Geophysical Research Abstracts
Vol. 13, EGU2011-8824-1, 2011
EGU General Assembly 2011

The Adamello Glacier (Central Alps): areal and volumetric variation since the Little Ice Age

Carlo Baroni (1), Maria Cristina Salvatore (2), Andrea Tamburini (3), and Alberto Carton (4)

(1) Universita' di Pisa, Dip. Scienze della Terra, Pisa, Italy (baroni@dst.unipi.it, ++39-050-2215800), (2) Universita' di Roma "La Sapienza", Dip. Scienze della Terra, Roma, Italy (mariacristina.salvatore@uniroma1.it), (3) IMAGEO S.r.l., Universita' di Torino, Italy, spin-off company (a.tamburini@alice.it), (4) Universita' di Padova, Dip. Geografia "G. Morandini", Padova, Italy (alberto.carton@unipd.it)

More than 140 glaciers developed during the Little Ice Age on the Adamello - Presanella Group covering an area almost the double of their present surface. Glaciers of the Adamello-Presanella retain a relevant and strategic water resource, available, easily accessible and not substantially polluted. The melting of these glaciers during the summer regulates the flow of rivers Adige, Oglio, Sarca, and Chiese, concurring to maintain balance in the levels of prealpine lakes (lakes Garda, Iseo, and Idro).
Since the middle of the 19th Century there was an important reduction in thickness and area extension of glacier bodies, broken by brief and weak advances, the most recent of which is around the 1980 AD. The notable regression of the fronts is marked by withdrawals ranging from several hundred meters to more than 2000 m.
Here we present new data on both areal and volumetric Holocenic variations of the Adamello Glacier, the widest glacier of the Italian Alps. Through detailed geomorphological and glacial geological field surveys aided by photointerpretation, we reconstructed the Little Ice Age glacial limits; areal variations occurred in the 20th and 21th Centuries have been inferred from historical maps and multitemporal aerial photographs. On the basis of detailed maps, precisely dated positions of the front of the Adamello glacier have been reconstructed and used for checking the time-distance curve obtained from annual glaciological surveys (conducted since the beginning of the 20th Century by the Italian Glaciological Committee). All the collected data have been georeferenced (photographic documents using a direct linear transformation to correct tilting and relief displacement) and managed using a GIS for evaluating the most relevant quantitative parameters.
Between the maximum LIA extension and 2007 AD, the Adamello glacier lost about 36% of the total area, while the mean value for entire Massive (including the Presanella Group glaciers) is about 40%. The most vigorous retreat of glacier terminus occurred between the first years of the 20th Century and 1959 AD. At present, we record not only frontal retreat but especially a noteworthy reduction also in the highest portions of the accumulation area. During the last ten years, the entire glacier was thinning and shrinking also at the highest elevation; the annual residual snow was on several occasions confined to small patches, if any was present. As a consequence, rocky windows created within the glacial body and are continuously widening.
Comparing Digital Elevation Models, expressly reconstructed, we calculated volumetric reductions occurred between LIA and 2007. To calculate the total volume of the glacier in the considered years, we have used the bedrock contour obtained from ground penetrating radar surveys (GPR).
Data on mass balance variations show that the Adamello glacier lost about 60% of its volume in 160 years (between LIA and 2007 AD) and about 30% in only 30 years (between 1982 and 2007). Data collected allow us to estimate the amount of ice melting as a consequence of global warming and evaluating future availability of melt-water.
Moreover, in recent years, the Adamello Glacier and other glaciers in the Group have been found completely below the limit of perennial snow, suffering significant areal and volumetric reduction. Only the inertia of the masses of ice against the merger has allowed them to overcome the most critical stages: the serious imbalance that seems to characterize glaciers compared to current climatic conditions suggests that if this situation will last, we should wait for further dramatic reductions in areal extension and thickness of most glaciers located in the Adamello-Presanella Group.