Variations of inherent optical properties in case of harbour dredging in Estonian coastal sea

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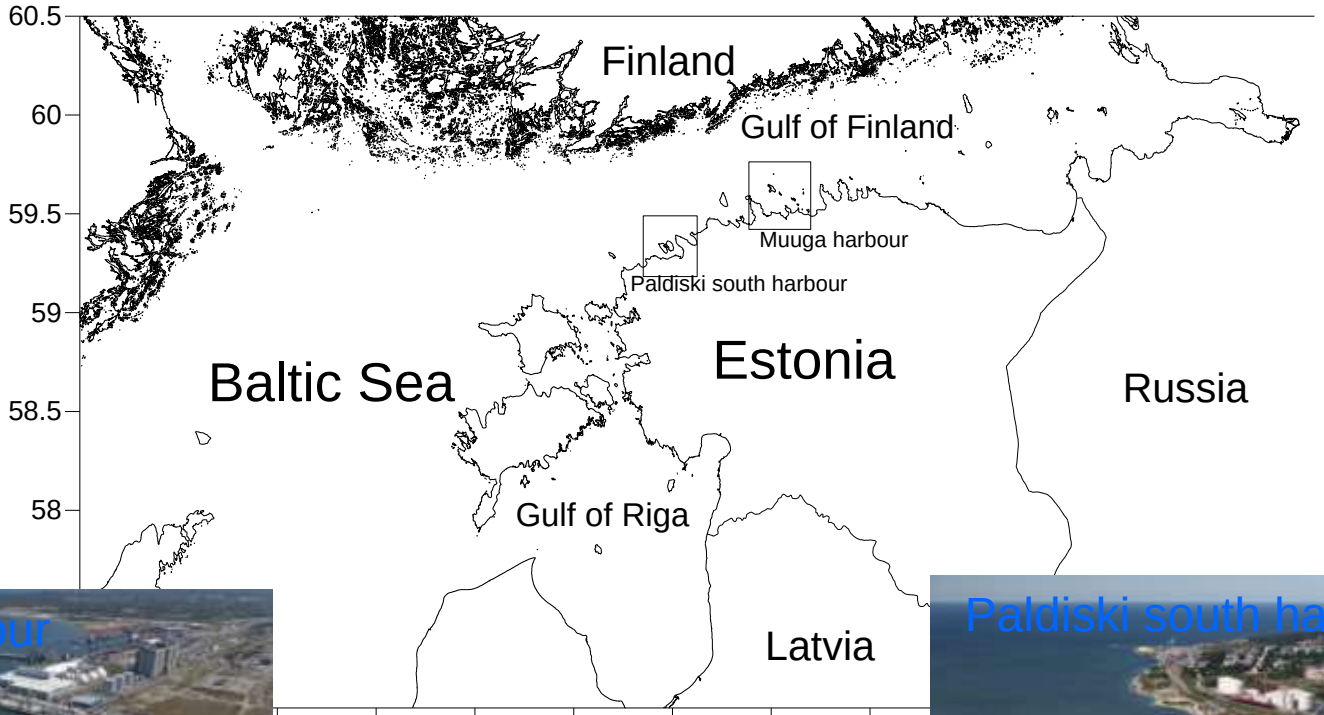
Outline

- Study sites and collected IOP dataset at the time of dredging
- Examples of data
- Use of MERIS imagery for monitoring SPM distribution
- Plans for upcoming PECS project “Environmental monitoring of harbour dredging”



- Harbours belong to the Port of Tallinn which is one of three biggest cargo handlers in the Baltic Sea
- Maintenance of the harbours requires dredging of the shipping channel and aquatory after every second year

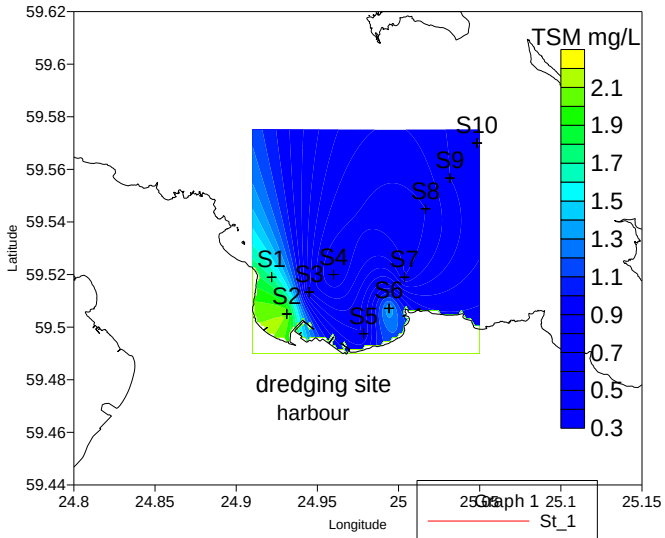
The dataset of IOP-s have been collected during the monitoring of SPM distribution at the time of port dredging. The data was used for detailed description of SPM distribution near the dredging site for later evaluation of environmental impact. The dataset contains:

