

# The Mountain and the Science

The mountains: not only for sports but a special environment for scientific research

The High Mountain Research Stations of Europe are widely distributed in the mountain regions, in the Alps, the Caucasus, the Carpathians, in Anatolia, in Armenia, always placed in spectacular, breathtaking places.

## HMO NETWORK

High Mountain Research Stations were established in Europe at the beginning of modern science (end of 1800) in order to provide the most adventurous scientists suitable and unique places to carry out research in various fields, from astronomy, to solar physics, to physiology.

In the course of time, the High Mountain Research Stations became important laboratories for the European Scientific Community, witnesses of scientific progress and site of historical data collections.

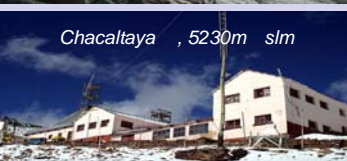
Pic du Midi, 2887 m slm



Capanna Margherita, 4559m slm



Chacaltaya, 5230m slm



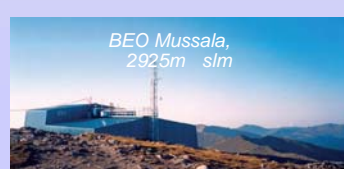
Jungfrauoch, 3580m slm



Testa Grigia, 3480m slm



BEO Mussala, 2925m slm



Sonnblick, 3106 m slm



## The High Mountain Research Stations : European scientific heritage

High Mountain Research Stations were established in Europe at the beginning of modern science (end of 1800) in order to provide the most adventurous scientists suitable and unique places to carry out research in various fields, from astronomy, to solar physics, to physiology. The strategic role of the High Mountain Research Stations is still today crucial in Earth observation systems, for long term observation and data collection in many scientific fields.



# When? Quando?

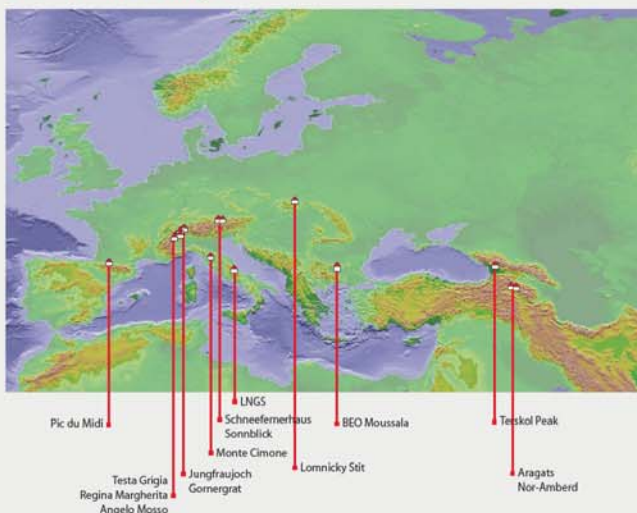
Pic du Midi 2887 m asl	1873				
Sonnblick Laboratory 3106 m asl	1886				1947 Testa Grigia Research Station 3480 m asl
Capanna Regina Margherita 4559 m asl	1894				1953 Norikura Observatory 2770 m asl
Istituto Angelo Mosso 2901 m asl	1907				1959 BEO Moussala 2925 m asl
Thien-Shan laboratory 3340 m asl	1912				1960 Gornnergrat Laboratory 3012 m asl
Jungfrauoch Laboratory 3454 m asl	1926				1961 Mauna Kea Observatories 4200 m asl
Echo Lake laboratory 3200 m asl	1930				1988 LNGS
Lomnick Stit 2634 m asl	1940				1990 Yangbajing Laboratory 4300 m asl
Chacaltaya Laboratory 5230 m asl	1942				1990 Pyramid Laboratory 5050 m asl
ASEC, Aragats 3200 m asl	1943				1995 Dome Concordia Station (summer station) 3233 m asl
Terskol Laboratory 3100 m asl	1944				1996 Ottavio Vittori Laboratory 2165 m asl
Osservatorio astronomico Campo Imperatore 2150 m asl	1947				1997 Mount Hermon 2020 m asl
Pamir Laboratory 4380 m asl	1946				1998 Schneefernerhaus Laboratory 2650 m asl

# Where? Dove?

The High Mountain Research Stations are widely distributed in the mountain regions of Europe, in the Alps, in the Caucasus, in the Carpathians, in Anatolia, in Armenia, always placed in spectacular, breathtaking places.

