Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03042, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03042
EGU General Assembly 2008

Global overview on distribution and changes of glaciers and ice caps

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Glaciers are an important freshwater resource, the dominant non-steric contributor to current sea level rise, and a cause of natural hazards. Because they are typically close to the melting point and react strongly to climatic changes, glaciers provide some of the clearest evidence of climate change and constitute key variables for early-detection strategies in global climate observations.

In 2007, UNEP complemented the IPCC 4th Assessment Report with an illustrated thematic assessment report entitled ‘Global Outlook for Ice & Snow’. We will present the results of our chapter within that report on glaciers and ice caps. We provide a brief overview of international glacier monitoring, available datasets, in addition to the main topic of glacier changes since the Little Ice Age, impact on the water cycle,

sea level change, and natural hazards. We conclude with considerations of anticipated changes during the 21st century.

Internationally coordinated glacier monitoring was initiated in 1894 and has resulted in an unprecedented dataset of information about spatial glacier distribution and changes over time. Today, the collection and distribution of glacier data and information is coordinated within the Global Network of Glaciers under the lead of the World Glacier Monitoring Service (WGMS; http://www.wgms.ch) in close cooperation with the National Snow and Ice Data Center (NSIDC; http://www.nsidc.org) and the Global Land Ice Measurements from Space (GLIMS; http://nsidc.org/glims) project.

Glaciers and ice caps around the globe have been shrinking dramatically since their Holocene maximum extent towards the end of the Little Ice Age, between the 17th and the second half of the 19th century, with increasing rates of ice loss since the mid-1980s. On a time-scale of decades, glaciers in various mountain ranges have shown intermittent readvances. However, under the present climate scenarios, the ongoing trend of worldwide and fast, if not accelerating, glacier shrinkage on the century time-scale is not a periodic change and may lead to the deglaciation of many mountain regions by the end of the 21st century.

Glacial retreat and melting of permafrost will alter alpine hazard zones. Given the increasing socio-economic development of mountain regions, altered hazard zones will most probably lead to hazard conditions beyond historical precedence. With an estimated potential sea level change equivalent between 150 and 370 mm (i.e., if all glaciers and ice caps, excluding the ice sheets in Greenland and Antarctica and peripheral ice bodies, melted away), glaciers and ice caps represent a considerable component of sea level also in the future. Glacier shrinkage and loss will strongly affect the seasonal availability of freshwater, especially considering the shrinkage occurs simultaneously with reduced snow cover and earlier snowmelt. The most critical regions will be those inhabited by large populations that depend on melt water from glaciers and snow, and glaciated mountain ranges that are densely populated and highly developed.