Ludwig-Franzius-Institute
for Hydraulic, Estuarine and
Coastal Engineering

Leibniz
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Analysis-Methodology of Event-Driven Sedimentation in a Shipyard

Workshop on Sediment Management in Ports, Eemshaven, 29th October 2019

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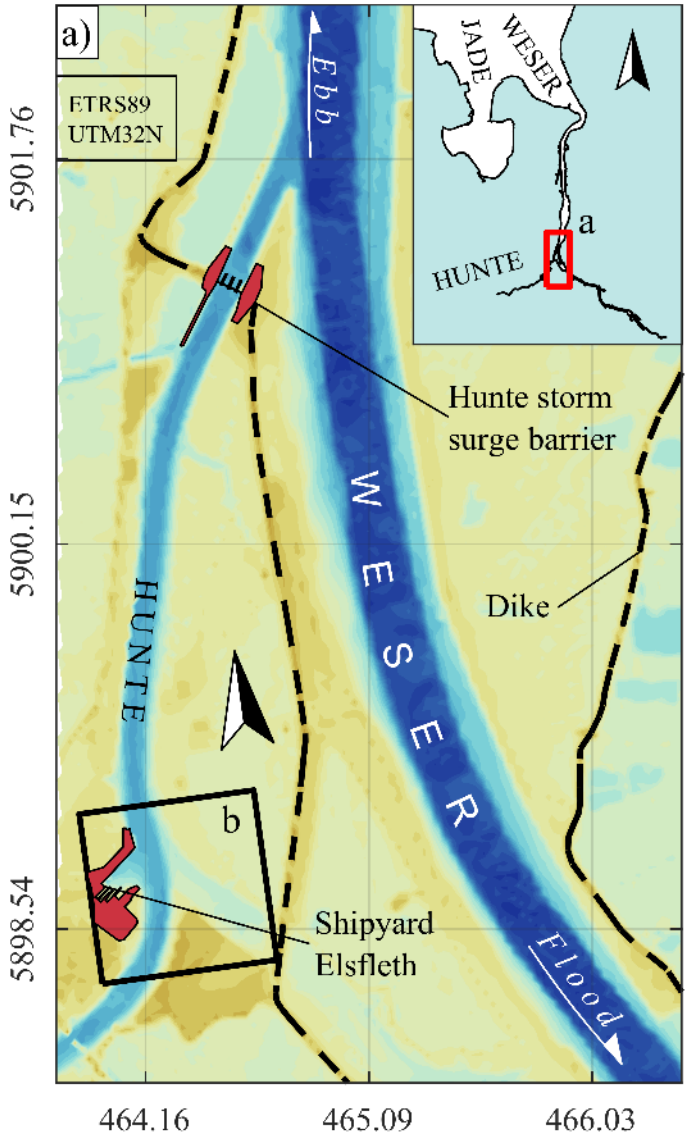
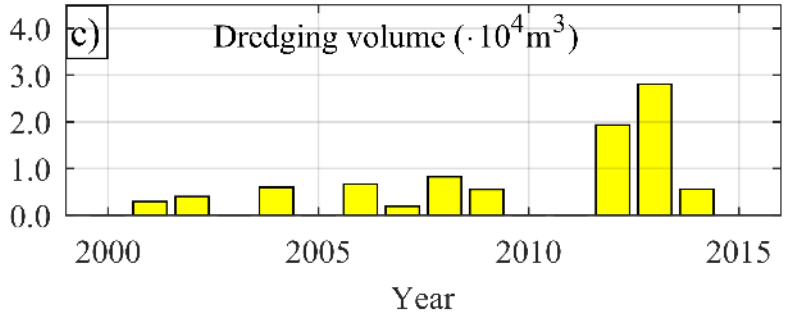
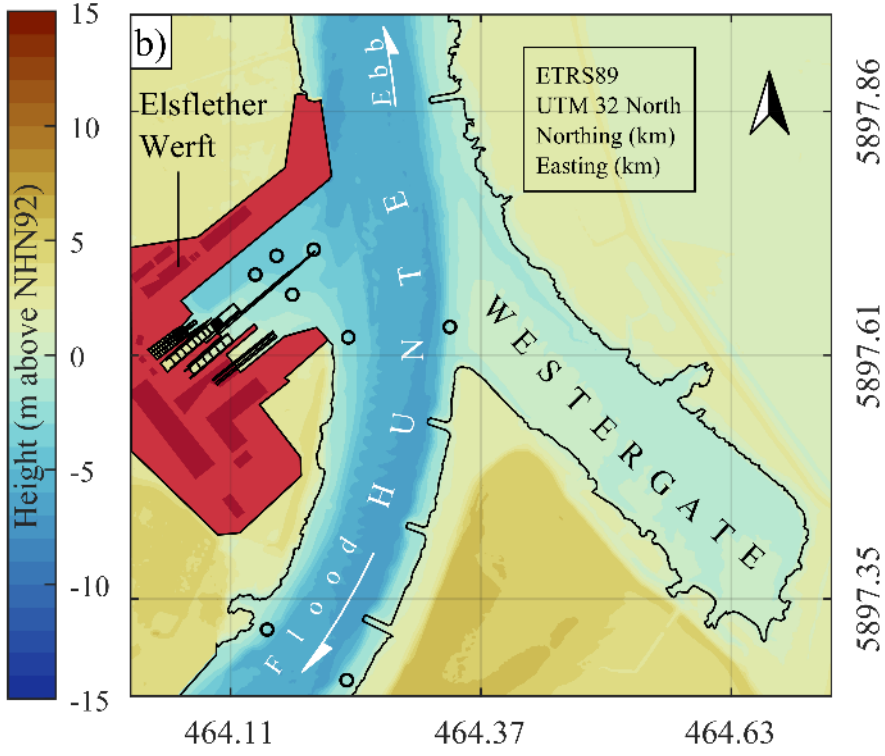
Motivation