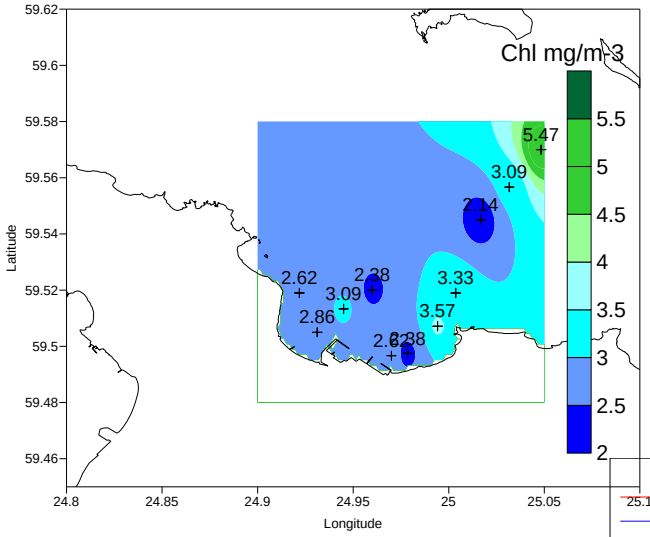
•Vertical profiles of attenuation and absorption coefficient with WetLabs ac - spectra

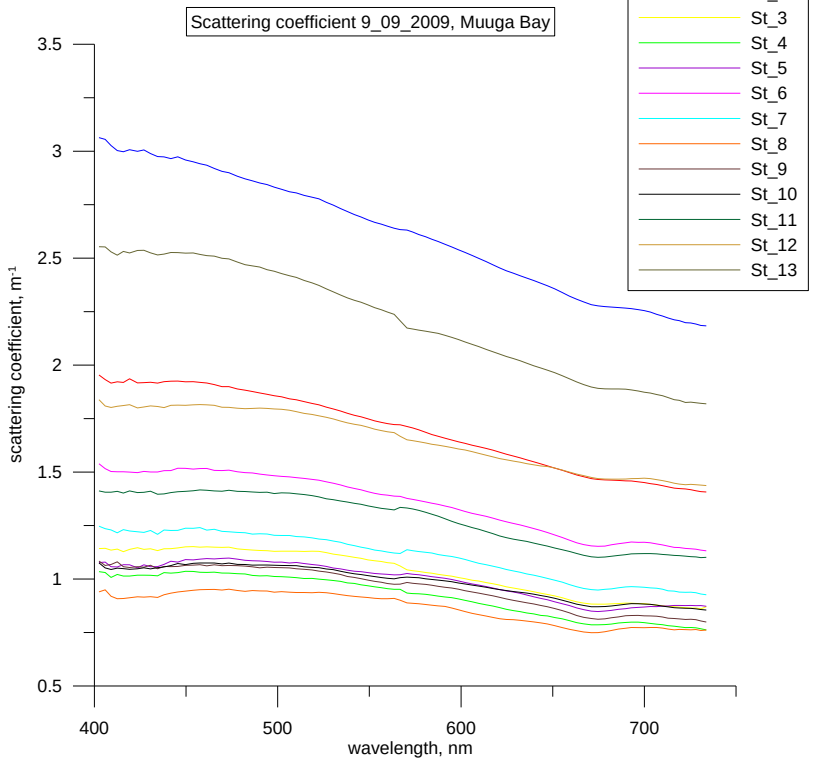
•Concentrations of SPM and Chlorophyll a

