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Modeling the annual contribution of authigenic sediment to the total suspended sediment load in a Belgian basin

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The Nete basin, located in the North-East of Belgium and part of the river Scheldt basin, contains the Grote Nete and the Kleine Nete and their tributaries. In total, the basin drains about 1670 km^2 of which approximately 590 km^2 lie upstream of Grobbendonk, on the Kleine Nete, where a monitoring station of Flanders Hydraulics Research is located.

In the Nete basin chemical precipitates derived from groundwater-associated Fe^{2+} seeping into the overlying surface-water significantly contribute to the composition, concentration, and fluxes of suspended sediment.

The aquifer responsible for most of the iron-rich groundwater seepage into the basin is the Formation of Diest, which contains high quantities of iron minerals (e.g. glauconite and iron sulfides). Also, due to its flat topography and the presence of ditches and trenches adjacent to the fields, a low erosion rate in the basin is ensured, which minimizes the detrital sediment contribution.

As previous models, predicting sediment transport, did not include authigenic sediment as a potential source, a new model, MARS 1.0, has been developed to determine the relative contribution of authigenic suspended sediment to the total sediment load transported by a river.

The degree of authigenic contribution for the period of 1999 up to 2004 was determined by comparing theoretical calculations as well as values modeled with. These

annual loads were determined by a combination of concentration and discharge measurements and by estimations from a site-specific rating curve, generated from log-transformed data for suspended sediment concentration, discharge, baseflow, interflow, and run-off). Where the theoretical calculations, based on various estimates of the concentration of Fe^{2+} in groundwater, as well as several other factors, could only place the averaged contribution of authigenic sediment between 43 and 126 % for the period-of-record, MARS 1.0 was able to predict contributions of 58% up to 96%.

It was also able to explain the decrease in total suspended sediment flux, observed in 2003 and 2004, as caused by consolidation of sediment on the river-bed.