Geophysical Research Abstracts
Vol. 13, EGU2011-14095, 2011
EGU General Assembly 2011

The Hydroelectric Power in mountain rivers: evaluation of the optimal flow rate

Claudia Dresti, Marzia Ciampittiello, and Houli Saidi
C.N.R.-Institute for Ecosystem Study (ISE), Largo Tonolli 50/52, 28922 Verbania Pallanza, Italy

Mountain rivers are some of the most important ecosystems because of their particular characteristics, such as low pollution, different habitats and high biodiversity, from source to plane. Too often, however, their water is used for hydroelectric power without a correct management of the hydro-morphological impact. These impacts can be recognized because of the typology of withdrawal, bank and river bed artificialization and the break of the river continuum, in term of fish passing and sediment transport. Moreover, in particular in these last 10 years, climate change is becoming very important, even in mountain regions that are characterized by a very high precipitation, such as in the Lake Maggiore catchment, into the Piedmont Region. In this catchment the annual precipitation is around 1700 mm, against 900 mm that represents the Italian average. Analyzing the last 30 years (1971-2000) it is possible to verify that the decreasing of the total precipitation into Lake Maggiore area is around 20-30% but the decreasing of the rivers flow is much more: 40-50%. On the contrary an increase of the extreme events that are causing a lot of problems of slope instability and river hydromorphology has been registered. This fact doesn't help the improvement of the water resources.
An important help to quantify the global quality of the river ecosystems, biological and hydro-morphological, considering the effect of climate change too, arrives from the European Community with the Water Framework Directive (2000/60/CE).
In the light of what is required by the WFD, it is necessary to analyze the hydro-morphological impact on rivers and their consequences on the biological community for defining river basin management plane to improve ecosystem quality for the year 2015. The first important thing to do in order to improve the river quality, is defining a correct flow regime downstream of the dam: an Optimal Flow. This Optimal Flow has to take into account the morphological natural evolution, the biota and the use of water according to the climate change. The first study on the definition of the optimal flow was developed using the method CARAVAGGIO (Core Assessment of River hAbitat Value and hydro-morpholoGIcal condition) into the Ossola Valley on 36 study points on the main inflow of the R. Toce, all used for hydroelectric power generation. This method is standardized at European level and with its application on rivers it is possible to know the hydro-morphological quality and the impacts present, with the index Habitat Modification Score (HMS), the habitat quality with the Habitat Quality Assessment Score (HQA) and the hydraulic characteristics with the Lentic-Lotic River Descriptor (LRD). These indexes were calculated for each river and used to define an Optimal Flow starting from the regional formula for the Minimum Flow Rate. The CARAVAGGIO indexes were introduced into the formula and, using the discharge flow measured during the application of the method, the optimal value of the discharge flow downstream the dam was calculated.