

Mountains under global change conditions

Mountains under global change conditions – excellence strategies for Austrian mountain research*Axel Borsdorf, Georg Grabherr & Johann Stötter*

The years 2006 to 2010 witnessed remarkable progress within Austrian mountain research. In 2006, the Austrian Academy of Sciences (ÖAW) established the Research Unit of Mountain Research: Man and Environment (IGF), upgraded into an institute in 2009. The University of Vienna and the ÖAW signed an agreement to implement the research network GLORIA (Global Observation Research Initiative in Alpine Environments) as a key research area of the IGF, led by the working group of Georg Grabherr in Vienna.

In 2009, the University of Innsbruck installed the research focus Alpine Space: Man and Environment with the aim of focusing research at the university alongside the other two foci in physics and molecular biology. In 2010, the alpS Centre for Climate Change Adaptation Technologies opened. It concentrates R&D activities spatially on mountain areas. In the same year, the Federal Ministry of Science and Research began supporting the Long Term Socio-Ecological Research Programme (LTSER) which aims to establish a new platform Tyrolean High Alps in addition to the existing alpine platform in the Eisenwurzen region of Styria.

These activities may be situated in Tyrol but they should be understood as a pan-Austrian field of research. A study evaluating mountain research worldwide (Körner 2009) ranks Austria in sixth place behind the USA, Switzerland, France, Germany and Italy. The University of Innsbruck with which all activities in Innsbruck are linked, holds the third place in a comparison of scientific institutions. Austria is still lagging behind the three large alpine countries and the USA. More efforts are needed to improve the position of Austrian mountain research internationally. There are encouraging signs: Georg Grabherr has put Austria on the map of mountain research with the EU project GLOCHAMORE (Global Change in Mountain Regions)

(Björnsen Gurung 2007). In Switzerland, an internal symposium looked at ways of securing the country's lead in international mountain research, possibly motivated by developments in Austria.

This volume tries to summarize research findings already achieved within these new initiatives and to provide an outlook for further research. In another form and with a different thematic focus this has been done before by the Austrian Academy of Sciences when it pulled together the results of international research programmes for the International Year of Planet Earth (Köck et al. 2009). Three years ago, the research activities at the IGF were also presented in book form (Borsdorf & Grabherr 2007).

This summary lays no claim to completeness, rather it concentrates on work done at the Institute of Mountain Research: Man and Environment. The institute maintains close links, however, with alpS, the research focus Alpine Space at the University of Innsbruck, the international research programmes of the Academy of Sciences and numerous networks of mountain research.

Chapter 1 provides an overview of Austrian mountain research. Günter Köck introduces the international research programmes, Roland Psenner and Reinhard Lackner write about the research focus of the University of Innsbruck and Matthias Monreal and Eric Vuilliet about the new alpS Centre for Climate Change Adaptation Technologies.

Chapters 2–5 present selected research at the IGF at its two locations in Innsbruck and Vienna. They describe some initial results but also new approaches being developed and identify open questions in reports on the current state of research. All authors of these chapters are, or have been, working at the IGF, be it as employee or contract researcher.

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Global change affects mountain regions in special ways. These largely near-natural and culturally traditional areas are ill prepared to cope. Climate warming is significantly stronger here than in the lowlands, economic globalization hits upon the competitiveness of the small scale, political globalization reduces decision-making competences, cultural globalization rapidly changes idiosyncrasies and identities and social globalization triggers dramatic changes in the population and social structure.

Against this background, chapter 2 deals with selected aspects of global change, the key research question at the IGF. Existing models and scenarios of climate warming are global in scale and do not do justice to the topographical differentiation of mountain regions. Christian Georges presents methods for regionalizing (downscaling) climate scenarios in order to be able to make reliable forecasts of potential impacts on man and the environment. Changes in the cryosphere have been analysed by many authors, the effects on permafrost in higher mountain areas in Austria have only very recently attracted the interest of researchers. Matthias Monreal and Johann Stötter report on the current state of research, introduce research carried out in Innsbruck and discuss the challenges for research in years to come.

