



## **A dynamic rating curve approach to indirect discharge measurement.**

F. Dottori, M.L.V. Martina, and E. Todini

Università di Bologna, Dipartimento di Scienze della Terra e geologico-Ambientali, Bologna, Italy  
(francesco.dottori@unibo.it)

The operational measurement of discharge in medium and large rivers is mostly based on indirect approaches by converting water stages into discharge on the basis of steady-flow rating curves. Unfortunately, under unsteady flow conditions, this approach does not guarantee accurate estimation of the discharge due, on the one hand, to the underlying steady state assumptions and, on the other hand, to the required extrapolation of the rating curve beyond the range of actual measurements used for its derivation.

Historically, several formulas were proposed to correct the steady-state discharge value and to approximate the unsteady-flow stage-discharge relationship on the basis of water level measurements taken at a single cross section, where a steady state rating curve is available. However, most of them are either over-simplified or based on approximations that prevented their generalisation. Moreover all the mentioned formulas have been rarely tested on cases where their use becomes essential, namely under unsteady-flow conditions characterised by wide loop rating curves.

In the present work, a new approach, based on simultaneous stage measurements at two adjacent cross sections, is introduced and compared to the approaches described in the literature. The comparison has been carried out on channels with constant or spatially variable geometry under a wide range of flood wave and river bed slope conditions. The results clearly show the improvement in the discharge estimation and the reduction of estimation errors obtainable using the proposed approach.