Highlights: Alpine Water Resources

Our project aims at a detailed understanding of the processes of snow accumulation and ablation in Alpine environments, as well as their climatic sensitivity, in order to improve future investigations concerning the impact on water resources availability due to future climate scenarios.
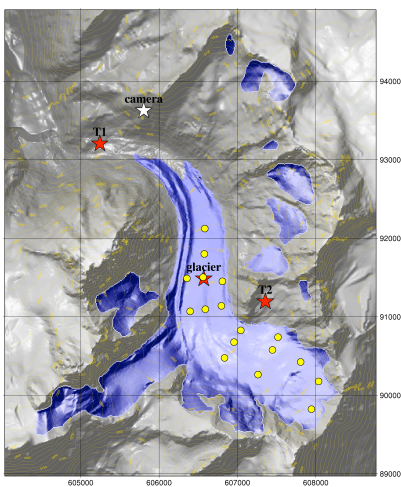

Fig. 1 Digital elevation model of the Haut Glacier d'Arolla basin. Indicated in blue is the glaciated area (5.3 km^2). In red is the locations of automatic weather stations, in white the location of the automatic camera and in yellow the locations of accumulation/ablation stakes. The total area of the catchment is 13 km^2 and the elevation range is from 2500-3800 masl.

The project Alpine WAter Resources: monitoring and modeling through continuous Simulation of ice and snow cover mass balance – AWAS – aims at improving the detailed understanding of the processes of snow accumulation and ablation on Alpine environments, as well as their climatic sensitivity. The main task is assessing water resources in snow covered and glaciated basins through continuous modeling of distributed snow and ice mass balance. The research site is the Haut Glacier d'Arolla in southwestern Switzerland. The intention is to use a highly instrumented site in the Alps for testing and implementation of process based mass and energy balance models, which could be applied in other mountain regions of the world. We now have a continuous series of meteorological measurements since 2000.

Aside from our continuous measurements, which contain 3 automatic weather stations, 2 automatic cameras and ablation/accumulation stakes (*Fig. 1*), we also evaluated digital elevation models from 1999 and 2005 in order to estimate total ice loss for this period.

The estimated ice volume loss for this period (*Fig. 2*) is about 40 million m^3 (10% accuracy), which is around 25% of the total runoff for this period. The rest of 75% available water comes from snow (60%) and

rain (10%). The net specific mass balance for the glaciated areas is -7.5 m.

It is therefore important for water resources management to understand the distribution of snow in the basin, as it seems to be controlling factor for the form of the discharge hydrograph, and therefore the availability of water throughout the melt season.
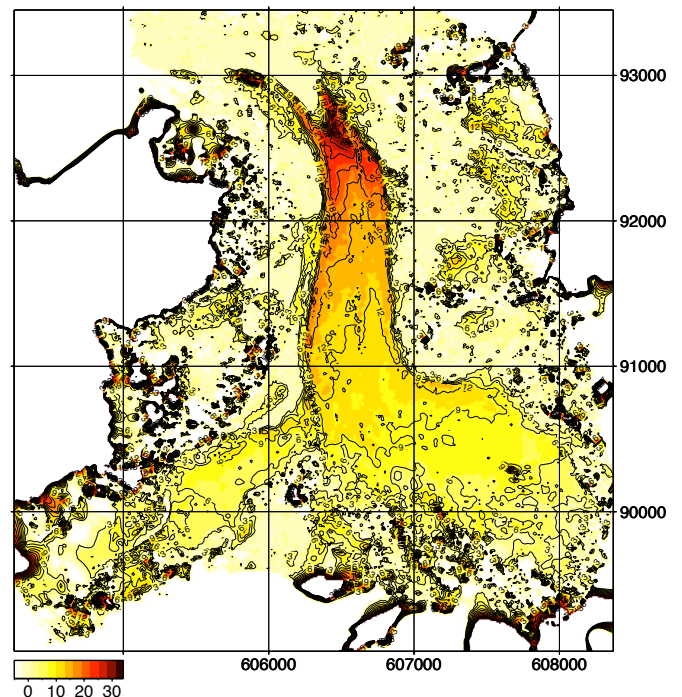

Fig. 2 Difference [m] in elevation on Haut Glacier d'Arolla from 1999-2005, estimated from DEM's. The accuracy is 2 m in non-glaciated areas and 1 m in glaciated areas. Maximum ice loss is at the glacier tongue with 34 m. The average ice loss is 7.5 m.