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Reply

Reply to Castro-Orgaz, O.; Hager, W.H. Comment on "Stilmant et al. Flow at an Ogee Crest Axis for a Wide Range of Head Ratios: Theoretical Model. *Water* 2022, *14*, 2337"

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The Authors thank the Discussers for their valuable and detailed comment on the paper. It clearly presents a broad picture of the knowledge about critical flow in irrotational motion and the implications for flow over an ogee profile to which the Authors' work contributes [1]. It also provides valuable additional references.

The Authors acknowledge the merits of Jaeger's pioneering works and further developments. This is evidenced by the many references in their paper to [2,3], the last of which was published when their first paper on the topic [4] was already under review.

The Authors' primary aim was to provide a physically based explicit relation between head ratio and discharge coefficient of an ogee crest. To the Authors' knowledge and understanding, the only way to do so is to impose the curvature parameter K ($-r'$ considering paper's notations), equal to two, independently of the quality of the resulting model. If poor agreement with observations would have been found, the conclusion would have been that an explicit relation does not exist and, consequently, that a numerical resolution of the equations is required, with then the possibility (or the need) to optimize the K (or $-r'$) value. The Discussers' remarks about the influence of the K parameter are very much appreciated and highlight the direction in which further developments should be performed.

As explained by the Discussers, theories related to weir flows, while available, are somehow lacking in books and papers; the weir discharge coefficient is often presented as an empirical parameter. The paper, the comment, and some recent publications such as [3], remind that this is not the case, and that sound theory can predict very well most of the flow features of free surface weirs. Efforts should be devoted to exploiting these theories and continuing their development in order to improve our understanding of the flow features over free surface weirs, better characterize the limits (for example, in terms of cavitation), and finally propose better designs for more efficient and safer hydraulic structures. This is of particular importance in the current context of a changing climate.

Conflicts of Interest: The authors declare no conflict of interest.

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