

# HIGH ALTITUDE RESEARCH

The Pyramid Laboratory-Observatory at Mount Everest





The Pyramid International Laboratory/Observatory, high altitude scientific research center, is located at 5,050 m (16,568 ft.) a.s.l., in the Khumbu Valley, Sagarmatha National Park, at the base of the Nepali side of Mount Everest. Since it was founded in 1990, Pyramid Laboratory has been offering the international scientific community a priceless opportunity to study the environment, climate, human physiology and geology in a remote mountain protected area. The Pyramid is jointly managed by the EvK2CNR Committee and the Nepal Academy of Science and Technology (NAST).

To date, 580 scientific missions have been carried out there by 220 researchers from more than 170 different scientific institutions in several countries. The main field of research are: Earth Sciences, Environmental Sciences, Medicine and Physiology, Anthropology, Development of new technologies.



## International Framework

Pyramid Laboratory hosts sophisticated instruments and research projects involved in large scale programs developed in accordance with major international organizations such as WHO, WMO, UNEP, ICIMOD, IUCN, WWF, etc.) giving a fundamental contribution to: studies on global change, promotion of sustainable development in mountain areas, biodiversity conservation, development and cooperation oriented research.



## The Nepal Climate Observatory - Pyramid

NCO-P is a scientific station located just above the Pyramid and it's a global hot-spot in terms of anthropogenic impacts to climate and environment. Continuous observations of meteorology, surface ozone and aerosol physical properties are currently carried out at this station, to accurately investigate the atmospheric composition of the Himalayan regions. Set up in January 2006 in the framework of ABC - UNEP and SHARE - EvK2CNR projects, in 2010 it became the 29th Global Station of the Global Atmospheric Watch (GAW) program by the World Meteorological Organization (WMO).



*Altitude:* 5079 m

*Data type:*

- Aerosol number, concentration and size distribution (15nm to 32 $\mu$ m)
- Black carbon concentration
- Total and back scattering coefficients
- Aerosol optical depth
- Surface Ozone concentration
- Greenhouse Gases Concentration (CFC, HFC, HCFC,...)
- Aerosol chemical closure mass
- Solar irradiance (200 - 3600 nm)
- Standard WMO Meteorological Variable



For decades, researchers like the famous Italian explorer and geologist, Prof. Ardito Desio, struggled to carry out scientific endeavors in remote high altitude areas, dependent on precarious tents and unreliable generators. By the end of the late Eighties, Prof. Desio, together with climber and businessman, Agostino Da Polenza, with whom he had founded the EvK2CNR Project, had decided that a permanent high altitude laboratory in the Himalayas was the answer. In 1990, EvK2CNR and the then Royal Nepal Academy of Science and Technology (RONAST), signed an agreement for the installation of the Pyramid on the Nepali side of Everest in the Sagarmatha National Park.

The laboratory was installed and became operational in September 1990. Not only did the Pyramid soon become a fundamental scientific outpost for researchers and technicians, but it also grew to be known as a point of reference for local populations and tourists who could take advantage of the advanced telecommunications systems available there to send urgent messages to Kathmandu or abroad.



The Pyramid International Laboratory/ Observatory was officially inaugurated in October or 1990, by the Prime Minister of Nepal, a RONAOST officer, the Italian Ambassador in Kathmandu, Agostino Da Polenza and the incredible Ardito Desio, who, at the age of 93, would not miss the historic occasion, making the trip personally to the Pyramid's 5,050 meters a.s.l. Since then, this flagship of international high altitude scientific research has become the symbol of EvK2CNR and a point of pride for the Nepali and Italian governments.



