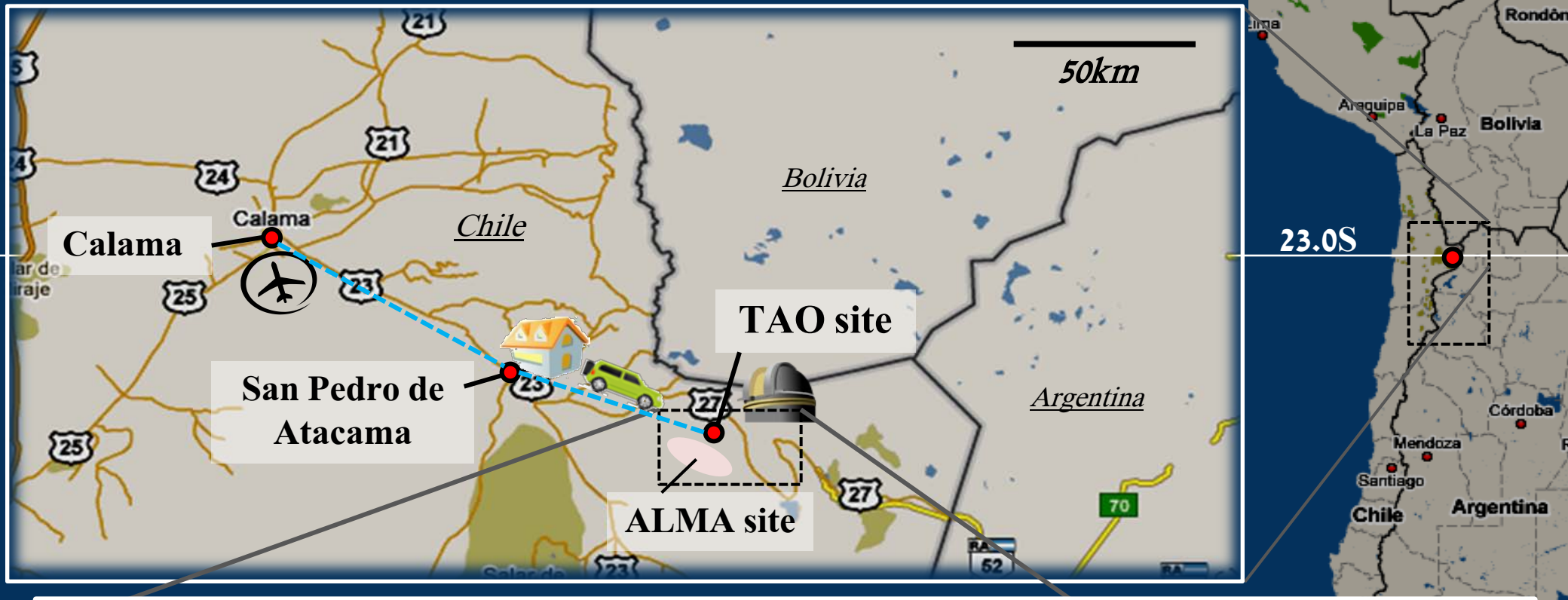
SOLAR-TAO PROJECT

- Astronomical observatory project promoted by the University of Tokyo
- A 6.5-m infrared telescope is built at the summit of Mt. Chajnantor, 5,640-m in altitude, in Atacama.

