Doppler sonar measurement of sediment transport: computer simulation and laboratory trials.

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ABSTRACT: Authors: Authors: **Len Zedel**(1), Alex Hay(2), Greg Wilson (3), Jenna Hare(2) (1) Memorial University (2) Dalhousie University (3) Oregon State University

Studies have demonstrated that velocity measurements of river beds made using Doppler sonar systems produces values that are proportional to the bedload transport; that is the transport of sediment in the river along the river bottom. Given the complexity of acoustic backscatter and sidelobe interactions near the bottom boundary, the exact source of this signal is not obvious. We explore this measurement using a computer simulation and a series of laboratory trials. The system that we have developed for these studies, MFDop, is a multi-frequency (1.2-2.2 MHz), bistatic Doppler sonar that provides 3-component velocity profiles over a ~ 30 cm profile with 1-5 mm resolution at a rate of 50 profiles/sec. Model simulations show that side-lobe contamination biases the velocity measurements above the bed but that effect is reduced in the bedload layer itself. We report on tests of our system in field-scale conditions at the St. Anthony Falls Laboratory (SAFL). The SAFL facility provides a 1.8 m deep, 2.74 m wide flume tank. In our trials, we used a 1 m depth flow of about 1 m/s over a mobile bed of sand with median grain size d50 = 0.4 mm. We find agreement between transport estimates determined using: the MFDop, the sediment trap system integrated in the SAFL flume, and estimates based on bedform migrations.

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