## EVK2CNR

Founded in 1989 from the meeting between Professor Ardito Desio and Agostino Da Polenza, EvK2CNR is a recognized association that has been dedicated to scientific and technological research at high and very high altitudes for 35 years, with a particular focus on the areas of the so-called Third Pole (Himalayas and Karakorum). Over the years, EvK2CNR has given new significance to the mountain world through its constant presence in the mountainous regions of the Hindu Kush, Karakorum, and Himalayas in Nepal, Pakistan, and Tibet, as well as in Africa, South America, and the Alps. This has been achieved through the creation and management of the Pyramid Laboratory-Observatory, located at 5050 meters on the Nepalese side of Mount Everest. This expertise is invaluable, providing information and data useful in combating the increasingly evident climate crisis.

The scientific research conducted over the years has led to innovative discoveries in the fields of earth and environmental sciences, medicine and physiology, anthropology, eco-efficient technologies, and environmental management systems. With an interdisciplinary approach, EvK2CNR has developed projects aimed at improving scientific knowledge on climate variability and the impacts of climate change, ensuring long-term, high-quality data. Notably, with the SHARE project – Stations at High Altitude for Research on the Environment – developed in direct cooperation with UNEP (United Nations Environment Programme), WMO (World Meteorological Organization), and a dozen Italian and international universities and research institutions.

## NAST



Nepal Academy of Science and Technology (NAST) is an autonomous apex body established in 1982 to promote science and technology in the country. The Academy is entrusted with four major objectives: advancement of science and technology for all-round development of the nation; preservation and further modernization of indigenous technologies; promotion of research in science and technology; and identification and facilitation of appropriate technology transfer.

## Climate, Water and Energy



- Long-term monitoring
- Link impact to climate-related changes in the high mountain cryosphere
- Projections of future climate change
- The use of Earth observation (satellites) in high mountains
- Radiative forcing effects of light absorbing particles trends
- Extent and ice content of permafrost
- Spatial and temporal variation of snow cover
- Water availability and security
- Integrated approach for adaptation strategy to climate change
- New energetic solutions in mountains

## Natural resources



- Long-term monitoring for biodiversity
- Link loss of biodiversity and climate-related changes in the high mountain
- Management protocols for Wildlife
- Long-term monitoring for water ecology
- Definition of a Carrying Capacity for tourists
- Establish the impact of tourists on ecosystem
- Increase the tourist security
- Link between climate change and forest structure
- To follow the tree-line dynamics

## One Health



- Generate new knowledge on health in mountain
- Integration of different Ecosystem Services (One Health Approach)
- Multidisciplinary approach to the acclimation problem
- Climate change and globalization will expose people to new pathogens
- prevent disease outbreak through the epidemiology of wild and domestic animals
- Water security in Himalaya is a major challenge for sustainable development.
- Climate change is posing new environmental risks for the health