The Global Observation Research Initiative in Alpine Environments (GLORIA) investigates the effects of climate change on high-alpine ecosystems. On more than 250 summits, in all major high mountain areas across the world, this network continually captures data in standardized form and collects them in a database. The GLORIA team at the University of Vienna and at the IGF coordinates the working groups (by now 77 in total), carries out comparative analyses in cooperation with its partners, advises them on the application of the standard methodology and maintains the database. In their two articles, Georg Grabherr, Harald Pauli and Christian Klettner introduce the research programme, exemplify it in the case of the GLORIA master site Schrankogel in the Tyrolean Alps and present results.

Apart from vegetation, soil is a sensitive indicator of ecological change. Clemens Geitner makes the case

for alpine soils to be understood as archives that yield insights into earlier changes in the ecosystem. Pedological studies are thought to be very valuable for assessing current processes and more reliable than just studying climate. Together with his student Christoph Wiegand he also reports on the current state of research on shallow soil erosion in grassland areas.

Living in the mountains is living with risk. This is the theme of chapter 3. Natural hazards such as earthquakes, mass movements, avalanches or floods endanger humans and infrastructures as do globalization processes. Johann Stötter and Matthias Monreal reflect on risk and adaptation strategies. Clemens Pfurtscheller and Klaus Kleewein analyse one particular event, the floods of 25 August 2005 in Tyrol. Rafael Sánchez takes the case of Santiago de Chile to investigate Andean mountain areas as danger zones and shows how much awareness of risk and coping strategies have changed over the centuries.

Many have noted that mountain researchers have so far focused too much on processes within abiota and biota, neglecting socio-economic aspects (Körner 2009). Risk research has already shown that such approaches fall short of the issues in question as natural processes always affect the human system as well, just as anthropogenous interventions affect the system of nature and only an integrative approach in the sense of research on man and the environment will do justice to complex systems of different mountain areas. Chapter 4 thematizes the future challenges for mountain regions and discusses some case studies.

Manfred Perlik looks at the Alps and their interaction with the strongly urbanized perialpine lowlands. A critical analysis begs the question whether mountain areas will in future be relegated to fulfilling leisure functions for metropolises at their rim and for lowlands further afield or if there are alternatives. This topic is also being discussed at the Forum Alpinum 2010 at the Bavarian Academy of Sciences. Taking cases from two areas, Oliver Bender points out the value of traditional land use for sustainable regional development. Mathilde Schmitt looks at the role of women in mountain areas. Sigrun

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Kanitscheider compares the issue of transit traffic across the Alps and the Andes. In the Alps, it is increasingly discussed in terms of negative effects on the quality of life, while in the Andes great hopes for the future are attached to an improved trans-Andean infrastructure.

This raises the question which strategies might achieve sustainable regional development in mountain areas. Carla Marchant tries to answer it for the Andes, as does Axel Borsdorf in his study on the expansion of hydropower in north-western Patagonia. Falk Borsdorf shows how UNESCO biosphere reserves can be turned into functioning model regions of sustainable development through participatory processes. Lars Keller develops a method for measuring – and implicitly improving – the quality of life across the alpine arc.

A variety of products have been developed at the IGF in recent years in collaboration with national and international partners. These products may be a highly valuable contribution to initiating sustainable spatial development processes in mountain regions. Brigitte Scott and Valerie Braun introduce *eco.mont*, the international *Journal on Protected Mountain Areas Research and Management*, which is issued jointly by the publishing houses of the University of Innsbruck and the ÖAW. In 2010, it is in its second year and has already become an important place for communication within protected mountain areas research and beyond. The volume *Mapping the Alps*, presented by its editors Ulrike Tappeiner, Axel Borsdorf and Erich Tasser, provides a comprehensive overview of the state of the Alps and with it the basis for identifying problem areas and for establishing development strategies tailored to the respective region. The Alpine Convention uses these maps for its status reports on the Alps. Oliver Bender, Axel Borsdorf and Kati Heinrich take the example of Austria to show how such a database may be leveraged by scientists, decision makers, business people and citizens as an instrument for developing hypotheses, regional analyses, assessing strengths and weaknesses, optimizing locations and for introducing the interests of citizens into regional politics in a targeted fashion.

