

Tracking log displacement during floods in the Tagliamento River using RFID and GPS tracker devices

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Abstract

Large pieces of in-channel wood can exert an important role on the ecological and morphological properties of gravel-bed rivers. On the other side, when transported during flood events, large wood can become a source of risk for sensitive structures such as bridges. However, wood displacement and velocity in river systems are still poorly understood, especially in large gravel-bed rivers. This study focuses on log transport in a valley reach of Tagliamento River (Italy). Log displacement during flood events of different magnitudes recorded from June 2010 to October 2011 has been analysed thanks to the installation of 113 radio frequency identification (RFID) tags and 42 GPS tracker devices in logs of different dimensions. Recovery rates of logs equipped with RFID and GPS trackers were about 43% and 42%, respectively. The GPS devices allowed us to analyse in details the log displacement and transport overtime, indicating a higher log entrainment during rising limb of hydrographs. The threshold for the entrainment of logs from low bars is around 40% of bankfull water stage. No clear relationship was found between the peak of flood and log displacement length and velocity. However, log displacement length and velocity appear significantly correlated to the ratio between the peak of flow and the water stage exceeding the flow duration curve for 25% of time (i.e. the ratio h_{max}/h_{25} ratio). Log deposition was observed to occur at the peak flow, and logs transported during ordinary events are preferably deposited on low bars. This study reveals the potentials of GPS tracker devices to monitor the entrainment and movements of logs in large gravel-bed rivers during floods. These observations could be useful for better planning of river management practices and strategies involving the use of large wood pieces and could help for calibrating wood budgets at the reach scale.