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Sediment management plan for river Gudbrandsdalslagen, Southern Norway

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During recent years, several large magnitude flood events have led to an increase in the input of sediment to the Gudbrandsdalslagen river system. The increased sediment delivery have caused bank erosion, aggradation and channel changes and resulted in severe damage to infrastructure and arable land and it was decided to make a sediment management plan for this river basin. It is important to have an understanding of the processes that is contributing to the sediment delivery and knowledge about the volumes of sediments involved, to choose which measures are most efficient. The data collection techniques involved the use of repeated airborne laser scans to build digital terrain models (DTM) used to compute eroded volumes. In addition, airborne photos were also used to observe changes due to erosion and deposition of sediments. At some stations, automatic water samplers were used to collect samples 1-2 times a day for suspended sediment transport calculations. Bed load rates was determined from repeated volumetric measurements of sediment deposition in dams. At the Harpefoss water reservoir, the bed load was measured to 13000 tonnes/yr over a period of 50 yrs amounting to about 19% of the total load.
The catchment area of the Gudbrandsdalslagen is 11200km2 consisting of a river system with lake Losna lying downstream. A number of steep tributaries drain the surrounding mountain areas to the main river stem supplying large amounts of sediments. The study of sediment sources from12 tributaries revealed that undercutting and erosion of slopes adjacent to the river bed is the most dominant process, but gullying and debris flows also supply much sediments. In the river Veikleai near Kvam, laser scan measurements gave a removed volume of 200 000 – 270 000 tonnes delivered from the undercutting of slopes adjacent to the river channel during the flood of 2013, whereas 80 000tonnes was delivered by debris flows. A total of 40 000 tonnes were accumulated in the river channel. In the tributary Vinstra, the 2011 – flood triggered around 20 debris flows and the river was dammed for some period.
Sediment cores from the lake Losna were analysed to obtain information about long term sediment transport rates. The cores were analysed by x-ray fluorescence to detect the chemical variability and composition of elements that may be used as proxies to detect changes in the sedimentary sequence. Distinct layers could be associated with large magnitude floods and major sediment transport events during the last 200 years. It was found that the sediment supply remained high during some years after a large –magnitude flood event, possibly due the number of erosion scars that were created during the floods.