

Measurement of sediment settling velocities in a tidal freshwater wetland



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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 determine the settling characteristics of suspended sediment in the 'Kleine Noordwaard' tidal freshwater wetland in the south-western part of the Netherlands. This wetland consists of a recently inundated former polder area in the Biesbosch area, in which water and sediment have been reintroduced since 2009. The area mainly receives sediment from the Nieuwe Merwede River, a downstream distributary of the Rhine River.

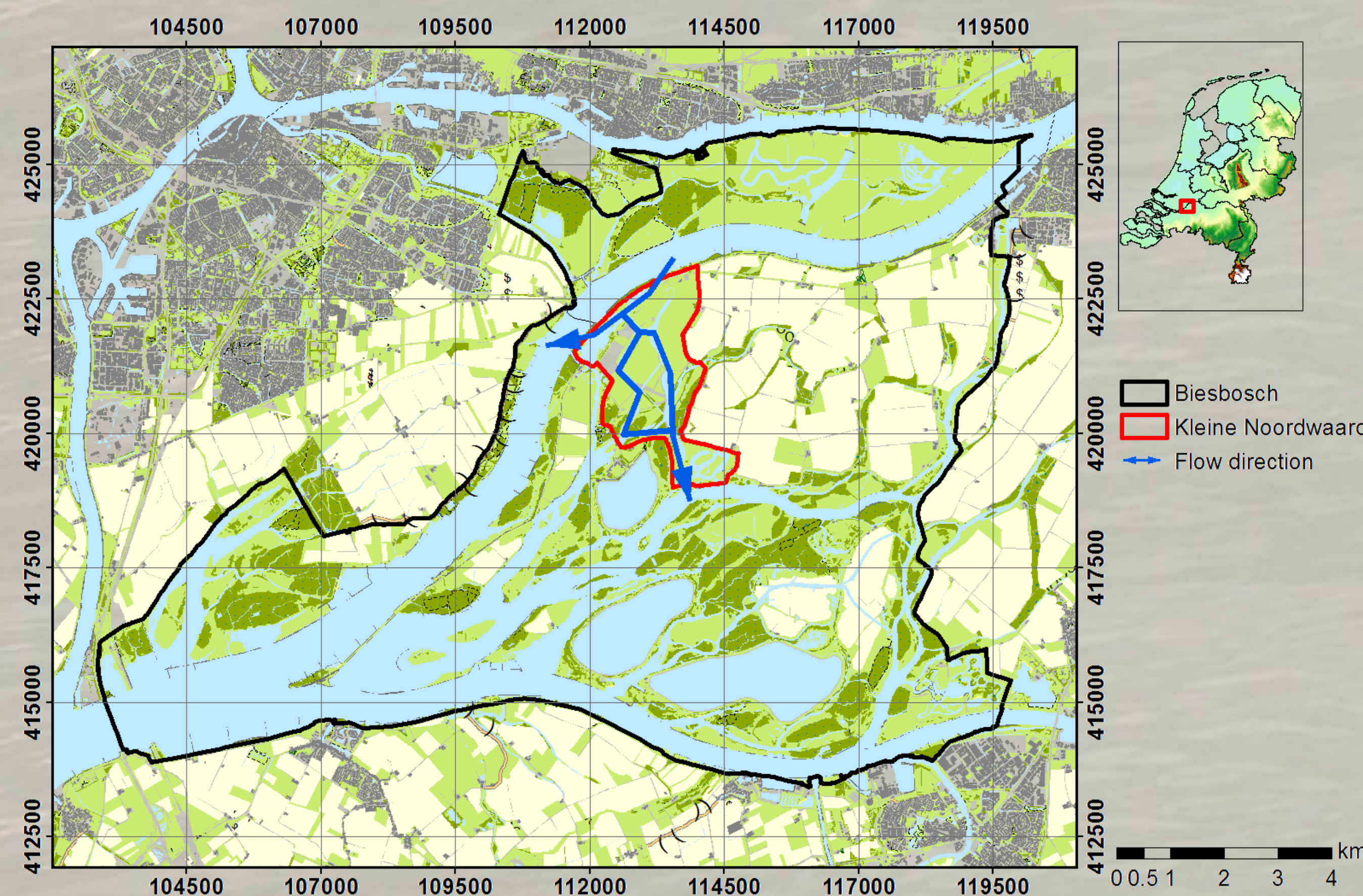


Fig. 1 Former polder area 'Kleine Noordwaard'

2. Methods

Water samples were collected in 30 cm diameter PVC settling tubes near the inlet and outlet of the area. The settling tubes were transported horizontally to a field laboratory where the settling velocity measurement started by placing the settling tube in upright position within 1 hour after sampling. At logarithmic time increments, 250 ml samples were extracted from the settling tubes through a valve at a depth of 250 mm below the top of the tube. The sediment concentrations in the samples were determined by filtering through 0.45 μm pore size membrane filters.



