A sediment budget for the ‘Kleine Noordwaard’ in the Biesbosch area, the Netherlands

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1. Introduction

Many deltas in the world are subject to drowning and loss of land due to accelerated soil subsidence, sea level rise and sediment starvation. Effective delta restoration requires a thorough understanding of the rates and mechanisms of delta aggradation and their controls. This study aims to quantify the rates and patterns of aggradation in the ‘Kleine Noordwaard’, (Fig.1) a former polder area in the Biesbosch area in the south-west of the Netherlands, in which water and sediment have been reintroduced since 2008.

2. Methods

The following data were used to derive the sediment budget:

- Digital elevation model (Actueel Hoogtebestand Nederland)
- Multibeam echosounder data (bathymetry of main channels)
- Field measurements of the thickness of mud or sand deposited on the compact, former polder soil surface (Fig.2). For this, we sampled multiple transects across the study area using a transparent corer tube.
- Location and height of the cut banks measured using a dGPS device and a ruler (Fig.3).

3. Results

Channels

Consecutive measurements of channel bathymetry showed that 5.7x10^3 m^2 of sediment was retained in the channels between March 2009 and March 2012 (Fig.4), which corresponds to a sedimentation rate of 17 mm/yr.

Intertidal flats

Approximately 21 mm of mud accumulated in the intertidal area between May 2008 and October 2014 (Fig.4). This corresponds to an accumulation rate of 3.2 mm/yr.

Cut banks

Comparison of the current cut bank position and height with the digital elevation model of the area indicates that only 31 m^3 of sediment eroded between 2009 and 2014, which is not significant compared to the sediment deposition and erosion in the channels and on the intertidal flats.

4. Conclusions

The total sediment budget of the ‘Kleine Noordwaard’ area amounted to 27.4 x 10^3 m^3/yr which corresponds to a net area-average sedimentation rate of 4.7 mm/yr during the first 5 years after depoldering of the area. The channels received 19.1 x 10^3 m^3/yr and the intertidal area 8.3 x10^3 m^3/yr. Remobilisation of sediment by erosion of cut banks occurred at a negligible rate of about -6 m^3/yr.

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