Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

EU 2007 DE

Time to Adapt – Climate Change and the European Water Dimension
Conference Concept and Introduction to Scientific Background

Developing adaptation strategies – the conference concept

The aim of this conference is to identify the impacts of climate change on the management and utilisation of European water resources and to develop suitable adaptation strategies. Several key sectors were selected for the analysis and discussion: water resources management (WRM), water supply and sanitation (WSS), agriculture, electricity, inland waterway transport and tourism. This approach is motivated by the idea that water resources management alone will not be able to deliver full adaptation, but that the success of adaptation efforts will depend on the contribution of other sectors which heavily rely on and influence water resources. The sectors that were chosen for this study are particularly relevant in terms of their vulnerability to water-related climate change impacts, their economic importance, and their potential to contribute to adaptation efforts.

Modern integrated water management approaches such as integrated water resources management at river basin level (IWRM) or integrated coastal zone management (ICZM) seek to find a balance of the water needs of different users and to involve all relevant actors and stakeholders in decision-making about water allocation and management. The protection of water resources and the long-term sustainability of water use is in the interest of all stakeholders alike, since all human activities rely to some extent on the availability of water in sufficient quantity and quality.

The conference concept takes into account both the need for individual sector contributions to adaptation efforts, and the need for an integrated approach and co-ordination between sectoral measures. For each sector, a discussion paper is available that presents challenges resulting from climate-driven changes in water resources, outlines possible adaptation measures, analyses relevant policy areas, and suggests key questions for discussion in the working groups. Each discussion paper also considers the relationships with other sectors, and the discussion of each sector's role in a comprehensive, integrated adaptation strategy is encouraged. The discussion paper on water resources management delivers a cross-cutting perspective and may be of interest to all working groups.

The conference organisers are aware that other sectors and areas such as forestry, built environment, human health, ecosystems and biodiversity will also be impacted by climate change, and will also have to be considered in adaptation strategies. However, in-depth discussions of challenges and adaptation measures for these issues would be beyond the scope of this conference - discussions should remain focussed on water-related climate change impacts. Comprehensive analyses of these issues can be found in recent relevant publications for instance by the European Environment Agency and the Intergovernmental Panel on Climate Change.

Introduction to Scientific Background

"Is this climate change?" was an often heard question during the hot summer months of 2006 in Europe. Whilst single events, like the summer 2003 heatwave or hurricane Katrina, cannot serve as evidence for a global phenomenon like climate change, they belong to a range of extreme weather events which are expected to occur more frequently in a warmer climate. And observations over the last century show that the climate is currently warming. Global mean surface temperature has been continually increasing over the past decades. Impressively confirmed by the latest IPCC-report, most scientists today agree that this change is largely caused by anthropogenic emissions of greenhouse gases (IPPC, 2007).

What has been observed?

Temperature and precipitation are the most important climatic drivers for the water cycle and changes in these parameters are expected to have considerable impacts.

During the last century, temperature has shown a relatively uniform increasing trend of 0.8-0.95°C over Europe (EEA, 2004). In winter, this warming trend has been accompanied by an increase in the number of both warm and cold spell days. Mean annual precipitation exhibited distinct regional differences and increased in Northern Europe by 10-40% while it decreased in some areas of Central Europe and the Mediterranean region by up to 20% (Klein Tank et al., 2002). Changes in seasonal precipitation patterns were also quite pronounced (see Figure 1).

Some of the resulting impacts on the hydrological cycle are already being observed today: eight out of nine European glacier regions are currently melting (see Figure 2); more extreme precipitation events are recorded; Central Europe, the UK and southern Scandinavia have reported prolonged drought periods in summer; Southern Europe experienced extended winter droughts and river discharge has consequently decreased markedly in many catchments; sea levels in the North Sea and Baltic Sea have been rising over the last century.

