



Upstream-migrating bedforms in steep channels: an important contribution to sediment transport fluctuations?

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Possible causes of high sediment transport fluctuations observed in mountainous rivers are still not well understood. Several studies have linked these fluctuations with the presence of bedforms. However, upstream-migrating bedforms, that are similar in principle to antidunes, have not been studied as they are difficult to observe in the field. Here, we present an extensive data set of bed morphologies from steep flume experiments that confirm the existence of these features.

In these experiments, conducted in steady conditions, we observe upstream migrating bedforms of different sizes. The fluctuations of the sediment transport rate are very well related to bedform characteristics. These bedforms migrate upstream through head/stoss deposition and lee/tail erosion, the latter associated with avalanche-like events where the stoss face becomes over-steepened due to the high channel gradient. These events cause intense pulses of transport in the channel.

Data collection has also allowed quantification of the relationship between the flow and these bedforms. In particular, hydraulic jumps were identified, manifest as hysteresis in the interactions between the flow and the bed, and controlling the duration of the bedforms. Finally, comparisons are made with field data from continuously recording datasets in Swiss Alpine rivers.