Le Stazioni di Ricerca di Alta Montagna sono situate nelle regioni montuose dell'Europa, sulle Alpi, nel Caucaso, nei Carpazi, in Anatolia, in Armenia, fra paesaggi spettacolari e panorami mozzafiato.

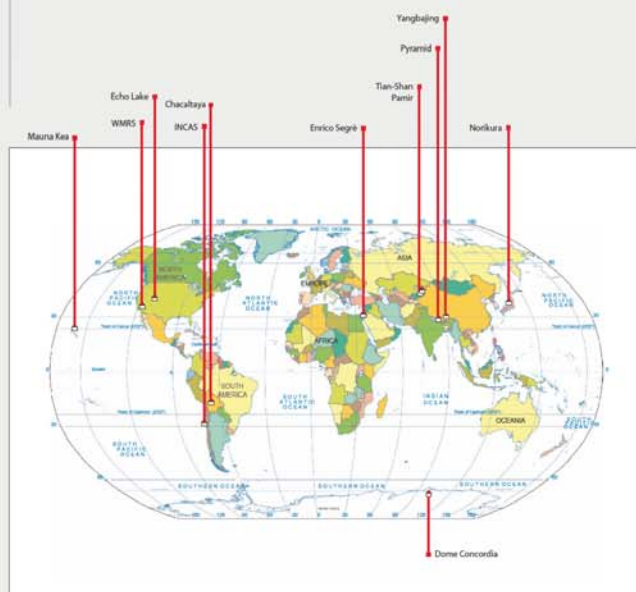
## European Laboratories Laboratori Europei



Observatory	Location	Country
Pic du Midi	43° 04' N, 0° 09' E Altitude, m 2887 asl	France
Testa Grigia	45° 56' N, 7° 42' E Altitude, m 3480 asl	Italy
Capanna Regina Margherita	45° 56' N, 7° 42' E Altitude, m 4559 asl	Italy
Istituto Angelo Mosso	45° 56' N, 7° 42' E Altitude, m 2901 asl	Italy
Ottavio Vittori Mt. Cimonte	44° 11' N, 10° 42' E Altitude, m 2165 asl	Italy
Laboratori Nazionali Gran Sasso	42° 28' N, 13° 33' E Altitude, m 2150 asl	Italy
Jungfrauoch Sphinx	46° 33' N, 7° 59' E Altitude, m 3454 asl	Switzerland
Gornergrat	45° 58' N, 7° 47' E Altitude, m 3012 asl	Switzerland
Schneefemerhaus	47° 25' N, 10° 59' E Altitude, m 2650 asl	Germany
Sonnblick	47° 25' N, 12° 57' E Altitude, m 3106 asl	Austria
Lomnický štít	49° 12' N, 20° 13' E Altitude, m 2634 asl	Slovakia
BEO Moussala	42° 11' N, 25° 35' E Altitude, m 2925 asl	Bulgaria
ASEC Aragats	44° 10' N, 40° 30' E Altitude, m 3200 asl	Armenia
Nor-Amberd	44° 10' N, 40° 30' E Altitude, m 2000 asl	Armenia
Terskol Peak	42° 18' N, 42° 42' E Altitude, m 3100 asl	Nord Caucaso Russia

## Laboratories in the World Laboratori nel Mondo

Observatory	Location	Country
WMRS	N37° 35' N, 118° 14' W Altitude, m 4340 asl	California USA
Echo Lake	38° 50' N, 105° 38' W Altitude, m 4312 asl	Colorado USA
Mauna Kea	19° 49' N, 155° 28' W Altitude, m 4200 asl	Hawaii USA
Chacaltaya	16° 29' S, 68° 8' W Altitude, m 5230 asl	Bolivia
INCAS Putre	18° 12' S, 69° 35' W Altitude, m 3600 asl	Cile
Dome Concordia Station	75° 06' S, 123° 23' E Altitude, m 3280 asl	Antarctica
Enrico Segrè	33° 10' N, 33° 29' E Altitude, m 2025 asl	Israel
Tian-shan	42° 30' N, 82° 30' E Altitude, m 3340 asl	Kazakhstan
Pamir	43° N, 77° E Altitude, m 4380 asl	Kyrgyzstan
Pyramid	27° 59' N, 86° 57' E Altitude, m 5050 asl	Nepal
Yangbajing	30° 7' N, 90° 32' E Altitude, m 4300 asl	Tibet P.R. China
Norikura	36° 6' N, 137° 19' E Altitude, m 2770 asl	Japan



Scientific and interdisciplinary exchanges are active with other high altitude laboratories in the world, from Tibet to the Antarctic, from the Andes to the Rocky Mountains, to Hawaii.