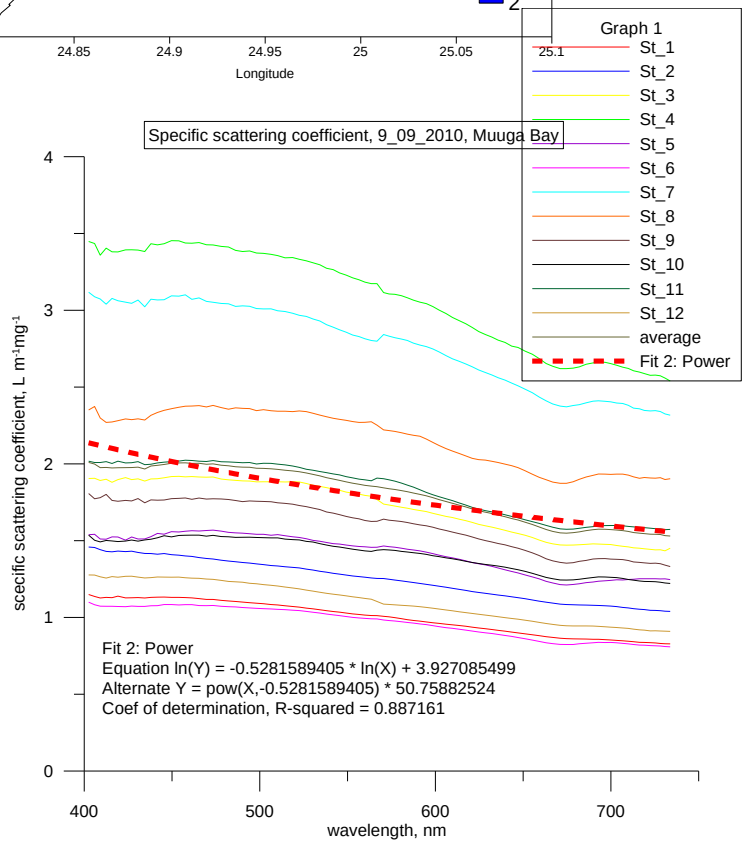
There are approximately 30 days of data from different sites collected during years 2007-2010.

