

Modelling sediment supply towards, and sedimentation processes in unnavigable watercourses in Flanders, Belgium

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Introduction: The Flemish Government wants to identify the regions exporting high sediment loads to unnavigable watercourses and the sedimentation zones within these watercourses. Two kinds of models are used: Hydrological sediment export models and hydraulic sediment transport models. In the study, the influence of different erosion control measures on sediment exports needs to be taken into account. Results of the study will be used by the Flemish government to plan erosion control measures, river engineering and dredging works.

Methods: For the whole of the study, more than 100 measurement years of high-frequency data of erosion and sediment transport in the period 1990-2012, of which 80 measurement years of 15-minute sediment discharge data (fig 1, [1]) is available to optimize and calibrate the models. All data originates from subcatchments within the Scheldt basin, with catchment areas ranging from 10 to 10000 ha. The data is analyzed for spatial and temporal variations. Correlations of sediment load with watershed and hydrometeorological characteristics are investigated.

In a first stage of the study, both types of models will be implemented for the pilot watersheds 'Maarkebeek' and 'Wallebeek'. In this paper, only the results for these pilot watersheds are given. For a retention pond in the watershed of the Maarkebeek, measurements at inlet and outlet are used to assess the sedimentation evolution in the pond.

Different types of hydrological (MCST and Watem/Sedem, [2] and [3]) and hydraulic (Infoworks ICM and RS, [4] and [5]) models are implemented for the pilot watersheds, and advantages and disadvantages for each model are listed. Model sensitivity analysis is performed.

Results: Some of the findings from the time series analysis are that more than 90% of sediment was transported in less than 5% of time, and that there is not always a decrease in sediment export and load with an increase in watershed area. In very hilly watersheds, all sediment exported from land to river is flushed through the river during high water events.

Large differences in sediment exports can be seen between regions, due to differences in watershed characteristics such as slope and watercourses density.

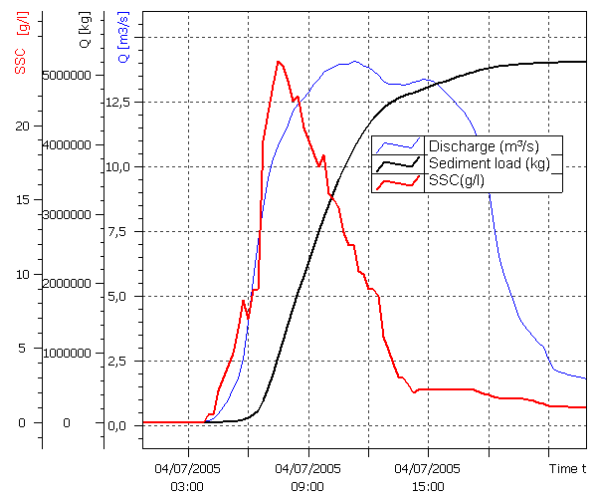


Fig. 1: Discharge (m^3/s), suspended sediment concentration SSC (g/l) and sediment load (kg) for a high water event in the Maarkebeek basin

In the retention pond, high trap efficiencies and low variability of efficiency are measured.

Modelling results show stability problems with RS and poor model capabilities for ICM.

The sensitivity analysis identifies critical model parameters, such as sediment settling velocity and specific gravity.

Discussion: From the first model results, some findings for the future steps in the study are:

- There is a need for extra measurements, such as bathymetric and shear stress data, for calibrating the bottom layer evolution. Settling velocity data and sediment density are needed for calibrating sediment transport.
- Implementing erosion reduction measures in both types of model will be the next step.
- A simplification of both model types will be necessary when, as a final step, the models are implemented for the whole of Flanders.

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