

Quantification of glacier contribution to runoff in a Chilean Andean basin with snow-glacier driven regime

M.Paz Bobadilla (1) and Ximena Vargas (2)

(1) Universidad de Chile, Santiago, Chile (mbobadilla@ing.uchile.cl), (2) Universidad de Chile, Santiago, Chile (xvargas@ing.uchile.cl)

Glaciers in mountainous regions play an important role in the basins located in such landscape. However, assessing their contribution is a complex task due to difficulties in taking appropriate measurements that could help to clarify this aspect. Most of the glaciers in the Andes within Chilean territory have shown glacier recession, which added to the hydric stress in the zone, making interesting to quantify their contribution.

The Cachapoal river basin is located in the Andes in central Chile. The study area is defined by the Cachapoal en Puente Termas gauge, covering approximately 2448 km², where 9% is cover by glacier. The basin shows a snow driven hydrological regime, strongly conditioned by the presence of glaciers, which are distributed in 4 of the 6 main sub-basins.

The basin hydrology is modeled in natural regime at daily scale using the WEAP model (Water Evaluation And Planning System), using scarce meteorological information as input. A simplified glacier module is included to characterize its processes and estimate its contribution to the total runoff.

The glacier contribution to runoff is studied, differentiating between normal, wet and dry years, which are defined by exceedance probability intervals of the annual precipitation using 44 years of information of the Rengo gauge. Thus, a normal year shows an annual precipitation between 473 mm and 622 mm, while the annual rainfall in a wet year is higher than a normal year and lower in a dry year.

The results show that glacier contribution to the total runoff is significant, reaching 42%, 65% y 24% in the summer period in a normal, dry and wet year respectively. The glacier contribution becomes more significant in dry years, where it is estimated to contribute 40% of the mean annual streamflow.