

## Abstracts

# CIRCLE-2 MOUNTain Kick-Off Meeting

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**UNIVERSITE**  
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**SAVOIE**

- Université de Savoie

Institute de laMontagne -



## Author Details:

Name: Marie CHENET

Institution: Paris 1 University, France

Email: [chenet@cirs-bellevue.fr](mailto:chenet@cirs-bellevue.fr)

## Abstract – ARNICA:

The **ARNICA project** focuses on a probabilistic assessment of slope hazards related to debris flows and landslides and their impacts on transportation networks in the context of future climatic change. We will tackle this issue through 5 work packages that focus on current and future climate scenarios, their impacts on the occurrence (frequency), run-out and spread of debris flows and landslides in three vulnerable Alpine regions located in France, Italy, and Switzerland, and a quantification of their consequences on national and trans-border transportation corridors from various hypotheses of frequentations by cars and trains or interruption of transportation corridors at the regional level. New approaches adapted to the operational needs of local and regional authorities and facilitated solutions for end-users will be proposed. This project involves four partners with different specialties including geomorphology, risk assessment, hydrometeorology and climate modeling.

Occurrence probabilistic models and susceptibility maps will be provided based on data bases constructed from direct observations and historical testimonies. Different climatic scenarios will be defined from downscaled output ensemble GCM techniques for three distinct periods (1960-2000, 2030-2060 and 2070-2100). In a subsequent step and based on the data on past events, their triggers and the occurrence of future precipitation events, the vulnerability of transportation networks to these slope processes will be documented. Direct and indirect costs of the dysfunction of national and trans-border road network analysis will be conducted to provide risk analysis and to quantify the risk of accidents (damage, fatalities). Help tools based on graph theory are proposed to local and regional authorities in charge of national network regulation. Tests of interruptions considering different socio-economic scenarios will be suggested to estimate costs and best solutions. The dissemination of the results will be assured through the direct involvement of the technical services in charge of land-use planning during the database construction phase and the diffusion of a film intended for the local authorities.

## Author Details:

Name: Hermann HAEUSLER

Institution: Dept. of Environ. Geosciences, University of Vienna, Austria

Email: [hermann.haeusler@univie.ac.at](mailto:hermann.haeusler@univie.ac.at)

## Abstract – EURAS-CLIMPACT:

The quality of global models on climate change depends on regional data input. In order to improve the knowledge on climate change impacts in high mountain regions at continental scale, we first apply state of the art – and newly developed – methods to assess climate change in Europe, and second, we will apply our methods to Central Asia, where data on environmental change, and in particular on glacier hazards are hardly available.

The **EURAS-CLIMPACT** initiative focuses on meteorological and climatologic aspects of glaciers and permafrost during the last fifty years. Therefore the change of four glaciers in Europe will be studied, namely the Pasterze- and Sonnblick Glacier in Austria, and the Storglaciären and Kårsa Glacier in Sweden, by reanalysing and downscaling global climate models of these regions. Based on these experiences, the impact of climate change on two glaciers in Central Asia will be quantified, namely on the Inylchek- and Karabatak Glacier in the central Tien Shan, where the Global Change Observatory "Gottfried Merzbacher" serves as a platform for international studies. The evaluation of reanalysing and downscaling global models in Central Asia will contribute to a better understanding of future IPCC- A1, -A1B and -B2 scenarios. Modelling the mass balance of the above described six glaciers compared to time series analyses of high resolution airborne and spaceborne remote sensing data such as CORONA, HEXAGON, LANDSAT-EM, ASTER, RAPID EYE, ALOS, TERRA SAR-X, digital camera- and thermal camera images will allow for assessing the change of these glaciers, and the increase of geo-hazards depending on climate change. As the European glaciers have been monitored since decades, an additional ground check of remote sensing data is mainly planned for the retreating but also advancing glaciers of the central Tien Shan.

The probably most important outcome of the EURAS-CLIMPACT project will be the proper dissemination of results to stakeholders, and capacity building at national and regional level. This is of particular interest for e.g. mountain risk engineering, and for tourist offices in Austria, for the authority of Land Survey and environmental research organisations in Sweden, and for regional and local mitigation measures to be undertaken by the Ministry of Emergency Situations in Kyrgyzstan.