- Shipyard Elsfleth located at river Hunte
- Hunte mouth closely upstream of Weser ETM
- Hunte dredging volumes show increase



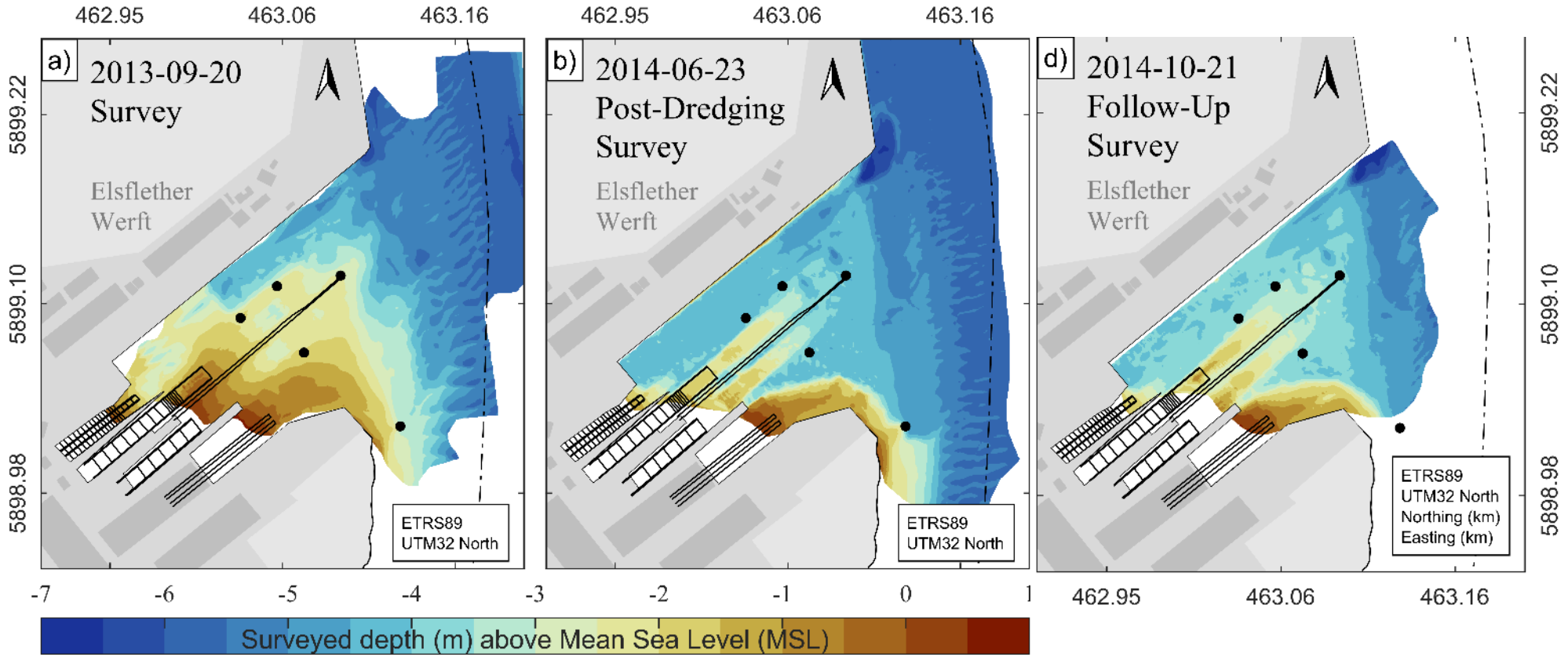




Graphics courtesy of Lojek, Tiede, Visscher, Cossu, Schlurmann (2019), ASCE Journal of Waterway, Port, Coastal, and Ocean Engineering, (in press)

Motivation 2

- Costly dredging – WI prohibited inside shipyard
- Rapid refilling observed: 3.500-5.000 m^3 within 4 months (~20% of dredged volume)