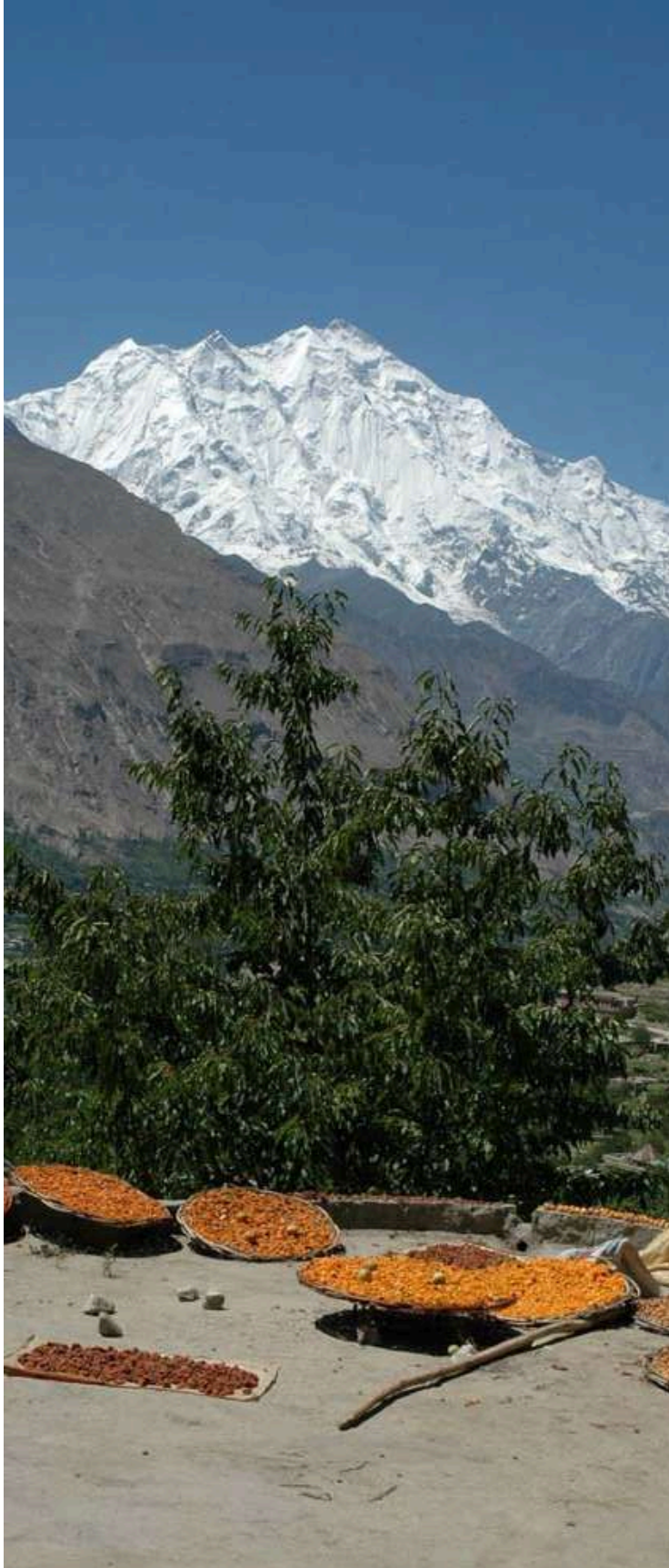
# Medicine and Physiology



# Anthropology and Culture



# Botany and Agriculture



# Development of new technologies



# Scientific research

## Main result



### Climate

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## Local cooling and drying induced by Himalayan glaciers under global warming

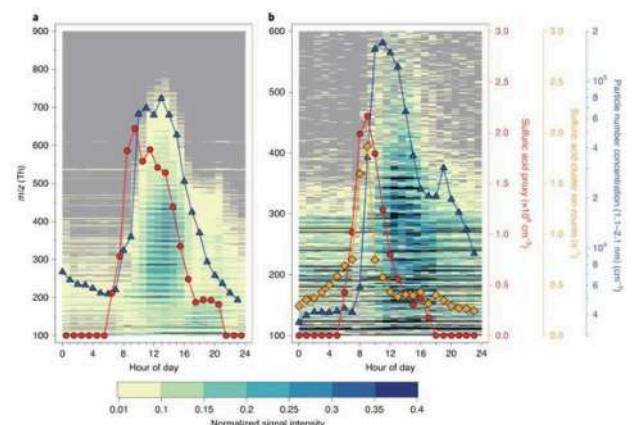
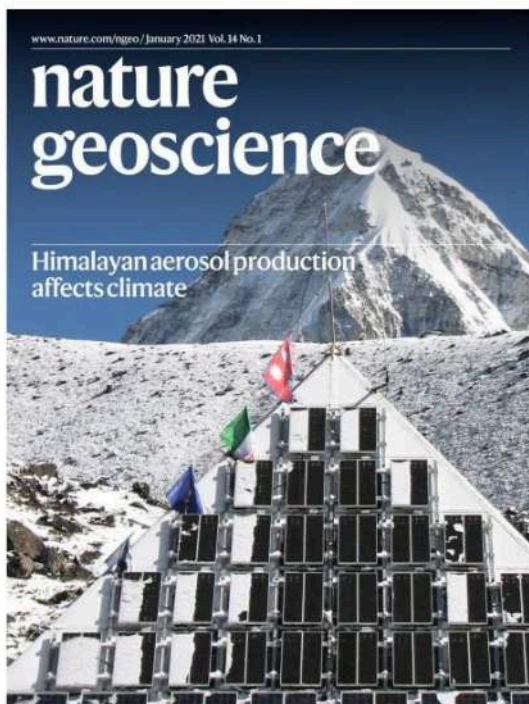
Franco Salerno , Nicolas Guyennon , Kun Yang, Thomas E. Shaw, Changgui Lin, Nicola Colombo, Emanuele Romano, Stephan Gruber, Tobias Bolch, Andrea Alessandri, Paolo Cristofanelli, Davide Putero, Guglielmina Diolaiuti, Gianni Tartari, Gianpietro Verza, Sudeep Thakuri, Gianpaolo Balsamo, Evan S. Miles & Francesca Pellicciotti