`Observatory Closest to Space'


50km
Bolivia
Chile
Argentina
Calama
Calama
San Pedro de Atacama
TAO site
ALMA site
23.0S
Arequipa
La Paz
Bolivia
Córdoba
Mendoza
Santiago
Chile
Argentina
TAO site
Mt. Chajnantor (5,640m)
ALMA site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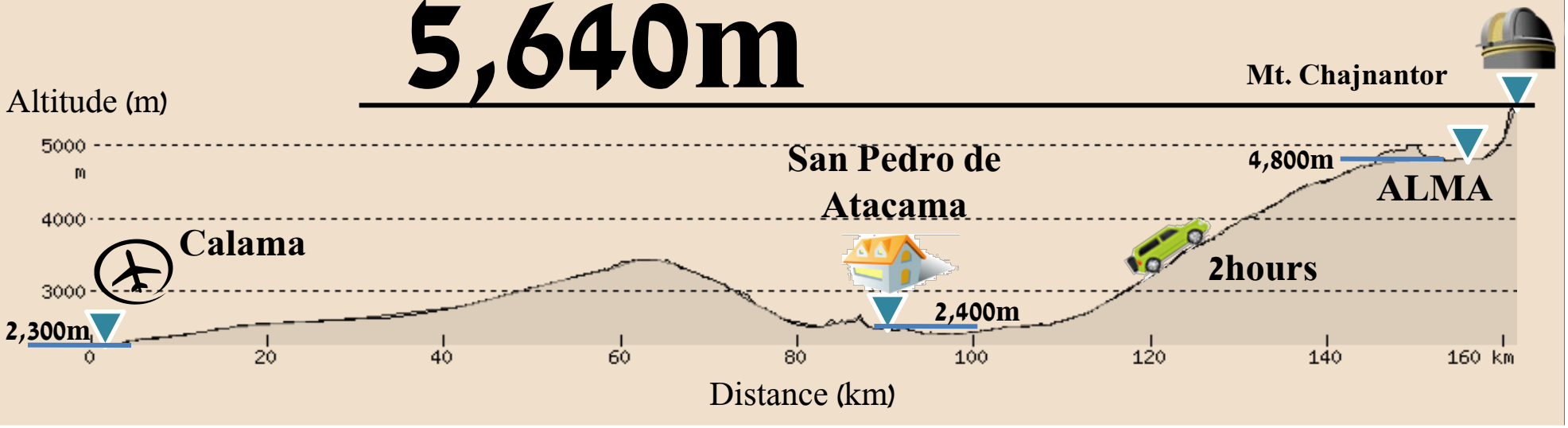
Argentina