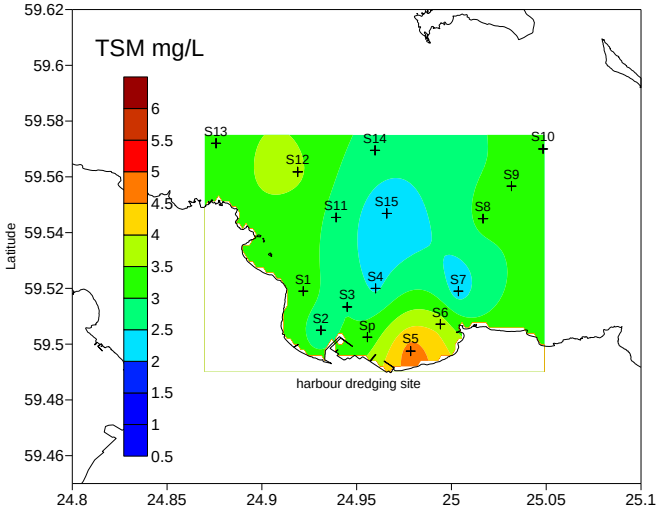
Dredging in Muuga 9_09_2009

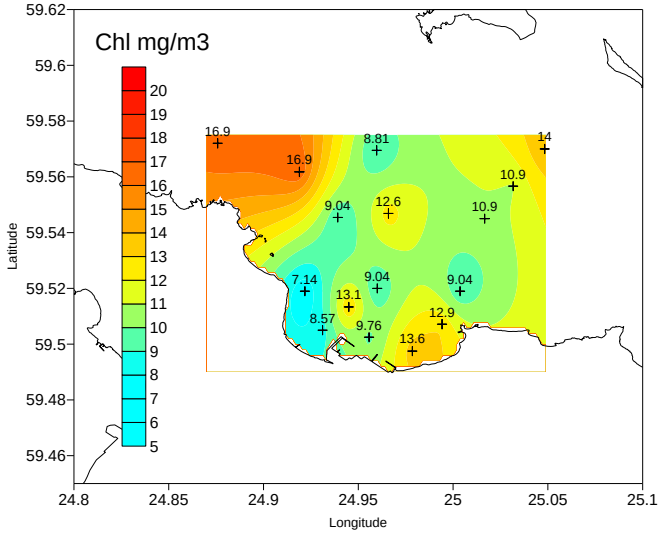




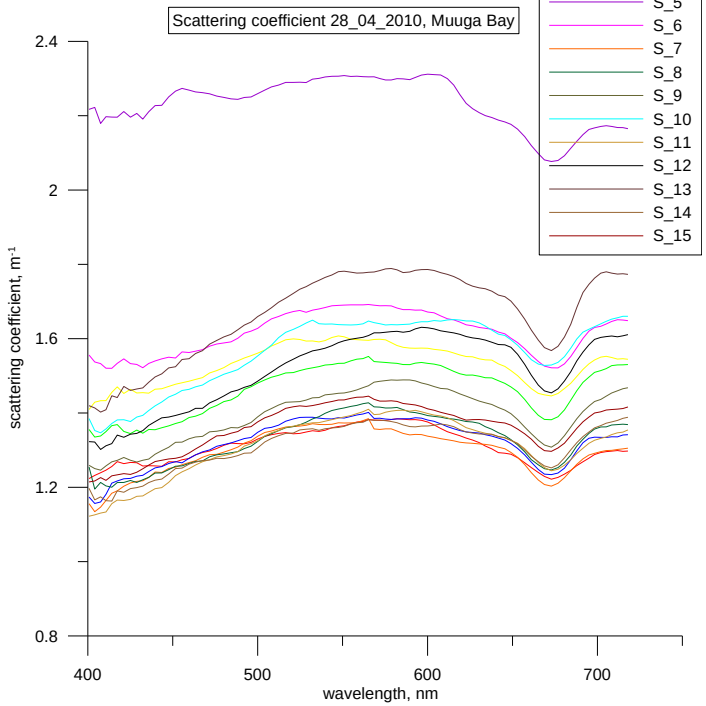