*Nature Geoscience* **16**, 1120–1127 (2023) | [Cite this article](#)

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### Air quality



The researchers revealed that even the clean air of the Himalayas can generate atmospheric particles that play an important part in shaping Earth's climate. The Himalayas thus act as an aerosol factory, pumping natural particles into the atmosphere. Knowing about this natural source could help scientists to untangle the effects of human-made aerosols.

# Scientific research

## Main result



### Wildlife

[Home](#) > [European Journal of Wildlife Research](#) > [Article](#)

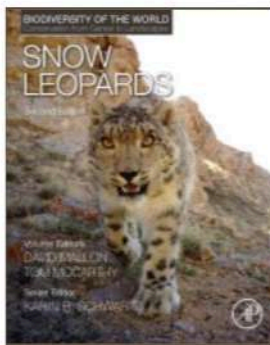
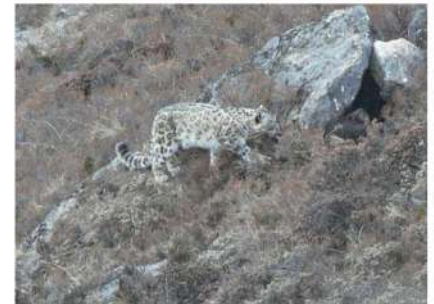
## Recovery of the snow leopard in Sagarmatha (Mt. Everest) National Park: effects on main prey

Short Communication | Published: 16 March 2014

Volume 60, pages 559–562, (2014) [Cite this article](#)

[Download PDF](#)

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### Snow Leopards (Second Edition)

Biodiversity of World: Conservation from Genes to Landscapes

2024, Pages 63-70



## Chapter 6 - Living on the edge: Depletion of wild prey and survival of the snow leopard

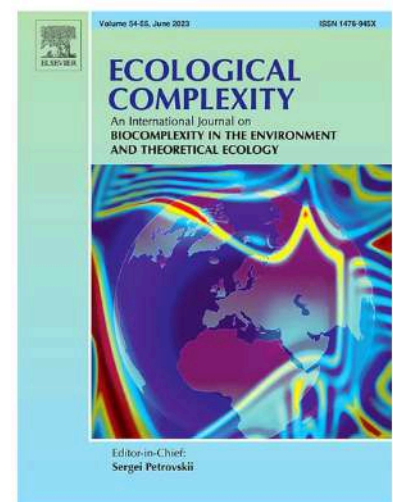
[Sandro Lovari](#)<sup>a, b</sup>, [Charudutt Mishra](#)<sup>c, d</sup>

### Plant ecology



Prediction of climate warming impacts on plant species could be more complex than expected. Evidence from a case study in the Himalaya

[Alessandro Ferrarini](#)<sup>a</sup> , [Graziano Rossi](#)<sup>a</sup> , [Andrea Mondoni](#)<sup>b</sup>, [Simone Orsenigo](#)<sup>a</sup>



