MODELING A HYDRAULIC JUMP WITH A TWO DIMENSIONAL FLOW MODEL; A COMPARISON WITH A PHYSICAL MODEL

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Summary. This paper presents a comparison between a physical model and a 2-dimensional numerical model (InfoWorks 2D) of a spillway. Two dimensional (2D) flow modeling is becoming widely used in river hydraulics. The 2D modeling can go beyond and cope with a variety of hydraulics scenarios as hydraulics structures.

The experimental study was carried out comparing the hydraulic model with a set of theoretical tests for which analytical solutions are known, and then contrast the model simulation against the real physical model results, built in the Technical University of Madrid.

Four different scenarios were tested. Each scenario is a combination of one flow and one variable "a" (height of the wall at the end of the model).

Flow (l/s)	15	30	45	60
a (cm)	6.5	8.8	10	10.5

Table 1: Four different scenarios

On each scenario, the depth was measured on eight different positions. The roughness in InfoWorks is built on the projection of the horizontal, instead of on the real slope (InfoWorks is designed to model natural streams with small slopes). In order to assign a Manning coefficient (n) to model the real losses on the spillway, a corrected Manning (n') should be applied. Using the energy losses equation in both, physical and numerical model and considering that n on the horizontal is 0.010, n' on the spillway is 0.0277.

The results on the set of flows of 15, 30, 45 and 60 l/s show differences in a range from 3% 12%, in depth and in a range from 1% to 3%, in energy losses.

These differences are due to the fact that the flow is 3-dimensional, and not 2-dimensional, as it is modeled by InfoWorks. In the physical model the 3-dimensional flow increases the losses.

Notwithstanding this, the energy loss from 68 % to 74 % in the physical model and from 67% to 71% in the numerical model, give similar results and make the numerical model suitable for modeling these kinds of spillways.

Therefore, the results obtained, prove that both solutions, analytical and physical, are very similar. Even taking into account that a hydraulic jump has a 3-dimensional behavior, it can be modeled quite accurately with a 2-dimensional model.