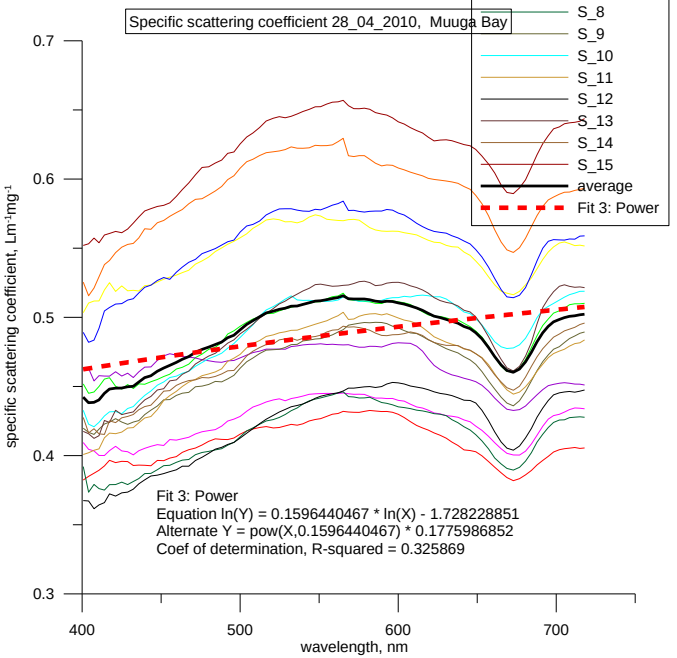




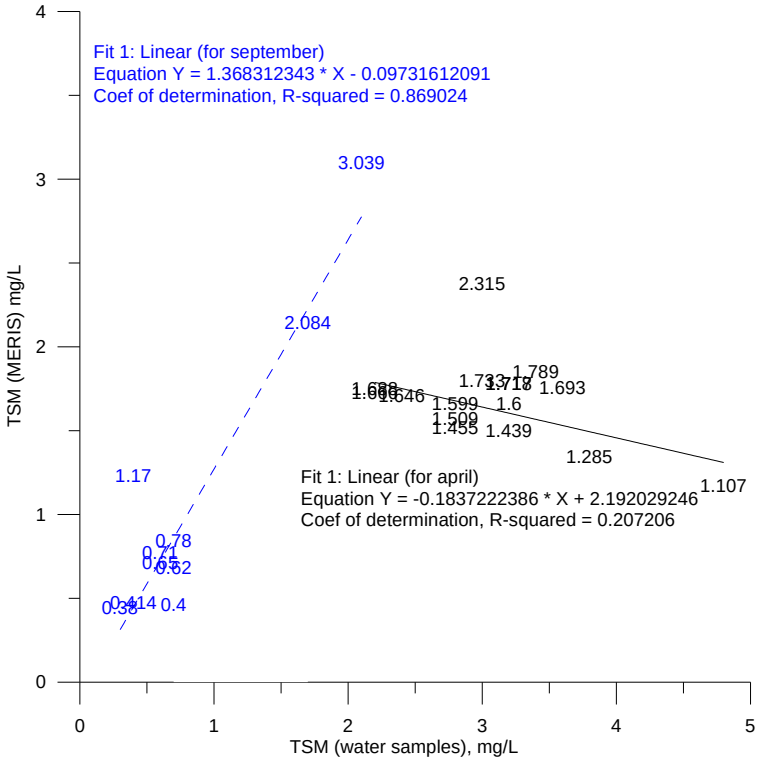


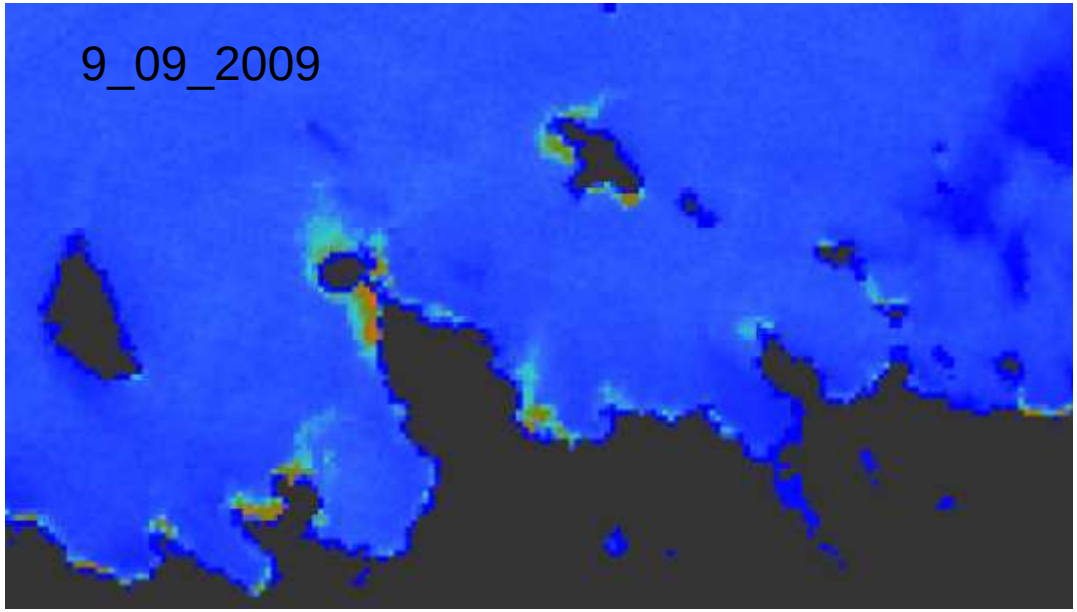
Dredging at the time of spring