We conclude that predicting climate change impacts on plant species could result more complex than expected at present

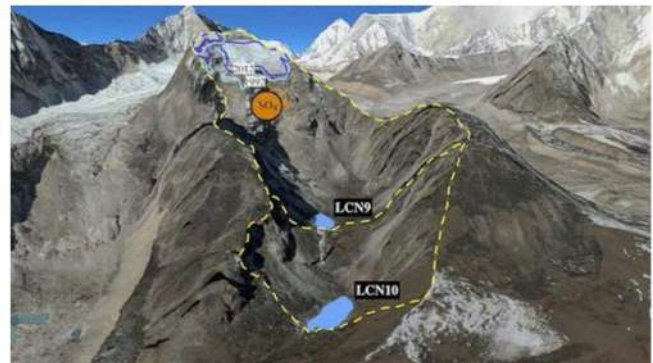
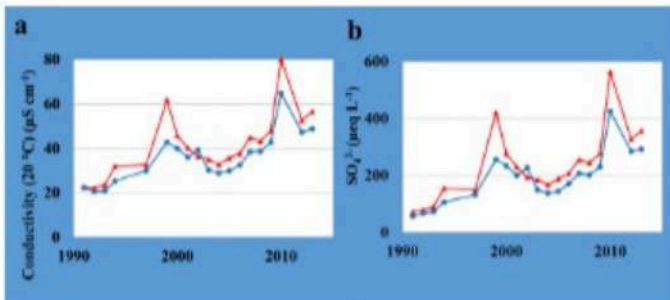
# Scientific research Main result



## Water quality

### Glacier melting increases the solute concentrations of himalayan glacial lakes

Salerno, Franco<sup>a, c</sup> ; Rogora, Michela<sup>b</sup>; Balestrini, Raffaella<sup>a</sup>;  
Lami, Andrea<sup>b, c</sup>; Tartari, Gabriele A.<sup>b</sup>; Thakuri, Sudeep<sup>a</sup>;  
Godone, Danilo<sup>d</sup>; Freppaz, Michele<sup>e</sup>; Tartari, Gianni<sup>a, c</sup>  
 Save all to author list



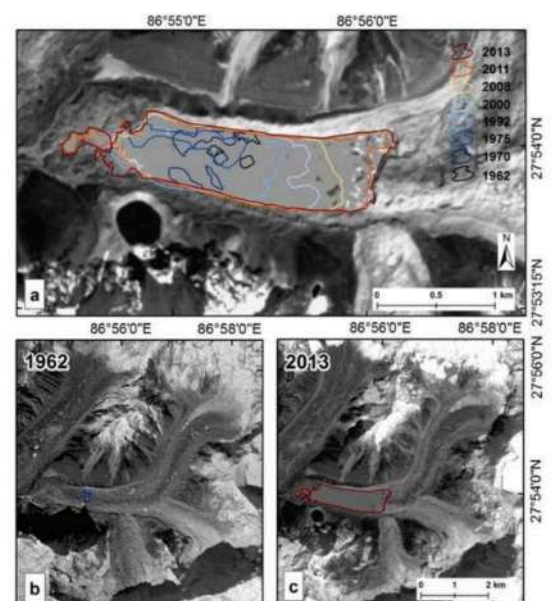
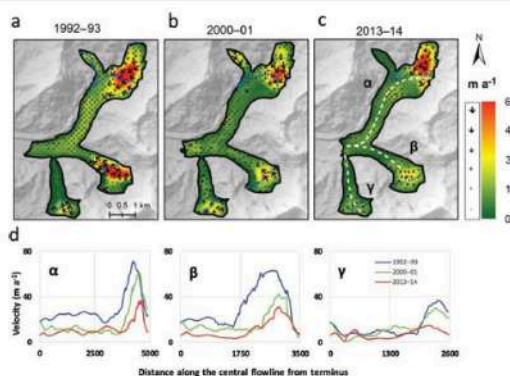
## GLOF