## Author Details:

Name: Jean-Philippe MALET

Institution: Centre National de la Recherche Scientifique, France

Email: [jeanphilippe.malet@eost.u-strasbg.fr](mailto:jeanphilippe.malet@eost.u-strasbg.fr)

## Abstract - ChangingRISKS:

Landslides across the Alpine countries are recognised by practitioners, politicians and scientists as having a major socio-economic impact, and may represent a significant risk for the population and the properties in particular locations. Even if many scientific advances have been made in numerous fields of landslide research in the last 10 years, there is no consensus reached on an integrated concept and methodology for landslide risk assessment (1) adaptable to a large range of climatic, environmental and socio-economic conditions, (2) applicable to perform scenario analysis taking into account global changes (climate, landuse, socio-economic development), and (3) directly connected to the practical demands of the stakeholders.

The **ChangingRISKS** project intends to develop an advanced understanding of how global changes (related to both environmental and climate change as well as socio-economical developments) will affect the temporal and spatial patterns of landslide hazards and associated risks in two territories of the Alps, and how these changes can be assessed, modeled and communicated (through mapping procedures) to stakeholders.

The multidisciplinary background of the members could potentially lead to the development of new concepts and emerging strategies for mountain hazard/risk analysis in the context of global changes. The project work is focused on two mountain study areas located in France (Barcelonnette Basin, South East France) and in Austria (district Waidhoffen/Ybbs, Lower Austria). These research areas, characterized by a variety of environmental, economical and social settings, are severely affected by landslides, and have experienced significant landuse modifications and human interferences over the last century.

From a scientific viewpoint the main outcome is the development of a generic methodology for quantitative landslide hazard, vulnerability and risk assessment taking into account changing patterns in the conditioning factors. ChangingRISKS will improve our ability to forecast landslide hazard and detect future risk zones, and pave the way to new adaptation strategies in response of changes in the frequency of landslide events or in the exposure of the social system. From a technical viewpoint, the main outcome consists in the setting up of reliable solutions for mapping landslide susceptibility, hazard, vulnerability and risk in a quantitative framework, through the development and implementation of a GIS-based experimentation and demonstration platform.

Active stakeholders' participation is a key feature of the project. Stakeholders from governmental organisations dealing with various aspects of risks will be involved in the activities of the project, to guarantee user oriented development and feasible application of the results.

## Author Details:

Name: Nicolas VIOVY

Institution: Laboratoire des Sciences du Climat et de l'Environnement, France

Email: [viovy@lsce.ipsl.fr](mailto:viovy@lsce.ipsl.fr)

## Abstract - CAMELEON:

The combination of climate and land use changes has triggered important land cover changes in European mountains over the past 50 years. Interactive effects between land use and climate changes still represent a critical gap in our understanding of carbon dynamics. With **CAMELEON**, we attempt to understand and forecast changes in the carbon stocks and fluxes in mountain ecosystems. A key objective is to model the effects of climatic changes on carbon dynamics at the landscape scale, with explicit incorporation of land cover changes.

Our project targets three long-term mountain research areas located in Eastern Pyrenees (Spain), South-Western Alps (France) and Eastern Alps (Austria), representing contrasting historical and climatic contexts.

First, we will produce consistent and high-quality land cover and land cover change maps from 1950-onwards and model corresponding changes in Plant Functional Diversity (PFD). Our hypothesis is that PFD will provide a link between the variety of environmental drivers in complex terrains and carbon-cycle related ecosystem processes.

Second, we will provide a synthesis of on-ground measurements of carbon stocks and fluxes available in the three investigated areas. The database will be completed by using moderate resolution remotely-sensed data to characterize the seasonal and multiannual dynamics of vegetation. Then, we will evaluate the ability of a widely used ecosystem-process model (ORCHIDEE) to reproduce components of carbon dynamics in complex terrains. A new parameterization of ORCHIDEE featuring continuous changes of PFD along environmental gradients will be tested.