bloom in Muuga Bay 28_04_2010

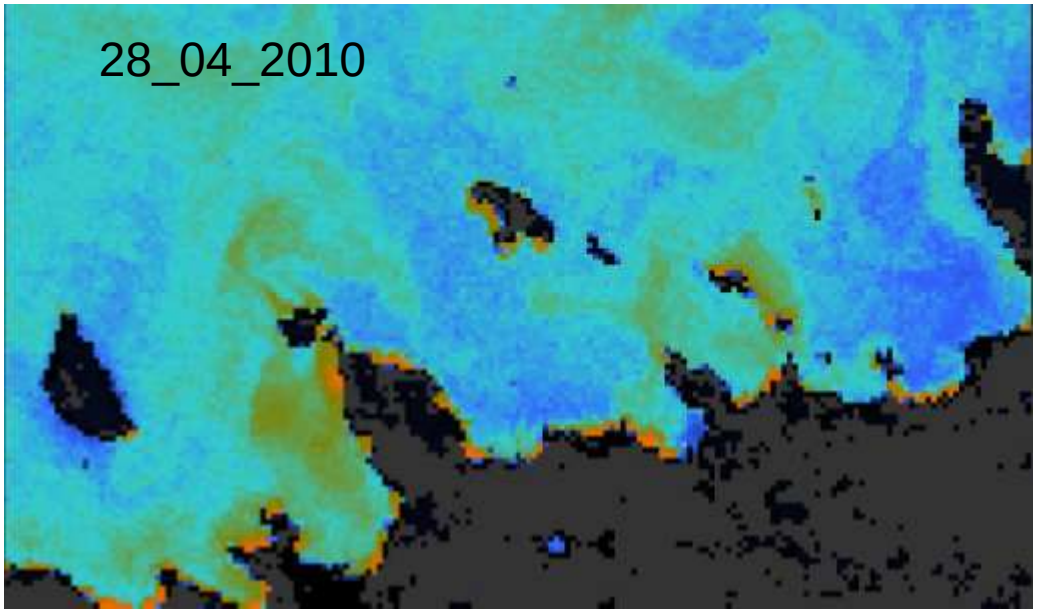




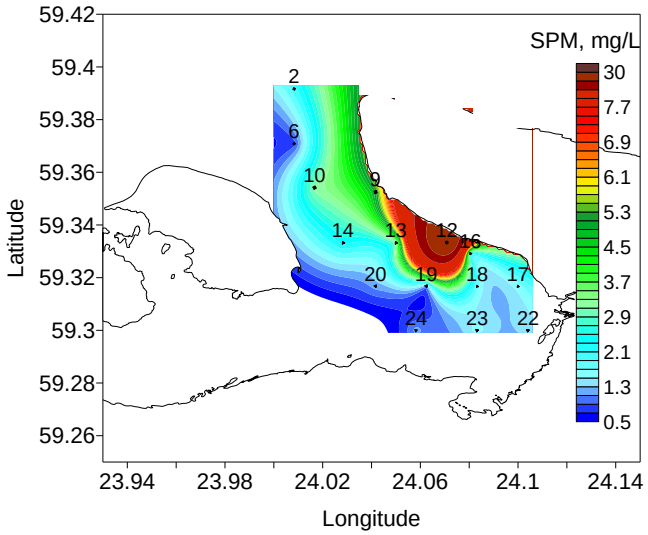
Comparison of MERIS TSM vs TSM water samples