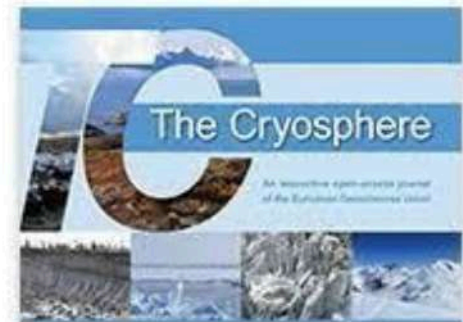
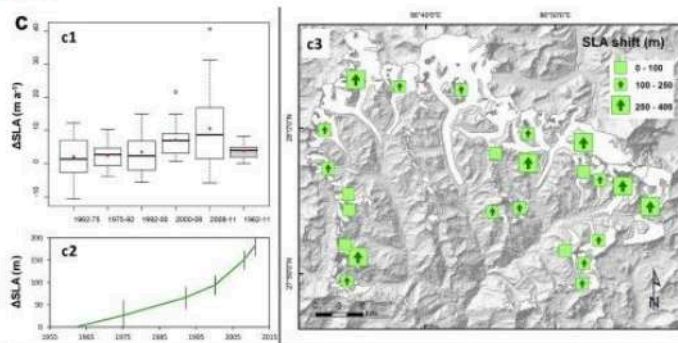
### Factors controlling the accelerated expansion of Imja Lake, Mount Everest region, Nepal

Published online by Cambridge University Press: 03 March 2016

Sudeep Thakuri, Franco Salerno, Tobias Bolch, Nicolas Guyennon and Gianni Tartari



## Glaciers



Tracing glacier changes since the 1960s on the south slope of Mt. Everest (central Southern Himalaya) using optical satellite imagery

S. Thakuri, F. Salerno, C. Smiraglia, T. Bolch, C. D'Agata, G. Viviano, and G. Tartari

## Indoor air pollution

Indoor air pollution exposure effects on lung and cardiovascular health in the High Himalayas, Nepal: An observational study

Lorenza Pratali<sup>a 1</sup>, Angela Marinoni<sup>b 1</sup>, Annalisa Cogo<sup>c 1</sup>, Kristian Ujka<sup>a</sup>, Stefania Gilardoni<sup>b</sup>, Eva Bernardi<sup>c</sup>, Paolo Bonasoni<sup>b</sup>, Rosa Maria Bruno<sup>a e</sup>, Luca Bastiani<sup>a</sup>, Elisa Vuillermoz<sup>d</sup>, Paolo Sdringola<sup>f</sup>, Sandro Fuzzi<sup>b</sup>  



Indoor pollution in high-altitude dwellings: An assessment of affecting factors across four Sherpa villages in the Khumbu region, Nepal

Enrico Duo , Rosa Maria Bruno, [...], and Annalisa Cogo  [View all authors and affiliations](#)

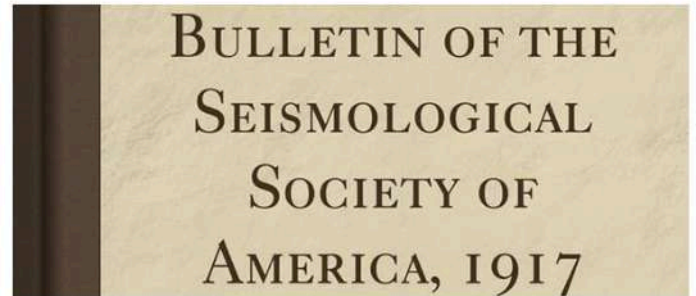
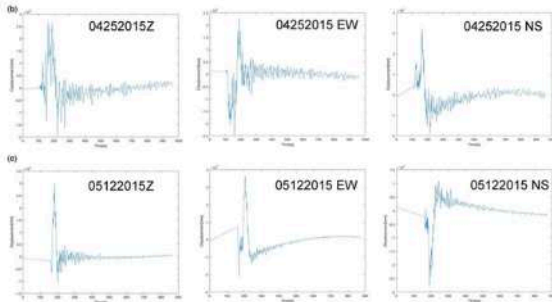
Volume 27, Issue 4 | <https://doi.org/10.1177/1420326X16676880>