Third, we will develop downscaled, regional climate and land use change scenarios and examine their impacts on carbon stocks and fluxes for the 21st century.

Land use scenarios will be defined with stakeholders. Key findings will be summarized in short assessment reports and discussed with stakeholders and policymakers in workshops at the end of the project.

Our project is the first attempt to provide reliable and comparative regional-scale simulations of carbon dynamics in European mountain ecosystems that incorporate our best ecological knowledge of these hot-spots of biodiversity. It is a milestone towards a better understanding of climate and land use change impacts on carbon cycling in European mountains.

## Author Details

Name: Martin PRICE and Gregory GREENWOOD

Institution: Director of the Centre for Mountain Studies, Perth College UHI and Mountain Research Initiative (MRI), Switzerland/USA

Email: [Martin.Price@perth.uhi.ac.uk](mailto:Martin.Price@perth.uhi.ac.uk) and [green@giub.unibe.ch](mailto:green@giub.unibe.ch)

### Abstract - CCIVA research in Europe: Current trends:

Mountains cover 36% of the Europe's area and are home to 17% of the continent's population. When projecting future climates and evaluating CCIVA, the respective populations – both within mountains and downstream – are key factors to be considered. In this context, it is notable that the longest available records and the most dense recording networks are in the Alps, followed by the Carpathians, British Isles and Scandinavia. Added to these challenges of data availability, technical challenges of using climate models in complex terrain add to considerable uncertainties in providing inputs for CCIVA.

Within the mountain.TRIP (Transforming Research Into Practice) project, funded by FP7, an attempt has been made to identify all FP6, FP7 and Interreg projects funded by the European Commission in mountain areas. Of 110 projects identified, 28 considered climate change. About one third of these are still ongoing. About two-thirds of these projects include research in the Alps; other mountain ranges considered include the Nordic mountains, the Pyrenees, and the mountains of the Iberian Peninsula; very few consider Southeast Europe and the Carpathians. Projects on impacts have addressed particularly those on freshwater ecosystems, glaciated areas, and biodiversity and ecosystem change. A number of projects have considered hazard vulnerability and adaptive forest management. Apart from these, a relatively small number of recent projects have taken integrated approaches to climate change impacts, resilience, and adaptation.

Much CCIVA work has been, and is being, undertaken at the national level. Regional networks established by the MRI have identified a number of projects in the Carpathians and Southeast Europe. However, there is a lack of awareness of these studies both within the respective countries and more widely, sometimes due to language barriers. Further challenges are lack of access to funding, in applying for EU projects, and of cooperation.

Recently, the International Council of Scientific Unions proposed five "Grand Challenges" for earth system sciences - forecasting, observations, thresholds, responses and innovation - which overlap the themes emerging from Perth, and provide guidance for research in the future.

## Abstract continued:

An analysis of presentations given at the recent conference, 'Global Change and the World's Mountains', held in Perth, Scotland from 27-30 September 2010, provides indications of research strengths, gaps and emerging themes. Conference organizers used the Global Land Project analytic framework as a means to categorize presentations. When viewed through this framework, global change impacts on ecological systems and the response of those systems are the dominant themes of the community, with a much smaller but still surprising number of papers examining the functioning of the social system. Major gaps include global social change impacts on social systems and the interactions between social and ecological systems. There is very little research on the evolution of the entire land system, and especially on the conditions for achieving long-term sustainability.

Four major themes emerged from the conference as worthy of support:

1. long-term monitoring of both social and ecological systems
2. ecosystem services, their origins , quantifications and relevance
3. coupled human-earth systems analysis linking social and ecological models
4. communication for transfer and transformation

## Author Details:

Name:

Institution:

Email:

## Abstract - UNESCO and Mountain research needs in Europe and beyond:

The diversity and the fragility of mountain ecosystems make mountains good indicator sites to assess, study and monitor global and climate change impacts on the biophysical environment as well as on the livelihoods of mountain people. This was the starting point for the EC funded (and UNESCO, University of Vienna and Mountain Research Initiative sponsored) project "Global Change in Mountain Regions" (GLOCHAMORE) which worked at detecting signals of global climate change in mountains the world over. From 2003 - 2005, some 300 scientists participated in the GLOCHAMORE project encompassing a wide range of different scientific disciplines, including ecology, hydrology, glaciology, social sciences and economy. The project also served to create a network of study/monitoring sites in some 20 mountain biosphere reserves representing the major mountain ranges in all world regions. Biosphere reserves are in situ demonstration and study sites which contain protected areas (for environmental conservation) and non-protected areas (to foster sustainable development) which have been internationally designated under the UNESCO Man and the Biosphere (MAB) Programme.

As an outcome of the project, the GLOCHAMORE Research Strategy recommends specific actions to detect and monitor signals of global climate change in mountain biosphere reserves in the following main axes of causality for global change: climate, land use change, the cryosphere, water systems, ecosystem function and services, biodiversity, hazards, health determinants and outcomes afflicting humans and livestock, mountain economies, and society and global change (download GLOCHAMORE Research Strategy from <http://unesdoc.unesco.org/images/0014/001471/147170E.pdf>).

## Abstract continued:

Since 2009, the UNESCO follow-up project GLOCHAMOST (Global and Climate Change at Mountain Sites – Elaborating Coping Strategies for Mountain Biosphere Reserves) implements specific themes of the GLOCHAMORE Research Strategy in selected mountain biosphere reserves. These are:

Climate: to develop climate change scenarios

Land use change: to understand origins/impacts of land use change

Water: to assess water quantity

Biodiversity: to identify and monitor key fauna and flora

Mountain Economies: to assess employment and income

UNESCO considers the above-mentioned themes priority to assess and cope with global and climate change impacts on mountains. These themes are currently implemented on the ground in mountain biosphere reserves (BRs) in Europe (Berchtesgaden BR, Germany; Teberdinskiy BR, Russian Federation; Sierra Nevada BR, Spain; Swiss National Park and BR, Switzerland), and beyond (e.g. Mount Arrowsmith, Canada; Changbaishan BR, China; Nanda Devi BR, India; Huascarán, Peru; Kamchatka BR, Alaska (Russian Federation)).

## Author Details:

Name: Martin BENISTON

Institution: University Genève, Switzerland

Email: [Martin.Beniston@unige.ch](mailto:Martin.Beniston@unige.ch)

## Abstract - Climate Change and Mountain Areas – example ACQWA project:

As the evidence for human induced climate change becomes clearer, so too does the realization that its effects will have impacts on socio-economic systems and terrestrial ecosystems. Some regions are more vulnerable than others, both to expected physical changes and to the consequences they will have for ways of life. Mountains are recognized as particularly sensitive physical environments with populations whose histories and current social positions often strain their capacity to accommodate intense and rapid changes to their resource base. This proposal aims to assess the impacts of a changing climate, focusing on the quantity and quality of water originating in mountain regions, particularly where snow- and ice melt represent a large, sometimes the largest, streamflow component. There, they represent a local resource (freshwater supply, hydropower generation, irrigation), but in most cases also considerably influence the runoff regime of the downstream rivers and the related water availability. Such an influence is reflected mainly in the amount of surface water available for supplying irrigated agriculture and water supply systems, but also in the amount of groundwater recharge that can take place in river-fed aquifers. An increasing number of evidences of glacier retreats, permafrost reduction and snowfall decrease have been observed in many mountainous regions, thus suggesting that climate modifications may seriously affect streamflow regimes, in turn threatening the availability of water resources, increasing the downstream landslide and flood risk, impacting hydropower generation, agriculture, forestry, tourism and, last but not least the water dependent ecosystems. As a consequence, socio-economic structures of downstream living population will be also impacted, calling for better preparedness in developed countries and strategies to avoid the exacerbation of the already conflictual situation in many developing countries, like those in Central Asia and South America.

