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Mountains in the third millennium – a decade of droughts and water scarcity?

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Droughts and water scarcity have touched the Alps, Mediterranean and East African mountain chains more intensively since the beginning of the third millennium and pose a major challenge for water management. The year 2011 has been no exception, with the lowest river levels on record over the past 50 years even for alpine rivers. Although considerable climate fluctuations and persistent droughts have occurred in the past, it is quite remarkable that the five hottest summers over the past 500 years in Europe and the Alps have all been concentrated after 2002, falling far outside their normal historical distribution. In most mountain chains drought phenomena are persistent over large areas and over a variety of scales. The hydrological consequences, such as decreased rain- and snowfall, drying of springs, decreased river and groundwater discharge, lowering of lake levels and excessive evaporation etc. are considerable. Seasonality has been considerably affected, with the summer extending well into the spring and autumn.

Mountain-fed rivers have experienced unusually low discharge over the last 10 years, with a decreasing trend both in summer and winter discharge. These hydrological changes have multiple impacts on availability of drinking water and the energy sector, decreasing hydroelectric production and availability of cooling water for the nuclear industry and negatively effecting river navigation, irrigation agriculture as well as winter tourism in mountains. Despite these naturally-induced shortcomings, adaptation has not always been rational. In some cases, maladaptation has led to overexploitation of water resources during drought conditions, exasperating water scarcity. For example, for the tourism sector in the Alps, water demand for drinking water and artificial snow making lies far above the available resources during the winter season for numerous resorts. This has long term environmental and socio-economic impacts such as destruction of wetlands, desiccation of streams and drinking water conflicts. However, Environmental Impact Assessments still lack consideration of climate change. Data availability and measurements are so sparse in these environments that proper interdisciplinary modelling has still to be developed and most predictions are based on conceptual model approaches.

Nevertheless, there is increasing necessity to adapt swiftly and rationally to droughts and increased climate irregularities in mountains. Some countries and regions have already adopted adaptation plans and strategies at the national level but they rarely consider mountain regions. Others have left it up to spontaneous adaptation at the local level. Even at the European level, there are few activities and policies yet dealing with adaptation to climate change under consideration of a combination of droughts, water scarcity or energy issues apart from the EU Strategy for Climate Change Adaptation planned for 2013.

Under such conditions, it is essential to carry out scientific observations and modelling as well as develop innovative indicators, for example via climate change witnesses identified amongst the local stakeholders as well as local and regional think tanks.