Fig. 2 Transport of settling tubes



Fig.3 Field laboratory

3. Results

The suspended sediment concentrations were low and varied between 10 mg l^{-1} and 35 mg l^{-1} (Fig.4).

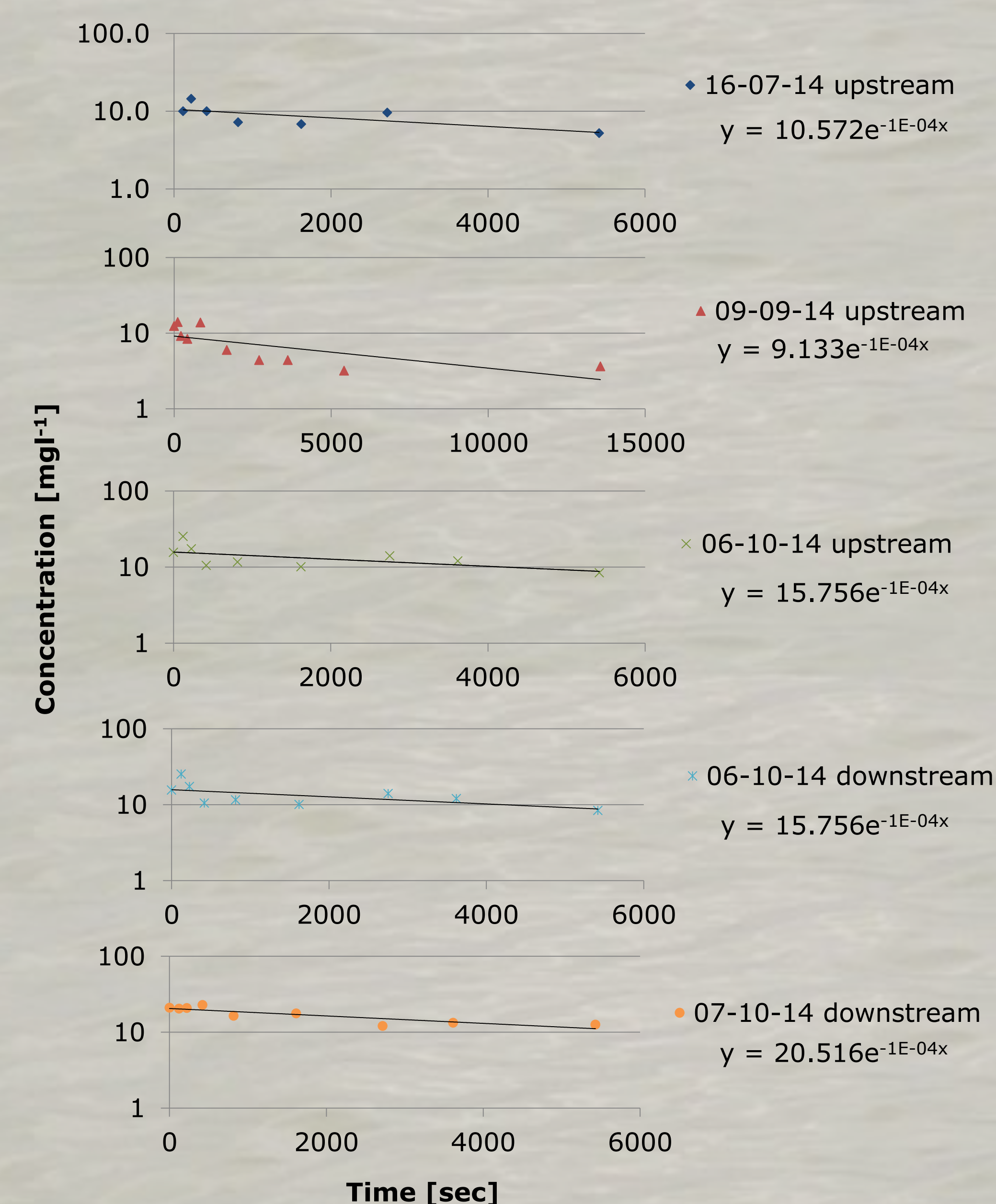


Fig. 4 Suspended sediment concentration over time.