The goal of the project is to use advanced modelling techniques to quantify the influence of climatic change on the major determinants of river discharge at various time and space scales, and analyse their impact on society and economy, also accounting for feedback mechanisms. The focus will be on continuous transient scenarios from the 1960s up to 2050. In comparison to many existing studies, the limitation of the modelling horizon to mid of the 21st century allows to develop more realistic assessment of the progressive impact on the social, economical and political systems, which we expect to evolve typically in an adaptive mode on shorter time scales than the centennial ones, eventually shifting to new equilibria when forced abruptly.

## Author Details:

Name: Regula IMHOF

Institution: Vice-Secretary General of the he Alpine Convention

Email: [regula.imhof@alpconv.org](mailto:regula.imhof@alpconv.org)

## Abstract - Alpine Convention - Climate Activities and environmental observation:

### The Action Plan on climate change and the Alpine Convention working groups<sup>1</sup>

Effective as of 1995 the Alpine Convention is an international treaty signed in 1991 by the Alpine countries (Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia and Switzerland) and by the European Union to promote sustainable development and safeguard the interests of the local population while taking into due account the complex environmental, social, economic and cultural issues. In order to pursue this objective, a Framework convention and eight thematic Protocols on spatial planning, agriculture, forests, nature and the landscape, energy, soil conservation, tourism and transportation have been adopted.

The Alpine regions can contribute to the collective effort to cut the emissions of greenhouse gases by seeking appropriate solutions to address specific issues relating, in particular, to transport, energy efficiency of buildings, tourism, agriculture and water management. An important actor to do so is the platforms and working groups of the Convention.

### **The Water Management Platform in the Alpine Space**

The mandate of the Water Platform adopted in 2009 implies the assessment of the river basin management plans (RBMP), which are being developed within the framework of the EU Water Framework Directive, with a view to the necessary adaptation of the Plans in light of climate change, including considerations as to the effects on downstream areas. This assessment identified gaps in the RBMP, such as for example insufficient knowledge about the effects of climate change on quantitative aspects of water resources. It also highlighted the challenge of identifying residual flows taking into account changing climatic conditions and the future management of reservoirs. Important information on water resources and water management concerning alpine waters, under changing climatic conditions, has also been provided by the 2<sup>nd</sup> Report on the State of the Alps 'Water and Water Management Issues in the Alps'. Furthermore, the Water Platform has produced a report and guidelines on small hydropower in the Alps, which contribute concretely to implement the decision of the 10th Alpine Conference, which adopted the Action Plan on climate change.

## Abstract - continued:

### **The Ecological Network Platform**

Through this platform, Alpine countries seek to share, compare, and revise crucial information on measures and methodologies concerning the protection of biodiversity through the approach of ecological connectivity, both inside and outside protected areas. Biodiversity is highly at risk in the Alps because of climate and land use changes, fragmentation and habitat loss. The main objective of this Platform is the creation of an alpine ecological network, based on existing protected areas and the links between these areas. This is a long-term effort pursued in the first stage through the identification of 'pilot regions', which are particularly active in ecological connectivity. The active participation of the relevant actors of these regions is fundamental to this process.

Some representative examples described in a document, the 'Catalogue of Measures' (restoration of wetlands), have a clear link to climate change and contribute directly to improve ecological connectivity. The conservation, restoration and creation of ecological networks are considered as central elements of climate change mitigation by offering alpine species the possibility to shift their distribution ranges. The protected areas that form the core zones of this ecological network have identified the question of climate change as a crucial issue and are involved in the science of climate change assessment.

### **The Natural Hazards Platform (PLANALP)**

Adaptation to the impacts of climate change in the Alps, and notably to the increasing risk and intensity of natural hazards has been one of the key messages since the 2006 Alpach Ministerial Declaration and included in the 2009 Action Plan under the parts on Adaptation and Research and Awareness. Therefore, it is no surprise that the Action Plan refers to the Platform working on Natural Hazards, commonly called 'PLANALP', and requests specific actions to be taken. The first is to be the base structure to "document the effects on climate change on natural hazards in the Alps". However, the Action Plan is even more specific on natural hazards. The general objective is to "Promote an integrated approach to adapt alpine space to new climatic conditions and (...) better control natural hazards and limit their consequences." To this end, the Natural Hazards Platform has been empowered to implement a coordinated observation system on phenomena, by surveying current evolutions, mapping territories, giving priority to areas that are most at risk and assess the costs of damage linked to climate change. As regards the prevention and strategic management of natural hazards, PLANALP published a series of recommendations on the 'Integrated Natural Hazards Risk Management', touching on the following aspects: residual risk arising from natural hazards; adaptation to climate change; risk dialogue: information & education of the public; land use.