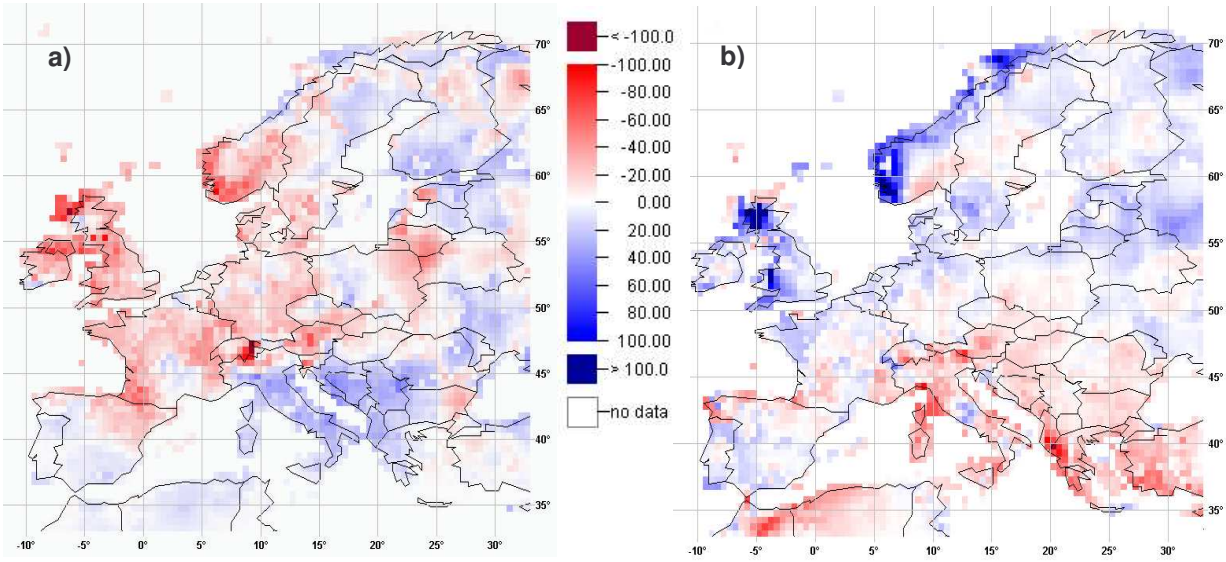

Figure 1 Observed changes in **a)** summer and **b)** winter precipitation (seasonal sums in mm). Shown is the difference in observed mean annual values between the recent period 1975/2004 and the reference period 1931/1960 (this reference period was chosen instead of 1901-1930, because many time series do not cover the first decades of the 20th century).
Source: PIK Global Climate Dataset, 2007.

