An integrating float method of discharge measurement

P. H. JOHN, F. A. JOHNSON & P. SUTCLIFFE

Dr T. M. Prus-Chacinski, Consultant, C. H. Dobbie and Partners

The Authors' method is ingenious and overcomes the difficulties of the 'floating' floats measurements to a large degree. I used floating floats in 1928 on medium size rivers at their almost bankful stages and the results were not much different from the current water measurements.

67. In a large river (all rivers in the UK are small by global or even European standards) probably more than two floats would be needed and the cross-section should be selected extremely carefully. In my opinion the secondary currents always present in any watercourse may play strange tricks, because the flow is never really steady but is pulsating.

68. There is no inherent reason why the Authors' method could not be used for the measurement of discharge during flooding, but it should be kept in mind that there is a hysteresis loop in any stage discharge curve and this may seriously increase the error. Also the water level at even the best selected cross-section in any large river is not level but either convex or concave, depending on the stage of the flood wave.

69. The Authors mention the difficulty of accurate observation of the popping-up of the floats. This would be seriously increased if more than two floats were used; presumably more than one boat would be needed and these boats would have to be anchored to the bed.

70. Could a cine camera, suitably adjusted for timing, be useful, despite the obvious increase it would mean in the cost of field operations?

71. This excellent Paper demonstrates that the old methods are well worthy of some modern adjustments. Many large schemes were designed and executed using so-called 'primitive' methods but they have worked successfully, sometimes over many centuries or even thousands of years.¹¹

Dr John, Dr Johnson and Dr Sutcliffe

Dr Prus-Chacinski's comment on the effects of secondary currents and pulsating flow are very relevant and even when the greatest care is taken in the choice of gauging section, it is always advisable to employ replicate float releases. The release mechanism used in our study had a capacity of six floats, allowing six replicates per deployment when using the single float method and three when employing the two-float approach. Should any secondary effects be of a permanent nature, the method described has the advantage of integrating the horizontal components in the downstream direction. However, if the vertical components of secondary currents are significant the use of precalibrated floats will introduce errors into a gauging. In such cases the in situ

DISCUSSION

measurement of flow depth and float rise time is necessary to produce optimum accuracy, but unfortunately this approach can be tedious and difficult to apply under field conditions. The likely effects of secondary currents and accuracy are discussed in reference 10 and suggestions are made which should limit their effect.

73. When considering the effects of flow stage on the accuracy of gauging results, the integrating float technique requires the same corrections as those employed when using current meters. However, as the field tests showed that the time taken to complete a gauging compares favourably with the conventional technique the problems of changing stage are no greater.

74. Dr Prus-Chacinski's suggestion concerning the use of cine photography is well taken. This possibility is noted in § 61 and it is intended to examine this aspect in the near future.

Reference

11. NEEDHAM I. *Science and civilisation in China*, vol. 4. Cambridge University Press, 1971.