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Accelerated worldwide glacier shrinkage

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Evidence is becoming stronger of accelerated glacier shrinkage if not even disappearance at a global scale. Compared with the two decades between 1980-1999, the average rate of loss of 30 reference mass balance glaciers with uninterrupted time series has doubled since the year 2000. The previous record mass loss in 1998 was exceeded already three times (in 2003, 2004 and 2006) and the new record loss in 2006 is almost twice that of the previous record loss in 1998. The average annual mass loss of 0.58 m water equivalent (w.e.) of the same glaciers for the decade 1996 - 2005 is more than twice that recorded between 1986-1995 (0.25 m w.e.) and more than four times that of the period 1976-1985 (0.14 m w.e.). Satellite-based determination of average loss rates of large glacier ensembles during the past decades confirms this trend. Certain regions, for instance, southern Alaska indicate even significantly higher losses. In the European Alps, glaciers have lost about half their total volume (roughly - 0.5% per year) between 1850 and 1975. Another 25% (or - 1% per year) of the remaining amount has vanished between 1975 and 2000 and an additional 15 to 25% (or - 2 to 3% per year) was lost in only the first few years at the beginning of our century. Extrapolation of the observed trend using numerical modelling approaches leaves no doubt that small- to medium-size glaciers in many mountain ranges could disappear within the coming decades and that large glaciers may develop extreme disequilibria. Positive feedbacks due to albedo changes and mass balance/altitude coupling are likely to play an increasingly predominant role. Phenomena of glacier downwasting and collapse can indeed be observed more and more frequently. Resulting run-away effects strongly contributes to sea level rise from large glaciers; impacts on landscape evolution, local hazard situations and the seasonality of the water cycle must be expected even in the case of small- to medium size glaciers. Modern glacier inventories based on digital elevation models open new perspectives on the documentation of ongoing changes and application of corresponding information to practical problems at local, regional and global scales.