These examples show that in a globalized world mountain research cannot be carried out in isolation or at national level. Processes interact globally and research has to recognize this state of affairs. Numerous international initiatives and research networks are proof that this has been understood (Borsdorf & Braun 2008). Astrid Bjørnsen's role at the IGF is one of establishing regional research networks in cooperation with the Mountain Research Initiative Europe and to develop them into effective instruments of international research cooperation. Taking the examples of Science for the Carpathians (S4C) and South Eastern European Mountain Research (SEEmore), she shows how to achieve international scientific cooperation through close networking. In the last chapter, Fides Braun introduces the FP7 EU project mountain.TRIP which aims to provide practitioners with scientific results, instruments, methods and products.

After reading this volume, some people will ask themselves if Austria really can go forward in mountain research or, to put it more pointedly, if the country might succeed in taking on a leading role in this area of research. Neither should be our aim, because research is international and should not serve national interests. As Paul Messerli noted in an internal paper from 2007, "The supremacy of themes over reference to a particular space (Alps) also means that alpine research must be embedded more deeply in the framework of international mountain research as has been picked up by the Austrian and Swiss initiatives. Clearly you can only be leading in mountain research if you are linked with others and in a position to codetermine the international research agenda."

If this book succeeds in raising mutual awareness of research internationally and encourage close cooperation among researchers then it has fulfilled its objective. At the same time, the book should give Austrian research politics pause for thought. In this country, mountain research receives at best rudimentary support, viz the low budgets for the research programmes Alpine Research, Man and Biosphere and Long Term Socio-Ecological Research and the history of establishing and imple-

menting ecological long-term research such as GLO-RIA. There is no doubt substantial need as witnessed for example by the figures for the ÖAW programmes. The most recent call for alpine research triggered proposals for € 1.02 million, with only € 370 000 available for distribution; in the latest global change tender, which contained many mountain research proposals, the ratio was € 2.1 million of proposals to € 200 000 of available grant.

Improving this situation, for instance through a large-scale research programme with an interdisciplinary orientation instead of a disciplinary one and including support for young scientists as well as capacity building, could be a big step forward in a research field that is extremely relevant for the future of an alpine state like Austria. Such a strategy would include creating institutions that are capable of collating research results, of documenting them and making them available – and possibly coordinating them better – and in this way creating added value for Austrian mountain research.

The decentralized structure, which has proved to be very efficient, need not be altered. However, Austria needs a centre of mountain research that can take on these tasks. These days much is being talked about excellence. Mountain research shows promising signs in this respect as should become clear in this volume, but we must not rest on our laurels. Top athletes need daily training as well as a trainer to keep up, let alone improve, their performance. Austrian research policy is called upon to establish a training centre and to take on the role of sponsor. It would make sense to seek international connections to realize such a project, for instance with Switzerland, the leading country in mountain research, rather than going it alone. Our interest is the same, let us undertake this jointly!

During the preparation phase of this book the UN General Assembly passed the resolution “Sustainable Mountain Development”. So it became evident that our book answers a research need formulated by the top international body. Bruno Messerli in his afterword draws together the thanks and underlines the significance of our work on sustainability in mountain regions.

Our thanks go to everyone who contributed articles or words of welcome to this volume. We are especially pleased about the welcome statements by the Minister of Research and Science, the President of the ÖAW and the Vice-Rector of Research at the University of Innsbruck. Eminent mountain scientist Bruno Messerli generously provided the afterword.

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