# Scientific research

## Main result



### Sismology

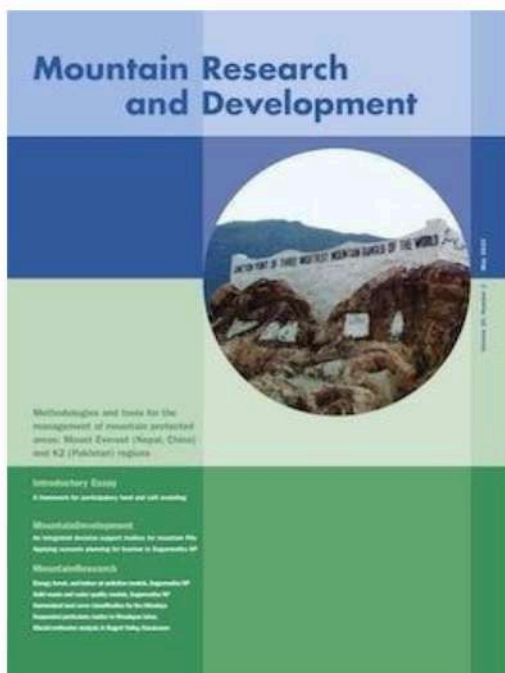


## Nepal earthquake evidence from GNSS data at the Everest Pyramid Lab

**Publication** Geological Society, London, Special Publications  
**Published** January 2019  
**Authors** G. Poretti | F. Morsut | F. Pettenati  
**DOI** <https://doi.org/10.1144/sp481-2017-71>

The station located at the Everest Pyramid Laboratory of EvK2CNR recorded its position coordinates during the earthquakes at the Gorkha (25 April 2015).

### Environmental management



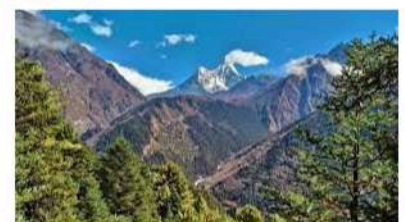
#### Solid waste



#### Energy



#### Foersts



#### Water quality



#### Tourism





## The Pyramid in Lombardy Region

The Everest Pyramid Laboratory Observatory was a highlight of Milano Design Week 2024, becoming an installation (17x17x11m) promoted by the Lombardy Region, positioned in Piazza Città di Lombardia. This installation told the story of the famous high-altitude laboratory: 35 years of technological, scientific, and industrial design innovation. It provided an opportunity to discuss the revival and future of the Pyramid Laboratory at the foot of Everest. During Fuorisalone, the Pyramid symbolized the mountains of the world, serving as a venue to promote them through events and raise awareness of their importance and fragility.

Inside, technical equipment, scientific instruments, and even furnishings developed over the decades specifically for the Pyramid were displayed. The first satellite phone from 35 years ago, sensors for climate monitoring in remote areas, photovoltaic panels—an essential part of the Pyramid's energy renewal—and a special edition of the "Miami" chair by Saporiti Italia, the historic folding chair born in 1983, which featured a special cover designed by Bob Noorda for the Pyramid Laboratory.

Also on display were three blocks of ice, each surface characterized by different conditions (clean ice, ice affected by darkening, ice covered by rocky debris). The melting of these ice blocks was monitored by researchers using a small indoor weather station. The collected data will allow for a physically based melting model to describe urban glacial melting in the three proposed scenarios. This urban glaciology experiment was conducted in collaboration with the Department of Environmental Science and Policy at the University of Milan.



**EvK2CNR**

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*High Altitude Scientific and Technological Research*



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