Geophysical Research Abstracts, Vol. 7, 10131, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10131

Consequences of current climate-glacier disequilibrium for streamflow in the North Cascades, Washington, USA and Pennine Alps, Switzerland

D. Collins (1) and M. Pelto (2)

(1) University of Salford, Manchester, UK, (2) Nichols College, Dudley, MA, USA
(d.n.collins@salford.ac.uk / Fax : +44 161 295 5015 / Phone: +44 161 295 4519)

That alpine glaciers are experiencing a period of disequilibrium resulting from changes in climate is evident in many regions of the world. Rising temperatures might be expected both to reduce the mass of water stored as glacier ice and to enhance runoff from montane glacierised basins. River flow has been monitored at two stations in adjacent basins in the North Cascade mountains, Washington, USA between 1984 and 2004, and at four stations within the upper Rhône basin, Switzerland, since 1955, together with climatic variables in both areas, with a view to examination of the impact of climate on glacier mass and runoff.

In the North Cascades, 47 monitored glaciers have retreated, five of which have disappeared. Average annual balance on eight measured glaciers was -0.41 m a^{-1}, and remapping glacier longitudinal surface profiles indicates that thinning was as great in accumulation areas as near termini. Runoff in winter (November through March) has increased in both Thunder Creek (14% glacier cover) and Newhalem Creek (ice-free) through rain on snow events, despite a slight (1%) decrease in winter precipitation. Whilst earlier melting of reduced winter snowpack has increased spring runoff (April-June) by 5-10%, summer runoff decreased by 27% in Newhalem basin. Runoff in Thunder Creek contrastingly increased by 2%, observed net ice loss accounting for 8% of mean summer streamflow.

In the upper Rhône basin, summer (May through September) runoff increased by 55% in the 66% glacierised Aletschgletscher basin, and by 25% in the Lonza basin in which ice cover declined from 40.6 to 36.5% in the same period. In the 1.8% glacierised Grande Eau basin, flow declined by about 28%. In both the western cordillera and

European Alps, differences in climatic regime notwithstanding, summer streamflow was reduced in basins with no or little ice-cover. In more highly-glacierised basins in both areas, enhanced melt in glacier basins has been offsetting the loss of runoff from reduced levels of precipitation, which suffered small decline in the North Cascades, but sustained diminution in the Alps (precipitation less than the long term average for much of the period since 1980). This trend of summer streamflow being increased by destocking of ice from glacier storage can not continue for ever, however, as the areal extent of glaciers continues to decline on both continents.