



## Effects of the Disposal of Dredged Sediments on River Bed Volumes and Morphological Structures

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## Introduction





## Motivation



#### (1) International conventions on the protection of marine environments

- "Joint Transitional Arrangements for the Handling of Dredged Material" regulate the application of these conventions in Germany
- Provides a framework to investigate environmental effects of the disposal of dredged sediments
- Need to investigate physical effects -> e.g. accumulation on river bed and spreading of dredged sediments
- Input information to further investigate chemical & biological effects

#### (2) Optimization of sediment management plans

- Restrictions on the use and accessibility of disposal sites due to insufficient water depths (",piles" of dredged material, morphodynamics)
- Maximum efficiency of a disposal site depending on total volumes and grain size distribution of dredged material

#### (3) Research

- Better advise and higher quality forecast through improved understanding of the process dynamics involved
- Influence of dredging operations on sediment budget

## Data base & Methodolgy



#### Data base

- Multi-beam echosounding data, spatial resolution is 1m \* 1m, available since 05/2011
- VS 738: 25 surveys until 03/2017
  -> 24 data sets of changes in volume
- 87 days is average interval between two surveys
- data processing according aQua Standards (http://www.aqua.wsv.de)

#### Methodology

- Calculations of the volume using "cut/fill" method in ArcGIS
- volumes defined by the difference between both surfaces
- each surface is defined by the echo sounding data taken at a specific date
- <u>result of the method</u>: total net volume, total volumes of erosion and deposition



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## **Results (for VS 738)**





### **Results (for VS 738)**





## **Results (for VS 738) – river bed volume**









### **Results (for VS 738) – morphodynamics**





# Example period from 06.02 – 02.04.2013

dredged material: sandy sediments – 0.02 Mio. m<sup>3</sup> fine sediments – 0.73 Mio. m<sup>3</sup>

# Example period from 02.04 – 10.06.2013

dredged material: sandy sediments – 1.00 Mio. m<sup>3</sup> fine sediments – 0.59 Mio. m<sup>3</sup>

#### **Results (for VS 738) – sediment transport**





04.11.2013

08.01.2014

12.05.2014



# Conclusions



- Multi-beam echosounding data
  - ..... provide more information than simply "water depth" from the nautical perspective
  - ..... provide valuable insight on a) development river bed volumes b) morphodynamics and
    - c) sediment transport directions on disposal sites
  - ..... need to increase the number of sounding campaigns per year
  - ..... should cover the adjacent areas of a disposal site (once in a year is too little)
- Performance capacity of a disposal site: resulting net transport of sediments (related to a specific grain size) from the disposal site to adjacent areas.
- Lessons learned for VS 738
  - ..... sandy sediments with grain sizes larger than 125 µm accummulate (as a rule of thumb)
  - ..... high performance capacity for grain sizes smaller than 63/125  $\mu m$
  - ..... low performance capactity for grain sizes larger than 125  $\mu\text{m}$  , average migration speed few hundred meters a year
  - .... preserve VS 738's capacity for the future disposale of cohesive sediments, dispose sandy sediments on other site (which might be located in greater distance)
  - .... pay attention to the morphodynamics of surrounding areas, these can significantly influence on the development within the disposal site