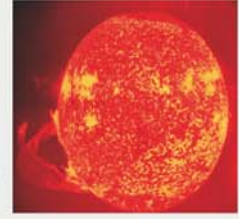
Sono in corso scambi scientifici interdisciplinari con i laboratori di alta montagna nel mondo, dal Tibet all'Antartide, dalle Ande alle Rocky Mountain fino alle Hawaii.

# Which science? Quale scienza?

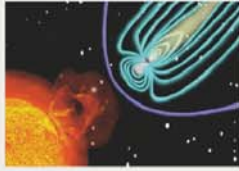
## Space Science Scienza dello spazio



Astronomy  
Astronomia



Solar Physics  
Fisica Solare



Space weather forecast  
Previsioni del tempo spaziale



Astrophysics  
Astrofisica



Cosmic Rays Physics  
Fisica dei raggi cosmici

## Atmosphere Science Scienza dell'atmosfera



Atmospheric Chemistry  
Chimica dell'atmosfera



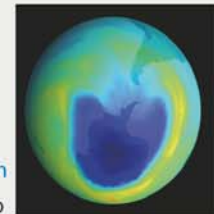
Atmospheric Physics  
Fisica dell'atmosfera



Clouds formation  
Formazione di nubi



Lightning & thunderstorm  
Fulmini e temporali



Ozone depletion  
Buco dell'ozono

## Earth Science Scienza della Terra



Paleoclimatology  
Paleoclimatologia



Seismology  
Sismologia



Geology  
Geologia



Glaciology  
Studio dei ghiacci

# Which science? Quale scienza?

Climatology  
Climatologia



Climate changes  
Cambiamenti climatici



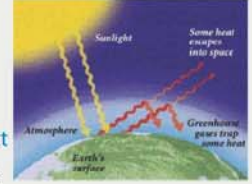
Pollution monitoring  
Monitoraggio dell'inquinamento



Weather forecast  
Previsioni del tempo

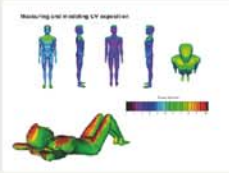


Meteorology  
Meteorologia



Greenhouse effect  
Effetto serra

Medicine and Biology  
Medicina e Biologia



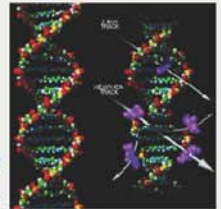
UV exposure  
Esposizione ai raggi UV



Human life in extreme conditions &  
Sport Medicine  
Vita umana in condizioni estreme e  
medicina sportiva



Pollutants effect on life and food chain  
Effetto di inquinanti sulla vita e  
sulla catena alimentare



Radiobiology  
Radiobiologia



Physiology and Biophysics  
Fisiologia e Biofisica

and more...  
e inoltre...



Telecommunication  
Telecomunicazioni

Satellite data validation  
Validazione dei dati da satellite



Ecological tourism  
Turismo ecologico

Instruments calibration  
Calibrazione di strumenti



Science divulgation & Education  
Divulgazione scientifica & Educazione

Environmental protection  
Protezione ambientale





## In the High Altitude Research Stations there are optimal conditions for scientific research

No light pollution



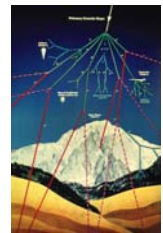
No anthropogenic pollution



High UV intensity



High cosmic ray flux



Millenarian glaciers



Extreme conditions for human life



## Integration in Earth Observation

The High Mountain Research Stations, worldwide distributed, allow to perform contemporary investigation on the “Earth System” at various altitudes and latitudes, in different conditions of atmospheric shielding and geomagnetic field.

The Laboratories represent essential ground-based facilities, integrated in the system of Earth observation:

- high altitude aircraft for scientific flights ~ 20 Km
- stratospheric balloons ~ 30 km
- Low Earth Orbit (LEO) satellites ~ 200Km
- International Space Station (ISS) - 386 Km