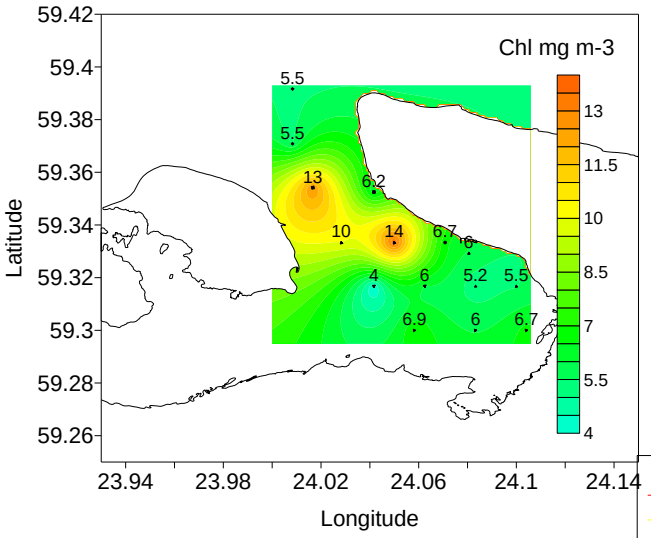




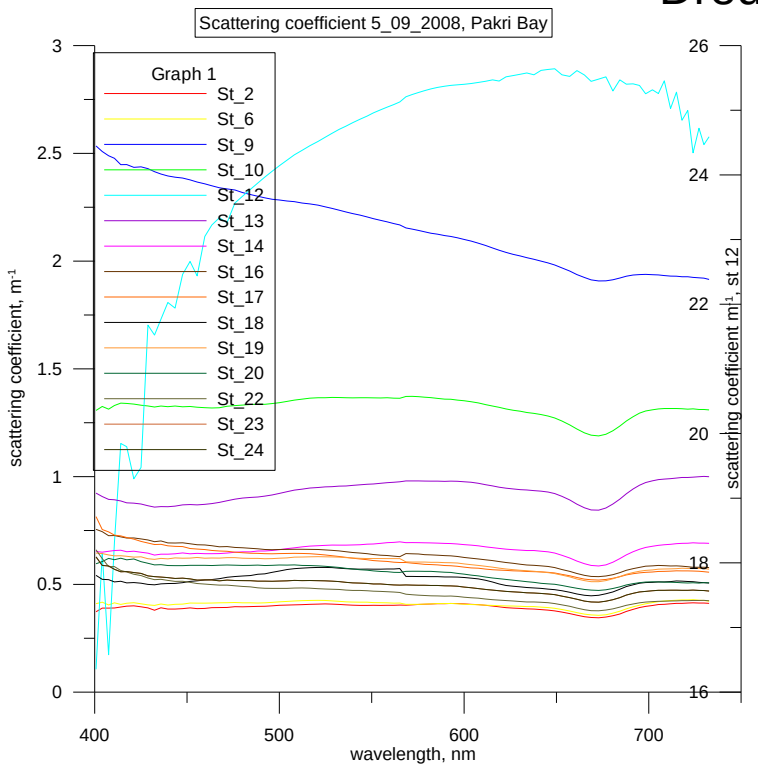


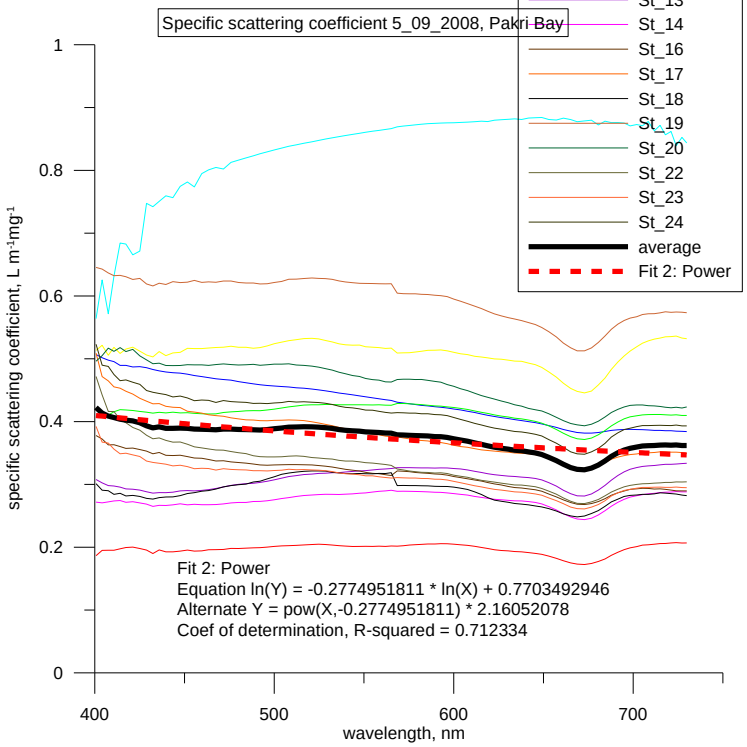
- If the Chl content is low and particles are mainly resuspended MERIS TSM product is reliable.
- In case of high Chl content the MERIS TSM is underestimated.