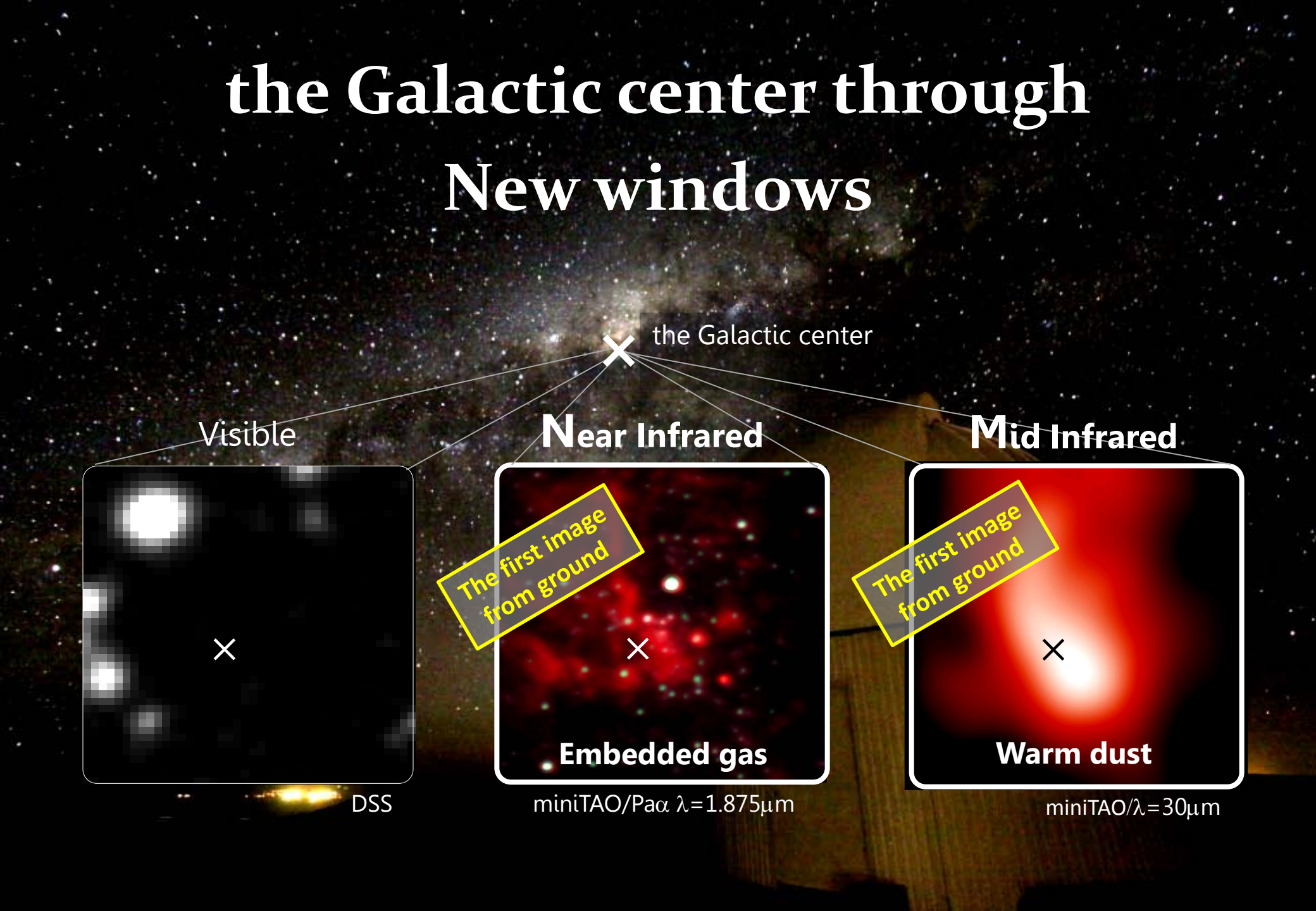
5,640m


Altitude (m)
5000 m
4000
3000
Mt. Chajnantor
4,800m
ALMA
San Pedro de Atacama
Calama
2,300m
2,400m
2hours
0
20
40
60
80
100
120
140
160 km
Distance (km)