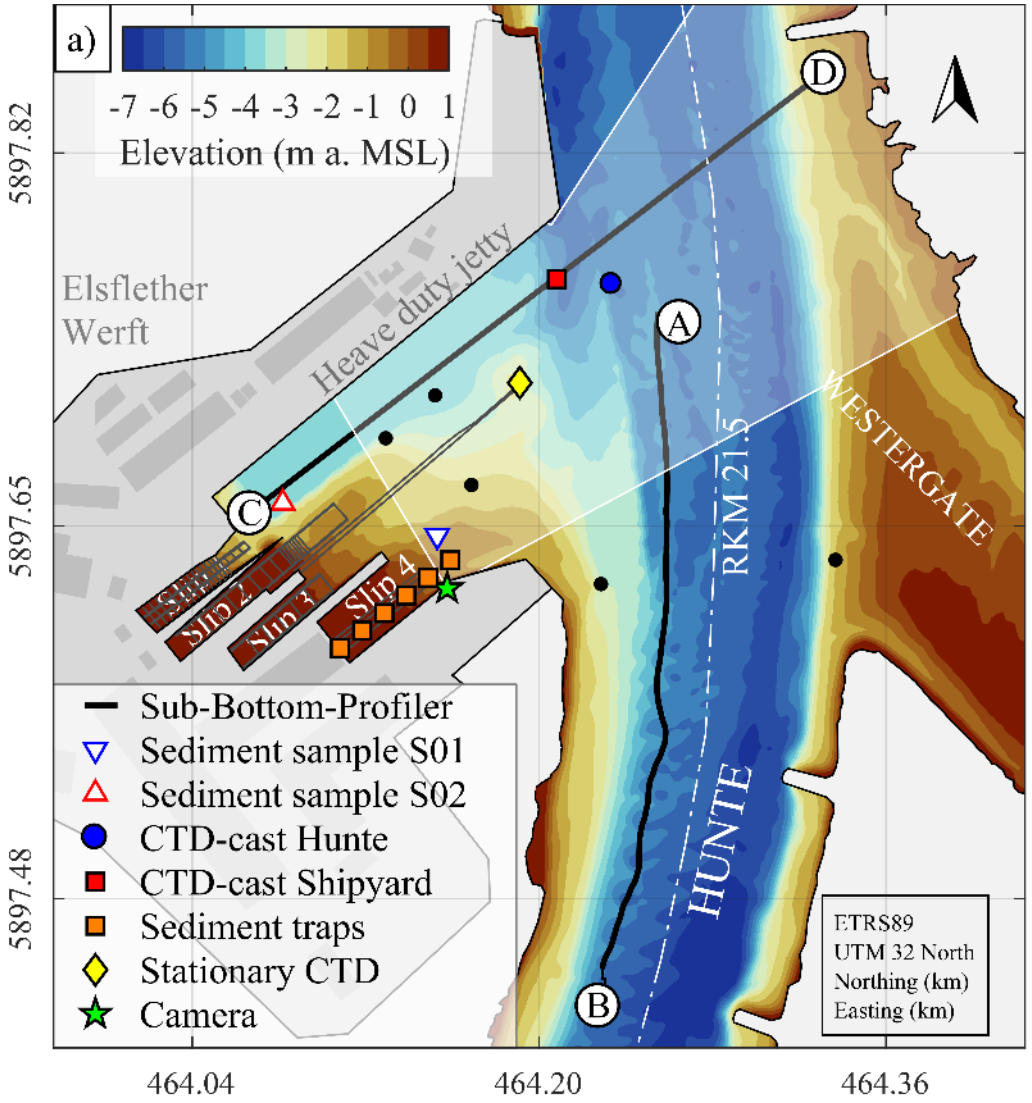


Analysis-Methodology of Event-Driven Sedimentation in a Shipyard

Methods

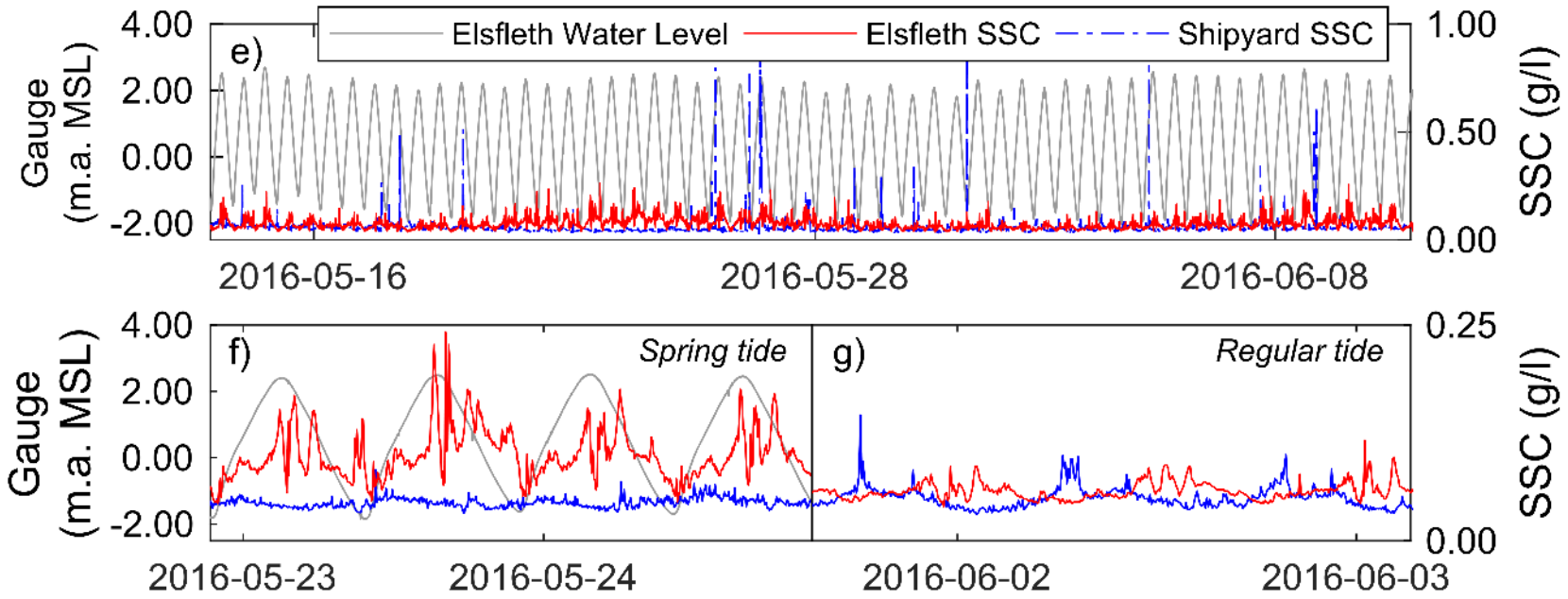
Broad variety of sensors:

- CTDs with turbidity
- Sediment traps
- Soil cores
- Water samples
- Sub-bottom profiler
- ADCP
- Timelapse cameras
- UAV



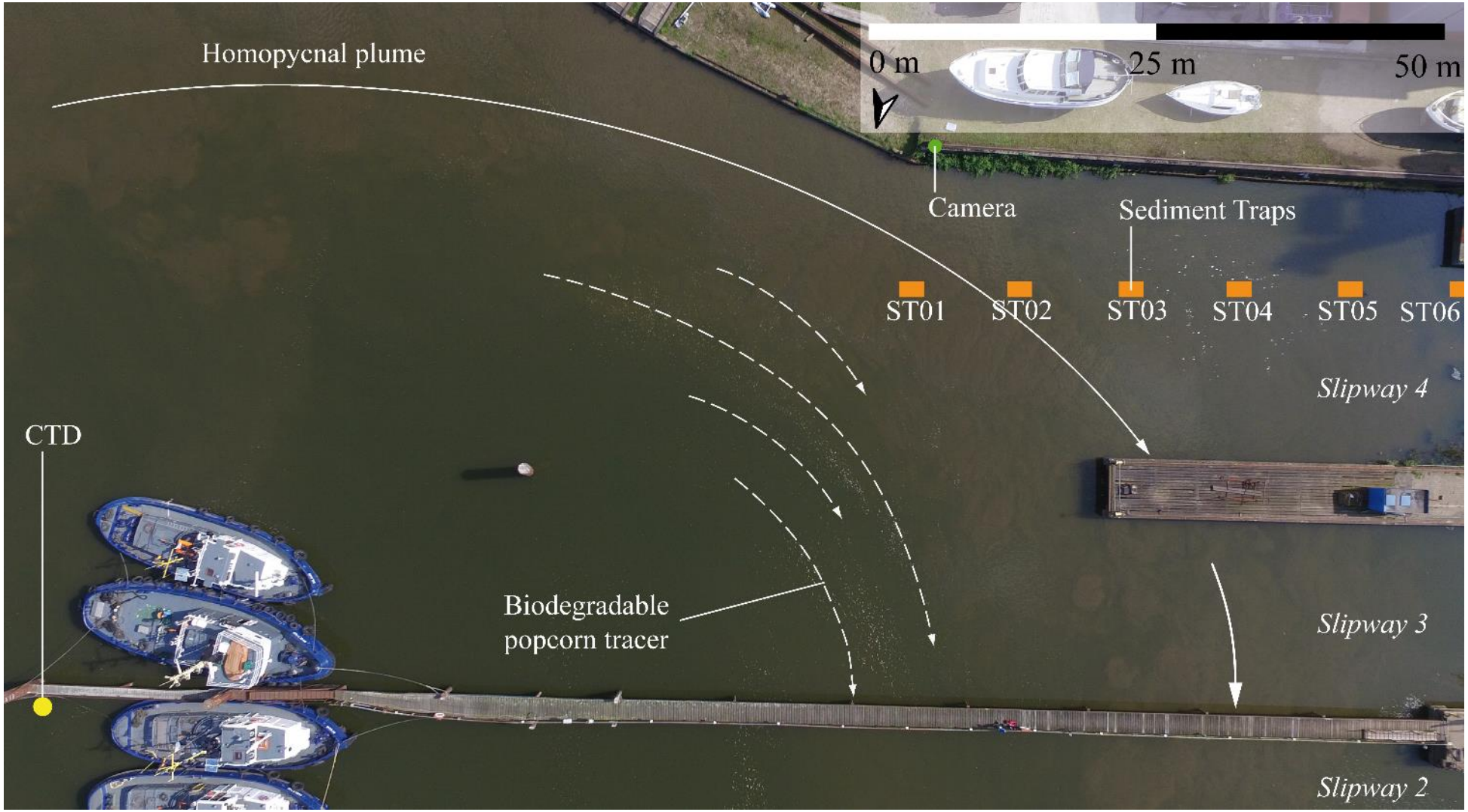
SSC results

- CTD recorded single, high SPM concentrations
- uncorrelated to Weser SSC values or tides

