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SHARE
- Stations at High Altitude for Research in the Environment - an integrated project for monitoring and environmental research in mountain regions

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Summary

Ev-K2-CNR/SHARE Project contributes to the study of climate change and its related impacts and adaptation in mountain regions, providing information on atmospheric composition and climate, energy and water cycle, glaciology, limnology, biodiversity and natural resources, environmental medicine. This ultimately provides important benefits to governments, international agencies and international scientific community.

SHARE represents an international point of reference about integrated and multi-disciplinary studies at high altitude, aimed at strengthening systemic approaches to sustainable ecosystem management in sensitive areas.

Keywords

Mountain ecosystem, Protected Areas, environmental research, monitoring station, climate change.

Aims of the Project

The role of mountains as primary indicators of climate change was stated by the UN General Assembly that recognized mountains as ideal and representative locations for the study of climate change, promoting the enhancement of research efforts in these areas. Mountains represent 24% of the Earth surface and to protect these areas, environmental monitoring is essential. In this context, SHARE (Stations at High Altitude for Research in the Environment) Project intends to contribute to the study of impacts and adaptation to climate change, with special attention to water resources safeguard, conservation of biodiversity and fragile ecosystems and food security.

This Project aims at the implementation of long-term environmental programs in high mountain locations, to produce observations and high quality measurements, within the framework of relevant international research programs.

SHARE activities include: i) Scientific Research and Climate; ii) Technological Research and Climate; iii) Information System; iv) Capacity building. It provides a feasible framework of adaptation and mitigation strategies to improve understanding of climate change effects on agriculture, biodiversity, health, water resources, and livelihoods, supporting environmental management and decision-making policies especially in developing countries, in agreement with UNEP – Bali Strategic Plan.

Area of Study

SHARE focused its network in Asia (Himalaya and Karakorum, Nepal and Pakistan), in Africa (Ruwenzori, Uganda) and Europe (Apennines and Alps, Italy), with expansion to South America (Cordillera Real, Bolivia) in the planning stages.

Considering the role of mountains as extraordinary platform for monitoring climate change and early effects on Earth system, results achieved by the SHARE could be representative on a global perspective.

Methods

Data are collected through the 16 mountain sites listed in the SHARE network table. SHARE data archive is based at the Ev-K2-CNR Committee headquarters in Italy. Data from most SHARE Automatic Weather Stations (AWS) are available on WCRP/GEWEX/CEOP website, atmospheric composition data from the Nepal Climate Observatory – Pyramid (NCO-P) are available at the UNEP-ABC Data and Information Service Center (ABC-Disc) whereas trace gas data from NCO-P and Mt. Cimone station (Italy) at WMO-GAW-WDCGG archive. AOD data are visible at NASA/Aeronet website and limnological data at ILTER website.

SHARE Technological Research is developing a system to monitor atmospheric composition and climate in extreme environmental conditions of mountain regions. This innovative, integrated station, modular and flexible, would only use renewable energy, ensuring a low environmental impact.

SHARE Electronic Information System will collect information on ongoing monitoring activities in mountain environments. Data will be organized in a synergic and integrated archive, accessible to scientific community, concerned stakeholders, general public.

Results

Some of the recent results achieved in the framework of SHARE Project are summarized below:

Atmospheric and climate

SHARE Project is depository of longer climate monitoring record (15 years) at 5,000 m asl in the Southern side of Mt. Everest area. Since March 2006, continuous measurements of atmospheric composition are carried out at the NCO-P station, the highest observatory of UNEP-ABC monitoring program. These measurements allow to characterize atmospheric composition at a high Himalayan PA site: it may be influenced by air masses from high troposphere and stratosphere, as well as from pollutants transported at the local, regional, and continental scales while a high percentage of carbonaceous particles have been found.

Within the framework of CEOP, part of GEWEX of WMO's WCRP Programme, Ev-K2-CNR led the CEOP-High Elevations (CEOP-HE) working group aimed at improving the understanding of multi-scale variability and change in hydrological and energy cycles in high elevation regions.

Glaciology

Studies have been performed on the Changri Nup glacier in Nepal, Mt. Everest region and on the Baltoro and Liligo glaciers in Pakistan, K2 region to help the understanding of relationship between climate and debris-covered glaciers and to forecast glacier response to climate change on a decadal scale and impacts on runoff in high mountain regions. To quantify recent and ongoing fluctuations of ice mass, historical maps and photographs were analyzed together with the processing of satellite images. Field measurements were performed to validate remote-sensing data and to investigate variability and magnitude of surface ablation on the glacier tongues. Overall, preliminary results indicate that response of debris-covered glaciers to the current warming climate is a long-term negative mass balance.

Limnology

Limnological survey of lakes located between 4,500 and 5,500 m a.s.l. have been performed since 1992 in the Khumbu Valley, Nepal. Lake hydrochemistry reveals a constant increase of ionic content, probably related to glacier retreat. Analysis of benthic fauna shows shifts in species composition as response to the recent warming. Paleolimnological reconstructions could potentially provide proxy data of past climatic changes. Most striking result is the presence of Little Ice Age (LIA) and Medieval Warmer Period (MWP). Along time span covered by the core several episodes of climatic variation are observed; multi-proxies approach indicates an alternating stage of warmer/wetter and cooler/drier period.

In future lakes and wetland regions at a catchment scale will be integrated to focus on key drivers of aquatic system change and their interactions with global drivers at different time scales. A unified system of ecological indicators for monitoring freshwater, and new methods for defining reference conditions and restoration strategies will also be developed.

Discussion

Climate change effects and improper use of resources in mountain areas must be taken into account at political and administrative level. It is therefore necessary to strengthen the capacity for integrating climate change responses within national and international development process.

Main activities carried out in the framework of SHARE are developed in Protected Areas. In the Hindu-Kush-Himalaya-Karakorum, the two Natural heritages of Sagarmatha National Park and Central Karakorum National Park, and in Uganda, the Ruwenzori National Park, are key-areas to understand processes through which climate change could affect vegetation, herbivore and carnivore altitudinal distributions and their inter-relationships. SHARE project could concretely contribute to the development of interventions devoted to mountain ecosystems and PAs managements, improving environmental conservation and increasing national and local capacities. Therefore, benefits of this Project are to understand how climate change could affect mountains and learning how to manage and mitigate any adverse effects.

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