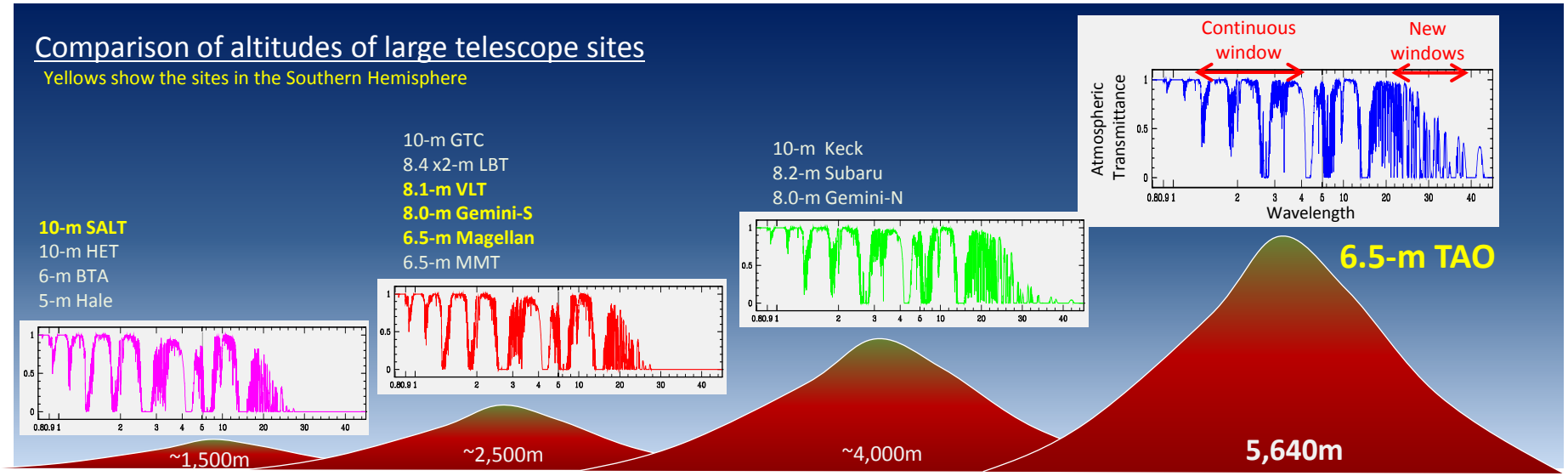
In prior to the 6.5-m TAO telescope,

Completion of the 1.0-m miniTAO

the Galactic center through New windows

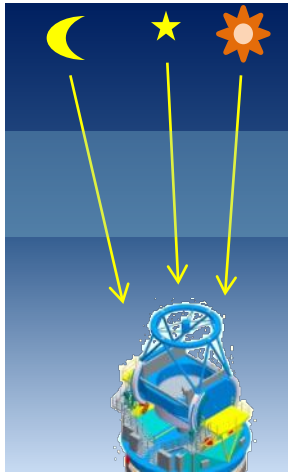


High-performance observations in the world's highest site



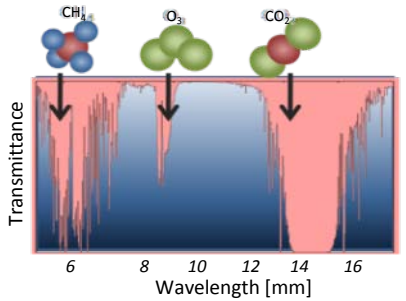
The TAO site has excellent transmittance in the infrared, and especially overwhelms others in the Southern Hemisphere.

The 5,640-m altitude enables accurate measurements of CO_2 .

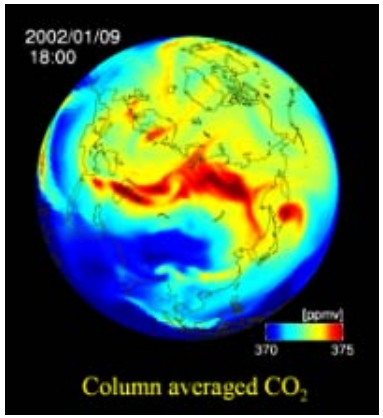


Measurements of atmospheric absorptions using stars and the moon as infrared light sources (world's first)

Predicted absorption by atmospheric gases



Measurements in South America which have not been well observed previously allow us to refine a global atmospheric circulation model.