## Abstract - continued:

### **The Permanent Secretariat of the Alpine Convention**

The Permanent Secretariat of the Alpine Convention has been trusted with specific tasks regarding the implementation of the Action Plan on Climate Change in the Alps. The Permanent Secretariat has the primary responsibility to disseminate the Action Plan on Climate Change in the Alps and make it known to the general public as well as to more targeted audiences. The Climate Portal was launched in 2009 to that effect, using the occasion of the International Mountain Day (11th of December). The Climate Portal is still growing and contains different sections: one can check all the Alpine Space projects related to climate change, or discover how long is the list of good practice already on the database to provide inspiration to decision makers and local authorities. Resources have been selected for teachers and younger generations, as well as for the large public or concerning specific topics: tourism for example or a knowledge centre with links to all energy agencies of the Alpine territory (which could help, for example, in house refurbishment etc).

A concise brochure was published in March 2010, “the Action Plan in a Nutshell”, and this current publication intends to amplify the plan further. Finally the Permanent Secretariat is continuing to raise awareness on the issue of climate change in the Alps in all its actions, even, for example, producing a game on transit and traffic called “Transalpin”, to alert young people to the challenges of transport in the Alps. The Preamble of the Action Plan summarises perfectly: “This plan complements a full and complete implementation of the Protocols of the Alpine Convention by the Contracting Parties. The fight against the effects of climate change goes hand in hand with a real policy on sustainable development.”

### **The Climate Action Plan**

The Climate Action Plan is based on the collective commitments undertaken by the Alpine countries within the framework of the UN Framework Convention on Climate Change and the Kyoto Protocol. Its objective is to propose tangible measures specific to the Alps in terms of both mitigation and adaptation. The following are the nine strategic sectors which the 24 main objectives in the plan are divided into:

- Spatial and urban planning;
- Energy: heating, a key sector in the Alpine environment;
- Transport: promotion of the shift of traffic to more environment- and climate-friendly modes of transport;
- Tourism;
- Preservation of biodiversity;
- Water and water resources;
- Promotion of mountain forests and development of the wood production chain;
- Mountain agriculture;
- Awareness-raising and applied research.

## Author Details:

Name: Anuška ŠTOKA

Institution: Alpine space Programme, Joint Technical Secretariat (JTS)

Email: [anuska.stoka@alpine-space.eu](mailto:anuska.stoka@alpine-space.eu)

## Abstract - Alpine Space Programme:

The Alpine Space Programme is the EU transnational cooperation programme for the Alps. Partners from the seven Alpine countries work together to promote regional development in a sustainable way.

During the period 2007-2013, the programme is investing 130 Mio € in impact-oriented projects in which key actors develop shared solutions on specific Alpine issues as laid down in the programme objectives:

- Priority 1: Competitiveness and Attractiveness
- Priority 2: Accessibility and Connectivity
- Priority 3: Environment and Risk Prevention

The Alpine Space Programme 2007-2013 aims to increase competitiveness and attractiveness of the cooperation area by developing joint actions in fields where transnational cooperation is required for sustainable solutions. Derived from this overall objective specific objectives have been defined:

- to encourage innovation, entrepreneurship and strengthen research and innovation capacities for SMEs;
- to enhance a balanced territorial development to make the Alpine Space an attractive place to live, work and invest;
- to improve accessibility of the Alpine Space and to manage economical and environmental consequences of transport systems;
- to improve accessibility to services and connectivity within the Alpine Space;
- to protect, manage and enhance natural and cultural assets for sustainable development;
- to prevent and mitigate natural and technological hazards and manage their consequences, with specific regard to climate change impacts.