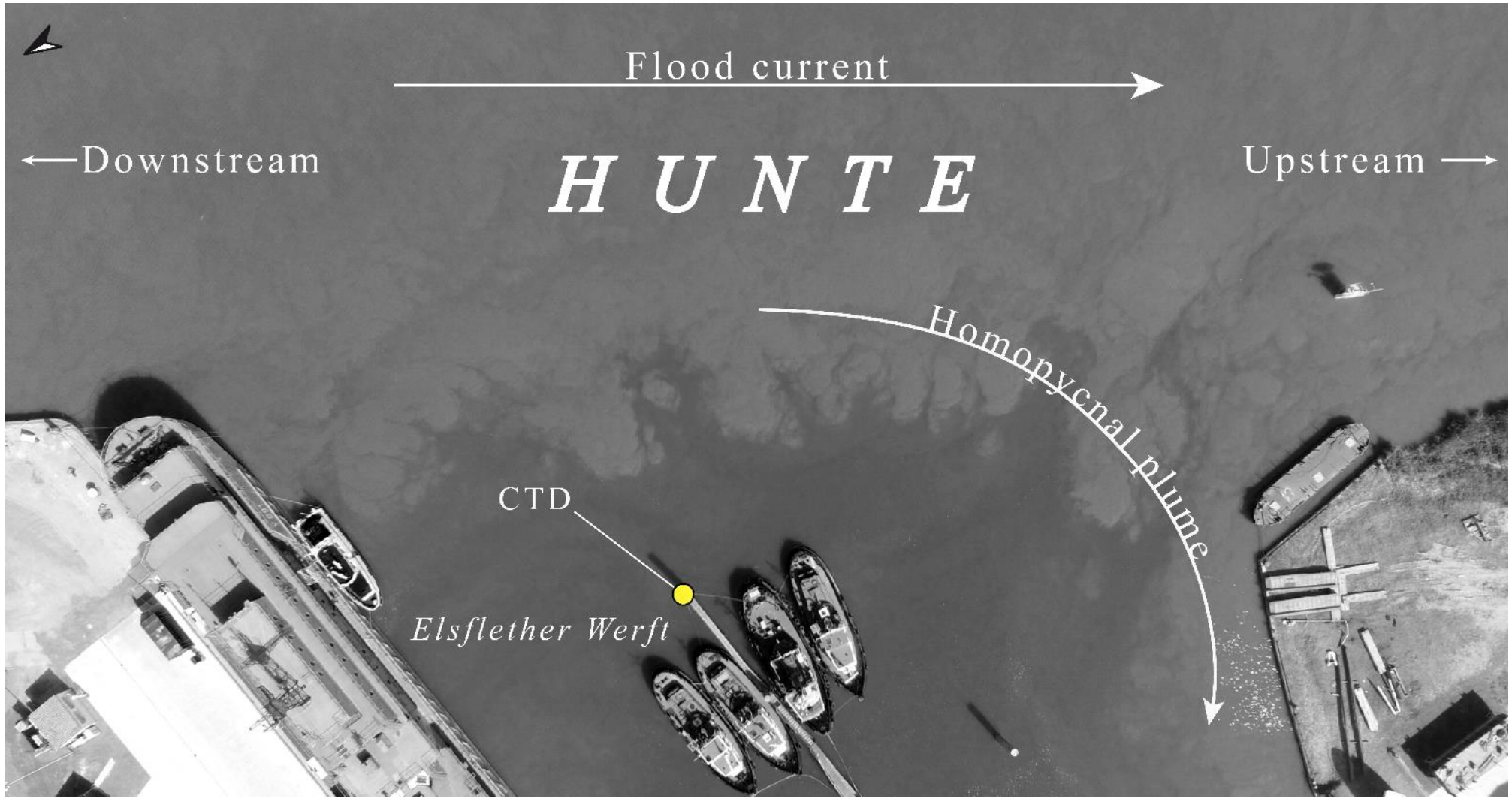


UAV results

UAV results

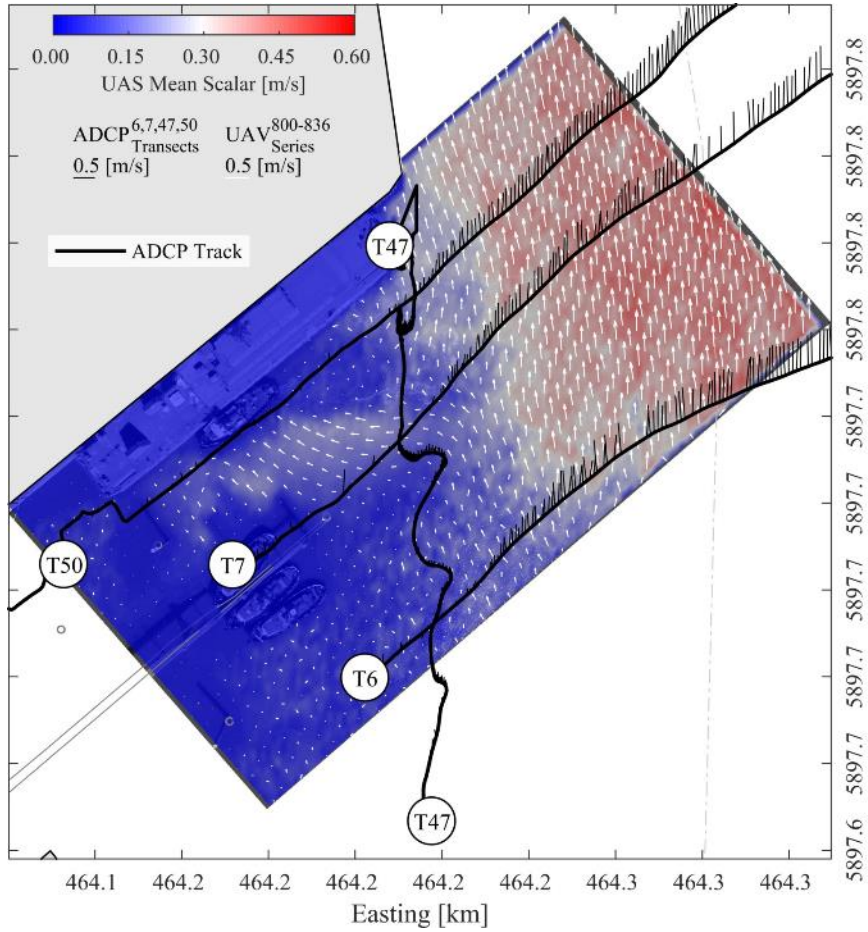

Homopycnal plume
0 m
25 m
50 m
Camera
Sediment Traps
ST01
ST02
ST03
ST04
ST05
ST06
Slipway 4
CTD
Biodegradable
popcorn tracer
Slipway 3
Slipway 2

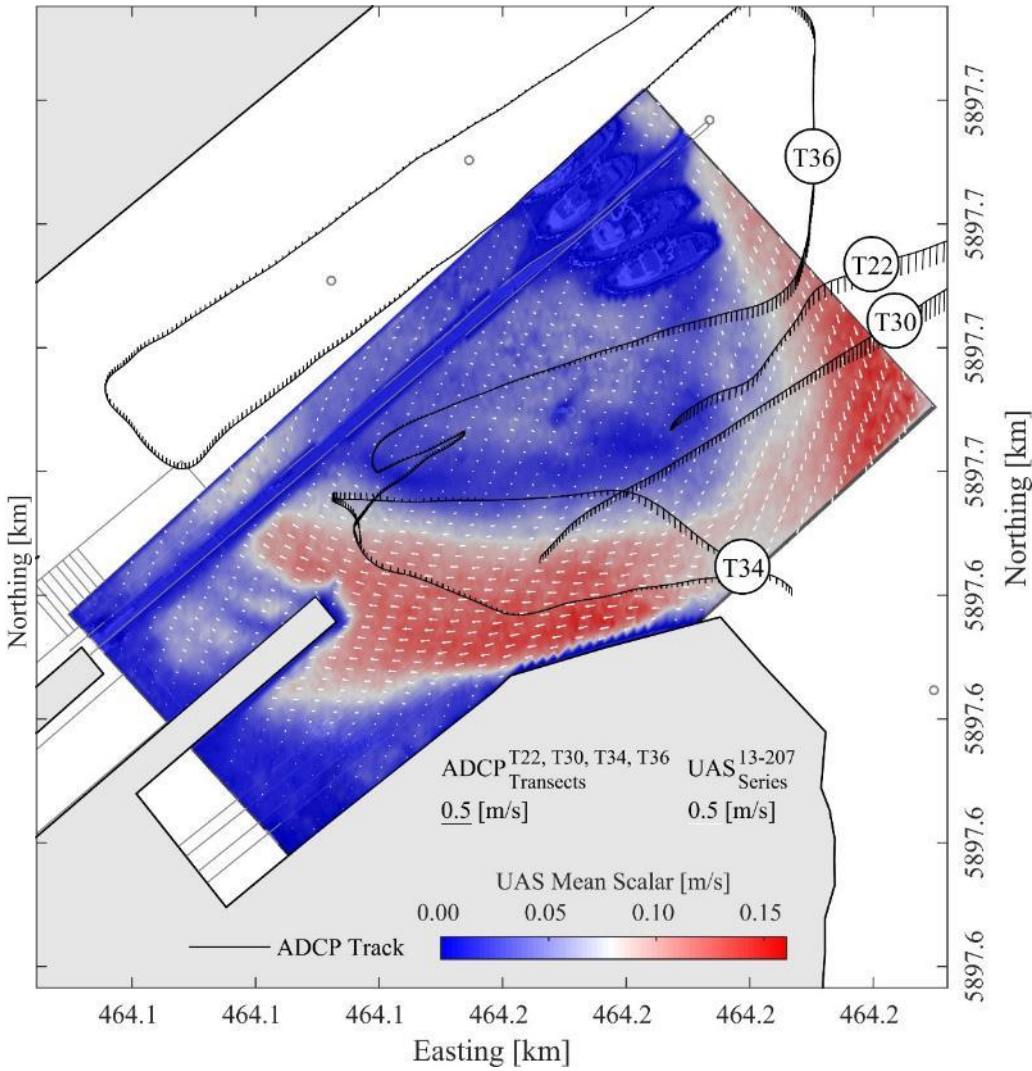
UAV results


Flood current
Downstream
HUNTE
Upstream
Homopycnal plume
CTD
Elsflether Werft

Large Scale PIV results

- 10-20 minutes of fixed-position observations
- 5 sec intervals
- Cross-correlation method on greyscale images from red channel
- Velocity fields show good agreement to ADCP
(but better visual impression)