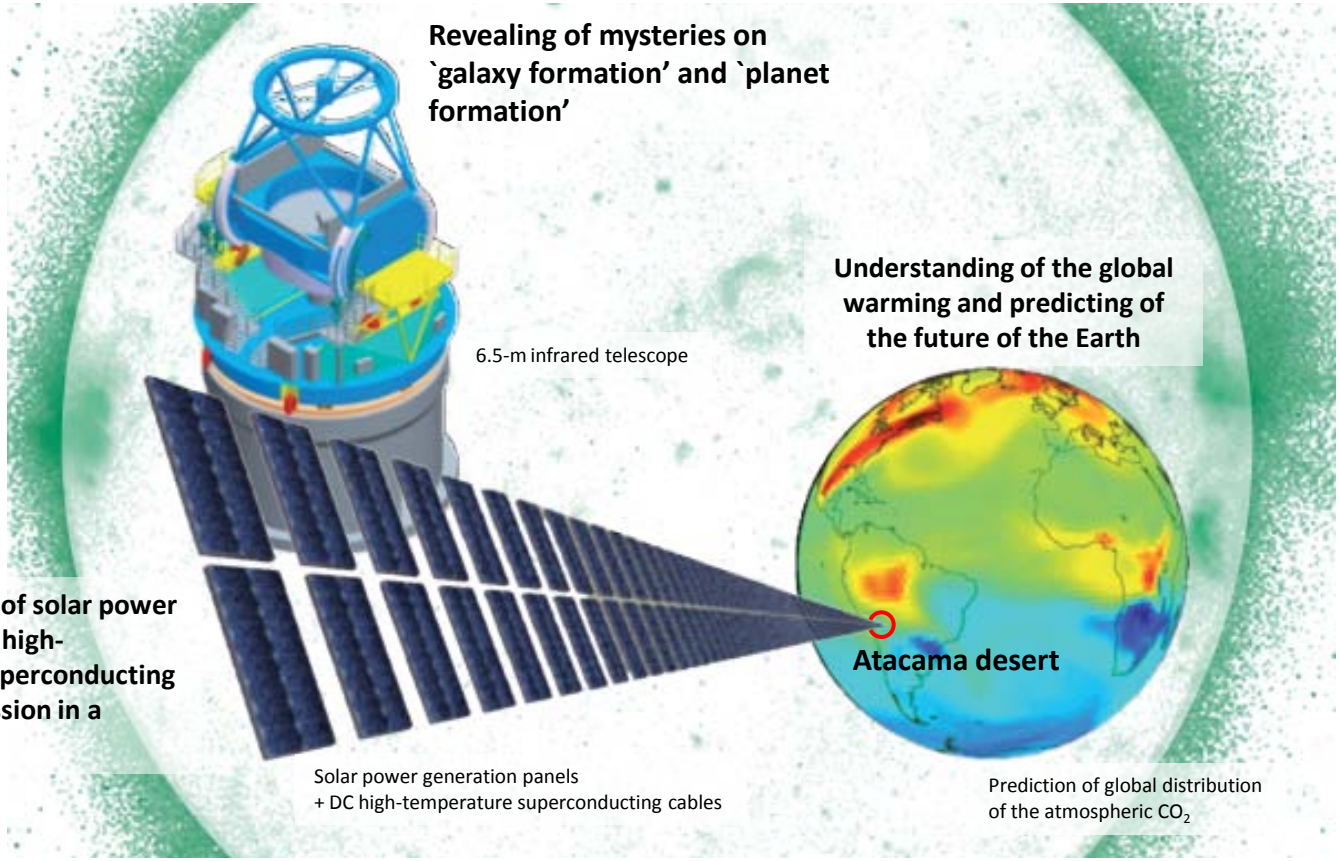


Example of the global atmospheric circulation model.

This study will show the current status of global warming, and predict the future of the Earth.

SOLAR-TAO project

Association of basic science and future technology in the Atacama desert



Infrared observations in the world's highest site realized by the solar power

Sustainability strategy required for basic science

Research facility for basic science

- It is often built outside of human activity fields.
  the Atacama desert, Antarctica, etc.
- Enormous amount of electric power is necessary with increasing in size of science instruments.
  A facility for a large telescope consumes the same amount of electric power as that in a small city, a few Mega-Watts.

→ **<u>It is a `mini city' in an undeveloped field.</u>**

The Paranal observatory (Chile)
- 8-m telescope x 4 units
- One of the largest observatory
- Power consumption is 2MW.

The ALMA observatory (Chile)
- Facility for large radio telescopes being built in the Atacama desert
- 12-m telescope x 80 units
- Power consumption is 7MW.

The electric power has been generated with diesel generators in the facilities.

Why is solar power NOT used ?

