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Hydrology and Earth System Sciences Discussions

Interactive comment on "Comment on "A dynamic rating curve approach to indirect discharge measurement" by Dottori et al. (2009)" *by* A. D. Koussis

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Referee #2 (2010) disagrees with my position that using two gauges to measure water level is inconvenient, or difficult to apply properly, or may not be feasible at all. Stating that the use of two gauges has been proposed about 10 years ago, Referee #2 summarises some of that work and also comments that all the referenced methods, including the one by Dottori et al. (2009) [DMT], suffer from the drawback that they "require knowledge of at least one directly measured discharge for the calibration of the model parameters"; this requirement is attributed to "the quasi-stationarity hypothesis".

The Comment of Referee #2 closes with a brief account of the method of Aricò et al. (2009), which "does not require the use of any instrumentation for velocity measurement", and of applications of that method to the rivers Arno, Tiber and Vallo di Diana in Italy (three stage gauges were used in the Vallo di Diana). Referee #2 rates the performance of the method as good, given the data uncertainties.

First, I would like to note that I interpret the term "quasi-stationarity" used by Referee #2 as relating to transient, or unsteady flow, rather than to a statistical-stochastic property of a time series. Regarding the applications of the method of Aricò et al. (2009), I still maintain my reservations about the availability of two, or three, properly placed gauges, for the reasons laid out in my Comment to the work of DMT; however, when the stage values themselves, not their differences (i.e., the surface slope) enter in the calculations, the particular gauge locations are less important than in the DMT method. Nevertheless, the statement of Referee #2 that "Worse results were obtained in the Tiber river, where the location of the peak water depth was subject to large uncertainty and major roughness heterogeneity occurs." reinforces my reservation that a "required extrapolation of the rating curve beyond the range of actual measurements used for its derivation" can be carried out based on the calibration of a single roughness coefficient.

My additional reservations stem from the realisation that the variable channel morphology makes transient flow in streams and rivers a very complex phenomenon. The complications of real streams often test the limits of one-dimensional hydraulics, especially flood plains yielding flow-rating curves with distinct branches for in-bank and out-of-bank flows. The stream morphology encompasses the macro-geometry (cross-sectional geometry, bed slope and thalweg tortuosity) and the micro-geometry, i.e., the channel roughness. Given that wall roughness (i.e., bank material and vegetation) varies with depth, calibrating a 1-D transient open-channel flow model with data up to, say, one half the bank-full depth does not guarantee its good performance at bank-full flow. The situation gets more difficult still, when the water spills out of the banks and flows over to the flood plain, as under such conditions the 1-D model reaches, or

exceeds its limits.

References

Anonymous Referee #2, Interactive comment on "Comment on “A dynamic rating curve approach to indirect discharge measurement” by Dottori et al. (2009)" by A. D. Koussis, HESS Discuss., 6, C3168–C3172, 2010.

Aricò C., Nasello C. and Tucciarelli T. Using unsteady-state water level data to estimate channel roughness and discharge hydrograph. Adv. Wat. Res., 32: 1223-1240, 2009.

Dottori, F., M. L. V. Martina and E. Todini A dynamic rating curve approach to indirect discharge measurement Hydrol. Earth Syst. Sci., 13: 847–863, 2009.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 7429, 2009.