# Harmonic analysis of the stability of reverse routing in channels

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Normal downstream routing of a flood flow is a highly stable process for Froude numbers less than 1 and hence the results are reliable. In contrast, reverse routing in an upstream direction, which may be required for flow control, is potentially unstable. This paper reports the results of a study of the practical limits on channel lengths for reverse routing. Harmonic analysis is applied to the full nonlinear solution of the St. Venant equations for 3 different wave patterns and 2 different wave periods, for a particular channel with a Froude number of 0.5. Reverse routing can be done for prismatic channels longer than 100km. For longer periods ($> 10$ hours) the shape of the upstream hydrograph is recovered well. However, when the wave period is short ($< 1$ hour), the high frequency components of the upstream hydrograph, and thus its shape, are not recovered. These limits are influenced by the channel morphology and shape of the wave. Further work is suggested to determine how these factors interact.