✓ Installation site and weather condition → ◎
✓ Economic requirements → ×

But in recent years, *Developments of generator, transmission, and storage of electric power. Mass production. Long-life technology* → **Price reduction**

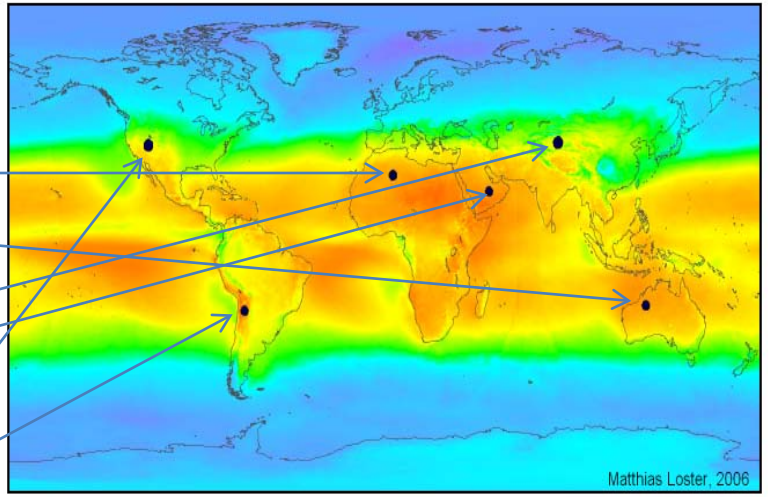
Excellent time to proceed the sustainability strategy for basic science facilities with the solar power

the Atacama desert

A desert is a treasury of energy for the solar power generation.

Comparison of major deserts in the world

Desert	Area [km^2]	Amount of Sunlight [Wm^{-2}]	Altitude [m]	Natives
Sahara (Africa)	***9,000,000***	***260***	***500***	**Arabic, Berber, etc.**
Great Sandy (Australia)	*390,000*	*265*	*400*	Aborigine
Takla Makan (China)	*270,000*	*210*	*0*	Uyghur etc..
Arabian (Middle-East)	*2,600,000*	*270*	*200*	Arabic
Great Basin (USA)	*490,000*	*220*	*2,000*	Native American
Atacama (Chile)	***140,000***	***275***	***3,000***	**Atacameno**



from *http://www.ez2c.de/ml/solar_land_area/*

The Atacama desert is the most suitable site for the solar power generation in terms of `amount of sunlight'.

- *The Atacama desert is larger than an installation area of solar panels necessary for covering electric power all over the world, ~130,000 km^2.*
- *Wind is moderate and sandstorm does not occur so much.*

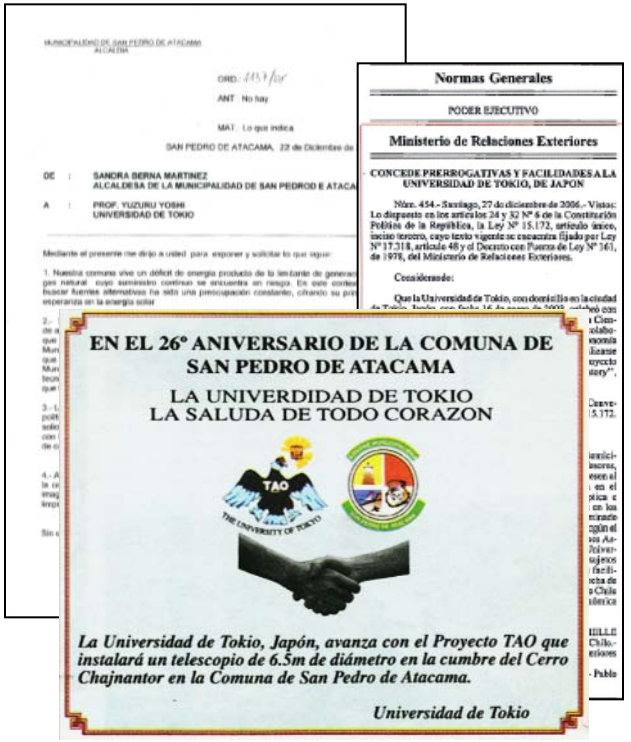
By developing the solar system in ultimate environments such as desert and high-altitude fields, the SOLAR-TAO project examines the capability for creating new electric power in remote areas.