In general, the sediment concentrations decreased exponentially during the measurements with exponents ranging between $0.98 \times 10^{-4} \text{ s}^{-1}$ and $1.27 \times 10^{-4} \text{ s}^{-1}$ (Fig.5). The settling velocity distributions were rather consistent between the measurement locations and measurement periods with median settling velocities of about 0.04 mm s^{-1} and 75th percentiles between 0.07 mm s^{-1} and 0.11 mm s^{-1} . Lower settling velocities were observed for measurements with lower initial concentrations (Fig.5).

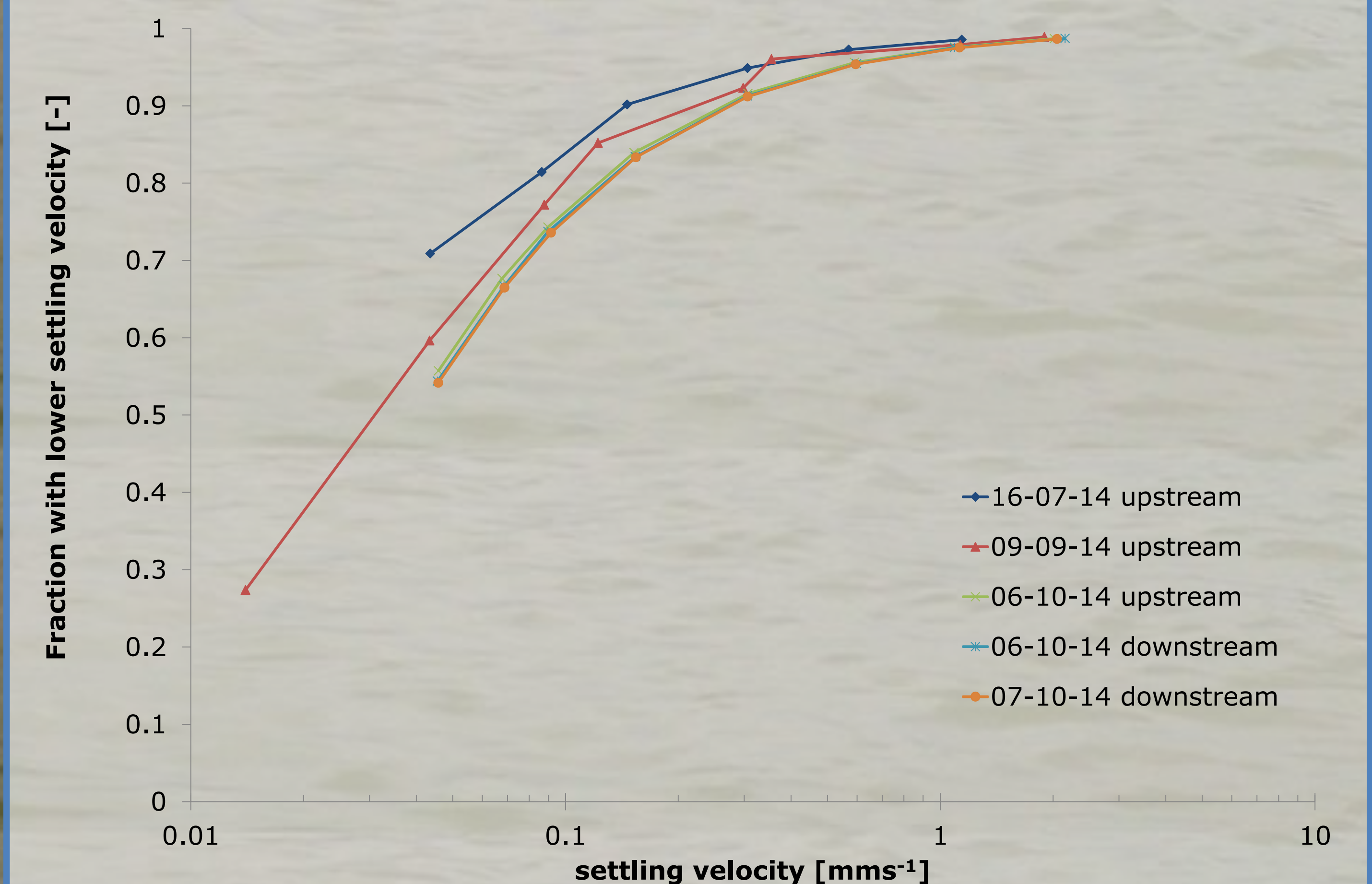


Fig. 5 Settling velocity distribution.

4. Conclusions

The settling characteristics of the suspended sediment measured in the 'Kleine Noordwaard' tidal freshwater wetland were rather consistent in space (measurement locations near the inlet and near the outlet of the study former polder area) and time (summer and autumn 2014) with a median settling velocity of about 0.04 mm s^{-1} .

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