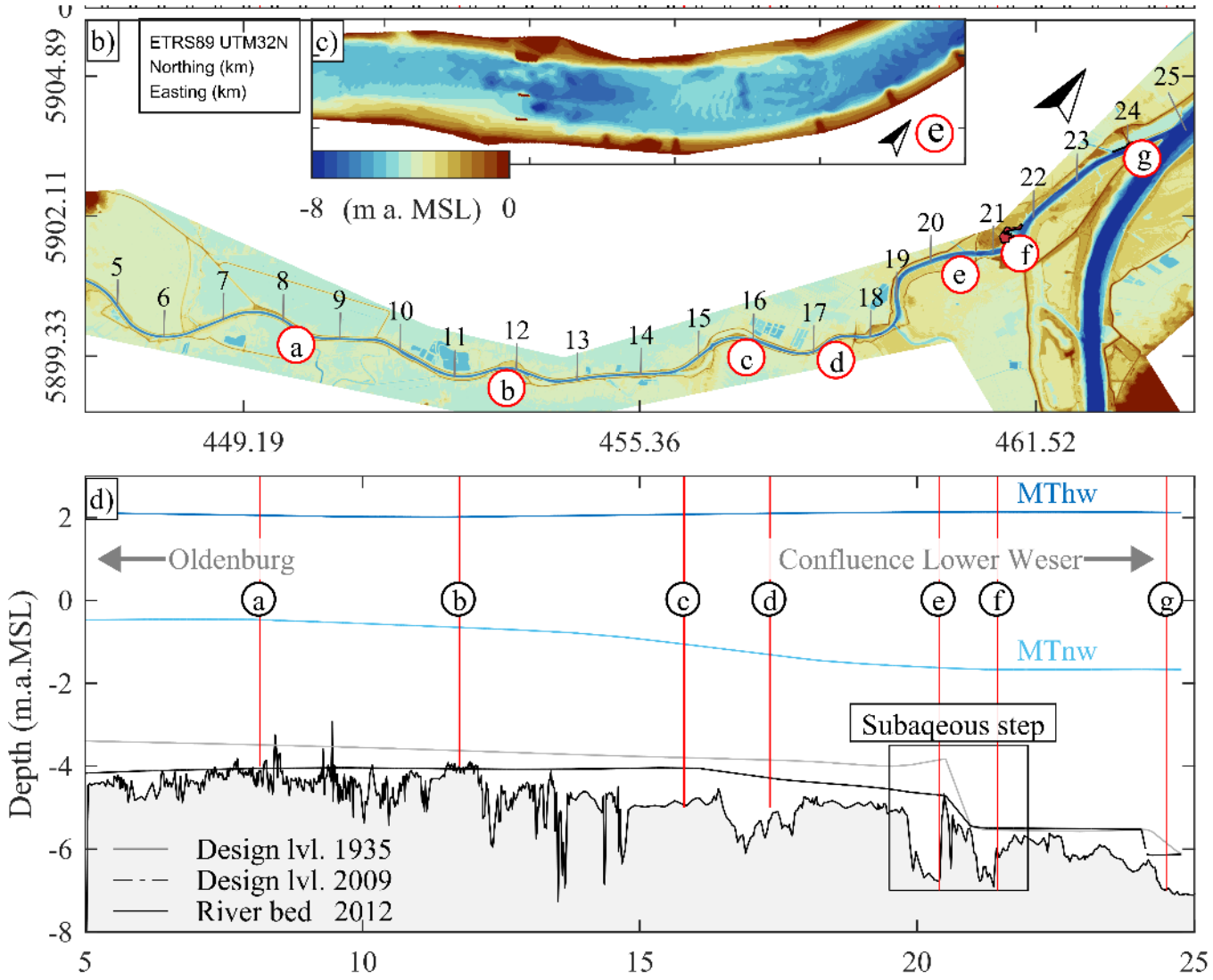


Lessons learned and Outlook

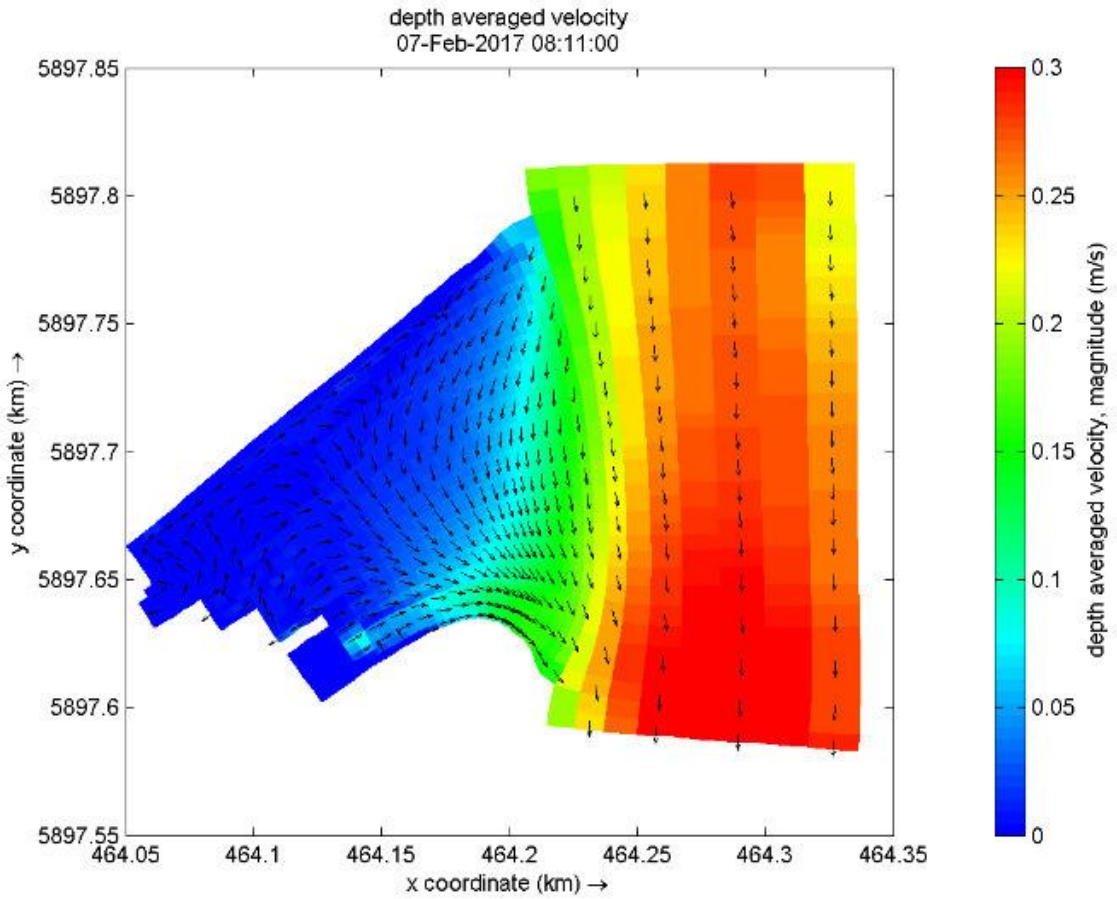
- More aerial observations in the initial project stage
- More targeted SSC measurements and samples
- Real synchronous sampling

Next steps:

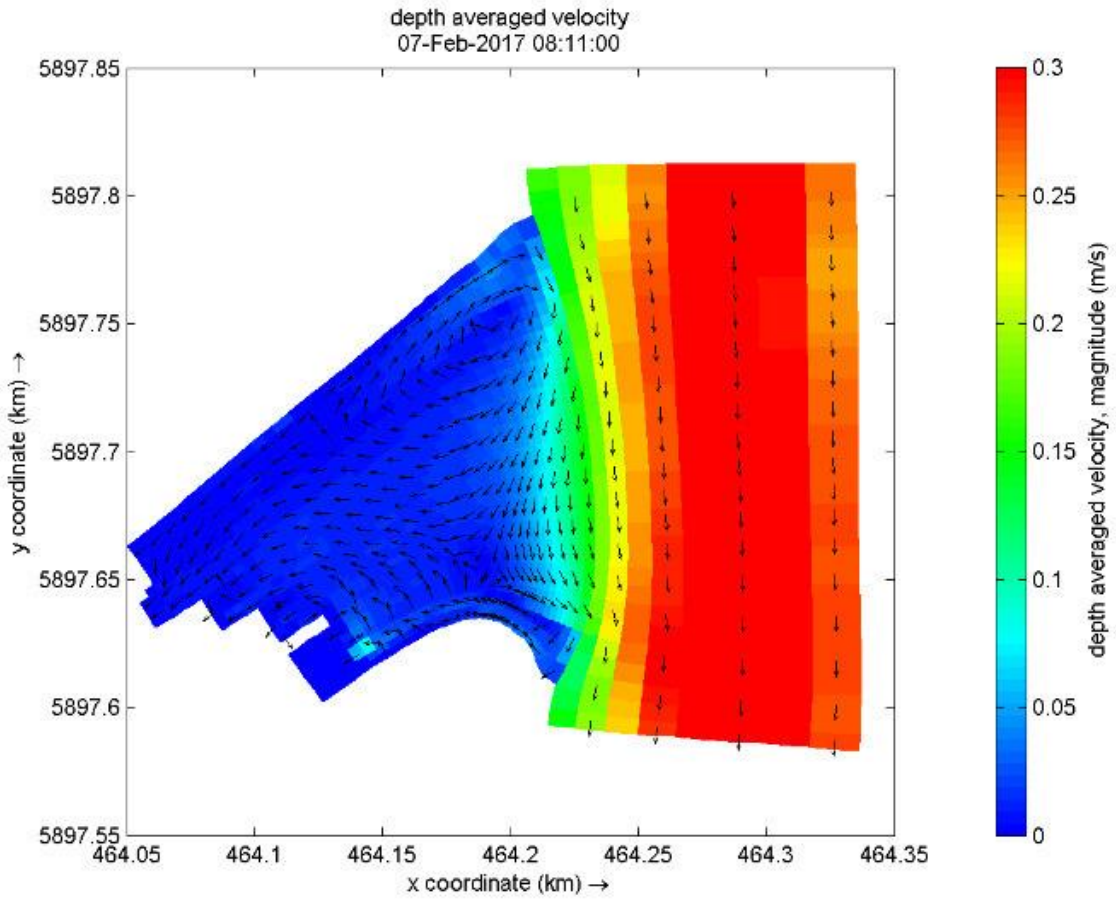
- More research on SSC peaks in the Weser
- Delft3D model of Hunte & Weser
- Effects of bathymetric changes
- Study constructive countermeasures



Preliminary numerical model results:



- Initial bathymetry, flood current



- Dual current deflection walls, flood current


Thank you!