Good relationship
between TAO and the governments and residents in Chile

Republic of Chile: the most politically-stable and financially-secure nation in South America

Consensus statements exchanged between TAO and the government of Chile, the regional government, and local residents

- ✓ **The University of Chile and the University of Tokyo**
  - Memorandum on science cooperation — 2001 May
  - Agreement on academic exchange — 2003 January
  - Agreement on science cooperation — 2003 January
- ✓ **The government of Chile and TAO**
  - TAO is incorporated, published in the official gazette — 2007 April
  - A diplomatic VISA is issued to Prof. Yoshii — 2007 July
- ✓ **CONICYT (National Commission of Scientific and Technological Investigation) and TAO**
  - Permit on weather measurements at the summit — 2001 July
  - Permit on development of road and land at the summit — 2005 August
  - Permit on construction of the 1-m miniTAO telescope — 2008 October
- ✓ **CONADI (National Corporation for Indigenous Peoples) and TAO**
  - Permit on summit work — 2005 August
- ✓ **San Pedro de Atacama city and TAO**
  - Agreement on mutual collaboration — 2006 February
  - Letter of support on desert utilization — 2008 December



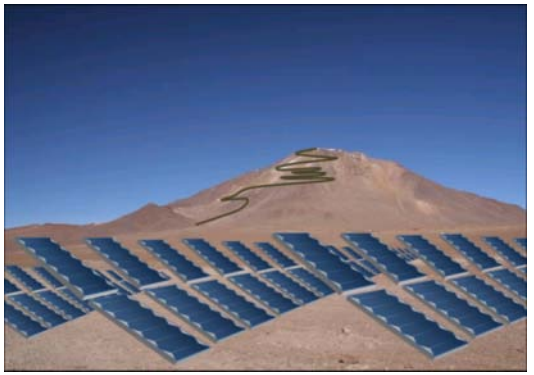
Relationship of trust, experience, and know-how developed by TAO in Chile

→ **Prompt realization of widespread use of desert**

SOLAR-TAO project

Merits of association of TAO(Astronomy) and SOLAR(Solar power generation + Superconducting power transmission)

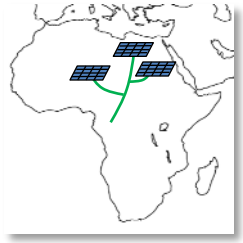
- ✓ Test bench for future solar power generation and superconducting power transmission
- ✓ Showcase of practical use on solar power generation for large science facilities and small cities
- ✓ Role model for sustainability strategies of facilities for basic science



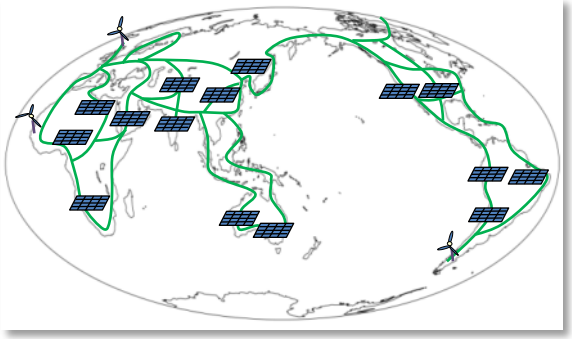
The final Goal of SOLAR-TAO project

- ✓ Creation of a stable society and mega-industry by establishing a global clean energy network

SOLAR-TAO
2009, Proposal by
The University of Tokyo



Sahara Solar Breeder
2009, Proposal by
Japan at G8+5



GENESIS
1989, Proposal by Prof. Kuwano