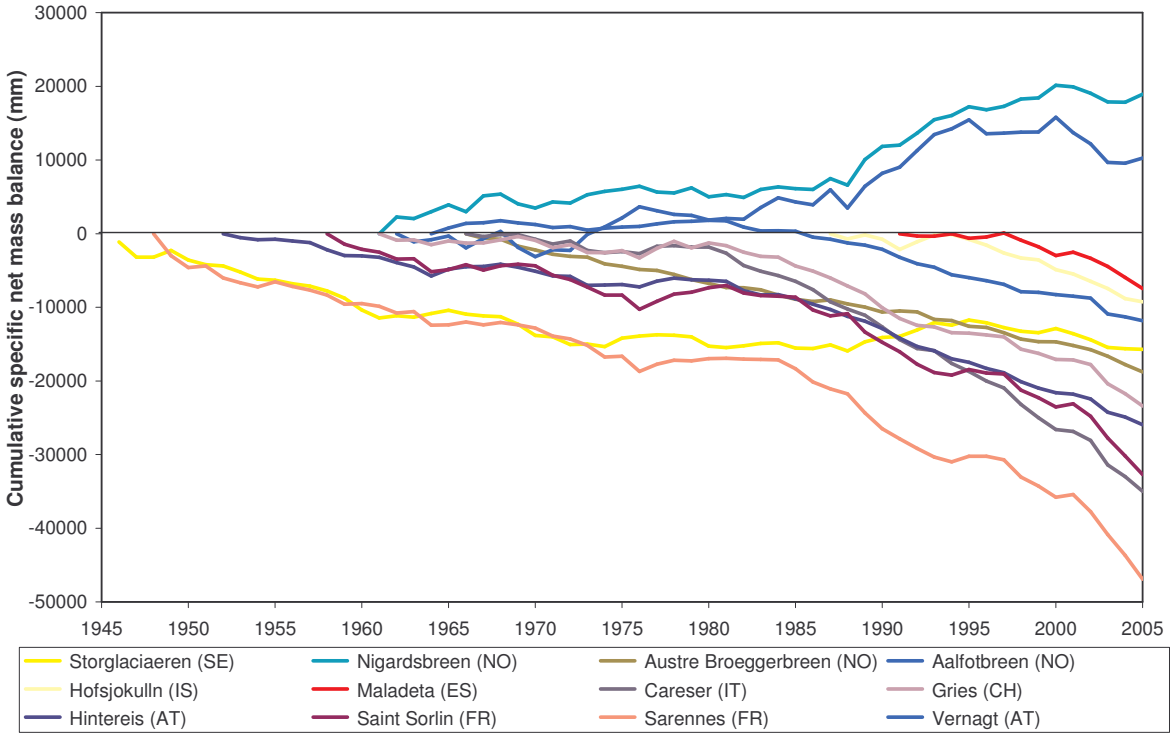

Figure 2 Change in cumulative specific net mass balance of glaciers from all European glacier regions between 1946 and 2005. Source: World Glacier Monitoring Centre, 2007.

What are the projections for the future?

Despite uncertainties about the degree of the projected changes, there is general scientific agreement that the observed trends of a changing climate are going to continue and are likely to intensify in some regions. Dependent on future greenhouse gas emissions, projections for the year 2100 anticipate the European mean temperature to rise by 1-5.5°C (IPCC, 2007). In winter, this warming trend is expected to be greater over Eastern Europe, in summer over the western and southern European countries (Georgi et al., 2004). In Northern Europe, winter warming is projected to be larger than in summer, with the reverse trend expected for Southern and Central Europe (Räisänen et al., 2004). Due to the complexity and various interacting factors in climatic processes, the impacts of climate change on precipitation and water resources will most probably show contrasting and site specific trends in the different European regions.

In **Northern Europe** mean annual and winter precipitation is anticipated to increase, with the latter reaching values of up to 15-30% by the end of the century (Georgi et al., 2004). Annual runoff is expected to rise accordingly, up to 10% by the 2050s and 50% by the 2080s. This would have beneficial effects on water availability and hydropower, but may be accompanied by higher risks of floods. In north-eastern Europe, for example, the magnitude of 100-year flood discharges might rise by more than 25% by the 2080s (EEA, 2005).

In **Southern Europe**, precipitation might experience pronounced reductions of up to 70% by the end of the century (Räisänen et al., 2004), but the occurrence of flash floods is still expected to rise. According to the projected drying trend for the Mediterranean, water availability is anticipated to decrease. In south-eastern Europe, summer flows could be reduced by up to 50% by the 2050s (EEA, 2005). Water stress is thus projected to rise, particularly in southern France and Italy, Spain, Portugal, and Greece. By 2080, 14-38% of the

population in the Mediterranean could be living in areas experiencing increased water stress (Schröter et al., 2005).

In **Central Europe**, large reductions in summer precipitation could occur by the end of the century, depending on scenario between 30 and 70% (Georgi et al., 2004 ; Räisänen et al., 2004). In winter, precipitation and the risk of snow-melt floods are anticipated to increase. Overall, a reduction in annual flows is expected.

In **Western Europe**, winter precipitation is projected to increase between 15 and 30% by the end of the century, while summer rainfall could decrease by 30 to 45% (Georgi et al., 2004). Western European countries might thus experience regularly occurring dry periods in the future, and the longest dry-spells could increase up to 50% by the 2080s (Good et al., 2006). At the same time though, the magnitude of 100-year flood discharges is expected to increase by 10% (EEA, 2005).

The projected impacts comprise inherent uncertainties which result from differences in climate models as well as unknown future development paths. Despite these uncertainties some trends are very clear: higher temperatures will alter snow melt dynamics and thus change the timing of maximum discharge. This will reduce water availability during spring and summer in snow and glacier fed river systems across Europe. Rising temperatures will cause the hydrological cycle to intensify and for most European regions, the frequency and intensity of extreme precipitation events and thus flood risks is projected to increase. In coastal regions, flood risks would be further intensified by the anticipated rises in sea levels, which could reach 1 to 7 dm by 2050. These developments have the potential to negatively impact on water quality and to disrupt water supplies. It is thus time to prepare for a future in which the availability of water will become increasingly variable.

For more detailed information visit the conference website www.climate-water-adaptation-berlin2007.org.

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