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Hydro-sedimentary monitoring of reservoir flushes in the Arc-Isère river system (French Alps)

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The Isère River is located in the South-East of France (French Alps) and is one of the main tributaries of the Rhône River as regards Suspended Sediment Matter (SSM) fluxes. The Isère River channel was strongly constrained laterally during the two last centuries and was harnessed by a lot of hydroelectric dams along the river network especially in the Arc River, one of its tributaries. The Arc-Isère river hydrology is particularly affected by the EDF (Electricity of France) schemes for producing electricity (river dams and side reservoir). The total SSM flux of the Isère River at Grenoble (5570 km2) was estimated as 2-3 million tons yearly. And large SSM concentrations may be measured at Grenoble during natural flood events (over 10g/L). To prevent SSM retention and siltation of dams, EDF regularly (yearly) conducts hydraulic flushes. The Arc-Isère system was thus instrumented to study the impact of such managements on the SSM dynamics along the downstream Arc-Isère river system. A system of six monitoring stations is under construction and calibration for the continuous survey of water level, discharges and SSM concentrations: two in the Arvan River (tributary of the Arc River), two in the Arc River and two in the Isère River. The SSM concentrations are recorded continually using a turbidity sensor (Hach Lange, 0-50 g/L, time step 30mn). An automatic sampler is coupled and controlled by the turbidity sensor in order to establish a calibration for converting the SSM estimated by the turbidity sensor into SSM concentrations in mg/L. Water discharge is estimated from water elevation measurements using a rating curve, where applicable. Two stations (Grenoble-Isère and Pontamafrey-Arc) are already built and validated, two stations (St Jean de Maurienne-Arvan, Montmélian-Isère) are built but need to be validated, and two stations are still under construction (St Jean d'Arves-Arvan, Randens-Arc). This site study is labelled as an observatory site of the French Research Institute CNRS (ZABR: Zone Atelier Bassin du Rhône). River dam flushes have been surveyed since 2005. First results allowed to study the propagation of the SSM and water peaks and to estimate the retention in the river network each year. The contribution of the flushing events to the annual SSM fluxes has also been evaluated. An analytical model was proposed to follow the SSM propagation and showed that erosion and deposition are approximately in balance during a river dam flushing event. This work is conducted in collaboration with research laboratories and river managers and is supported by research projects (EC2CO-Variflux, SHARE European program, . . .).