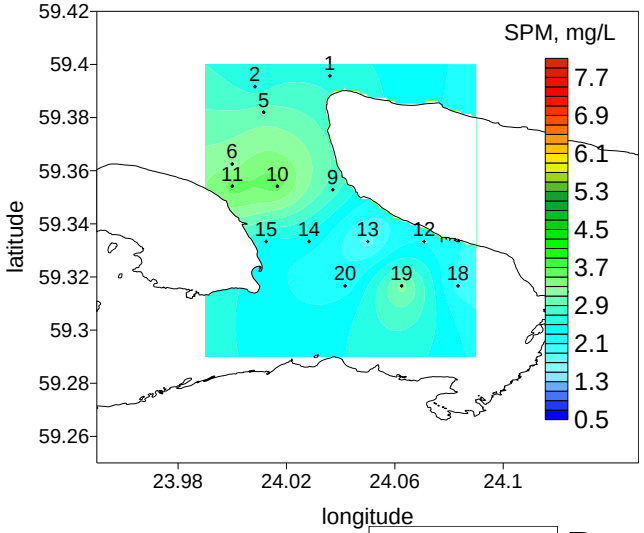


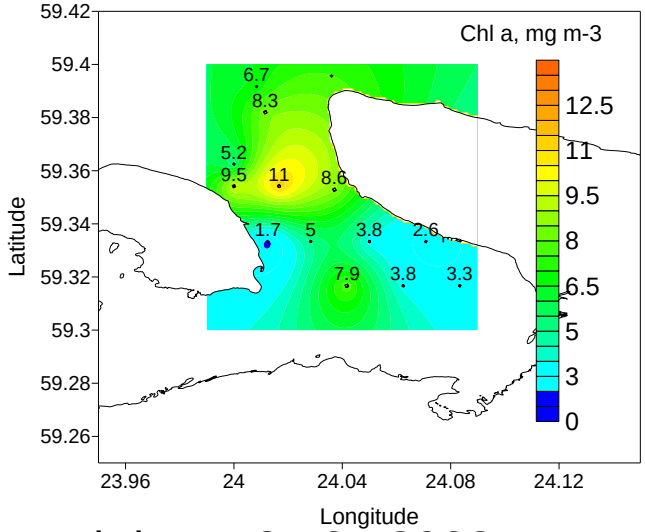


Dredging Pakri Bay 5.09.2008

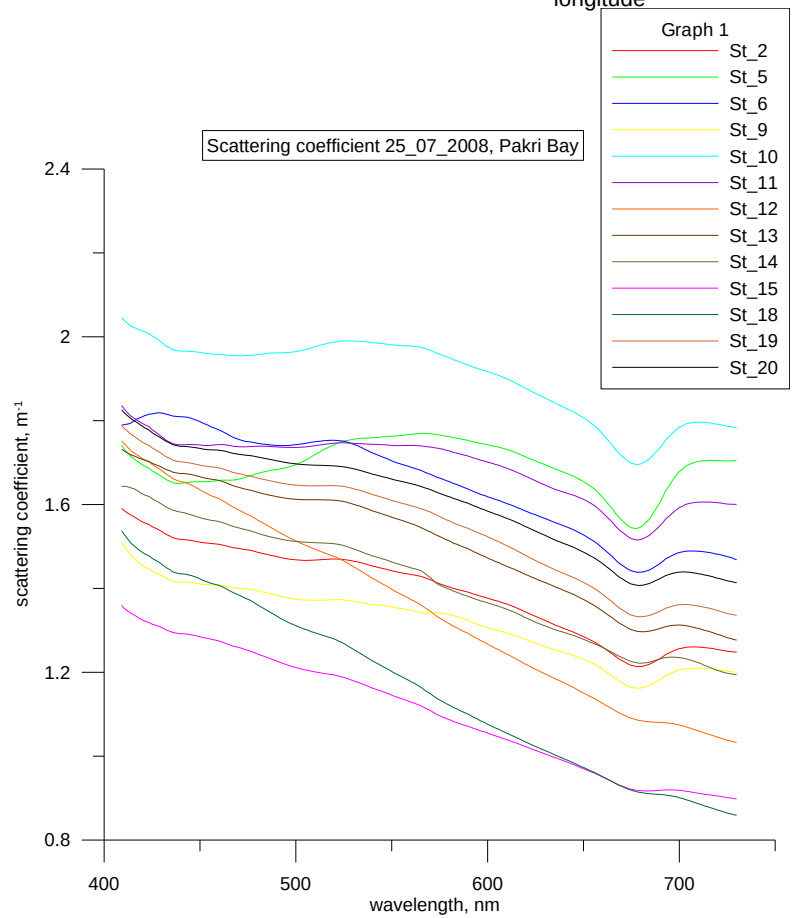


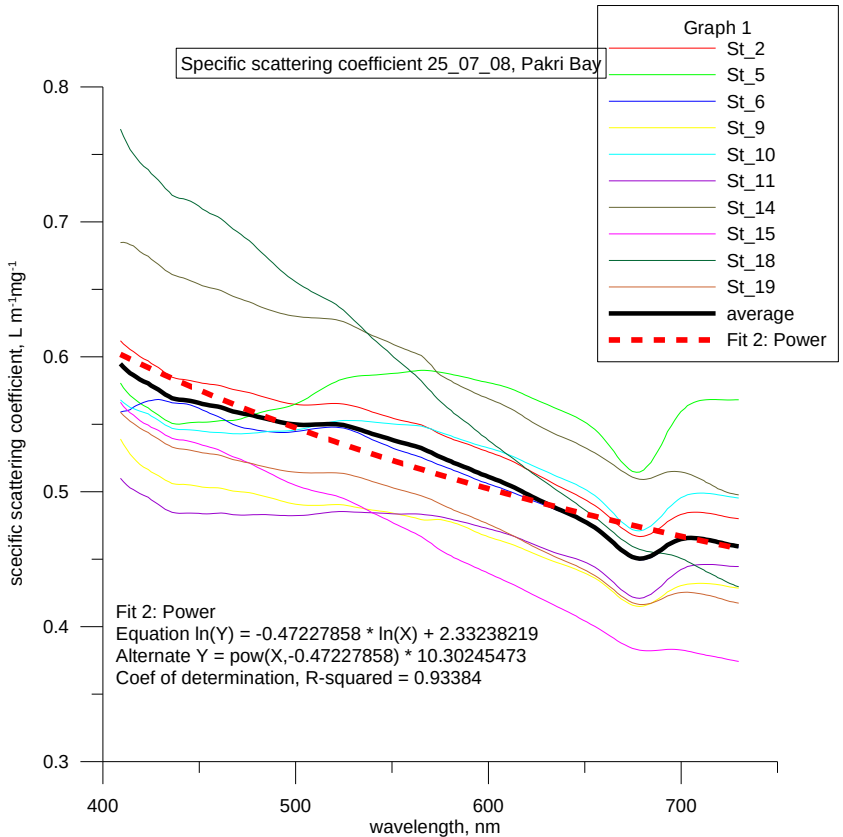


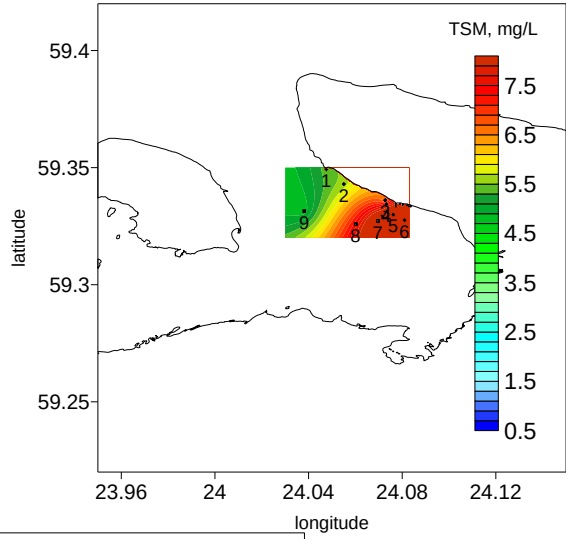




Dredging Pakri Bay 25.07.2008



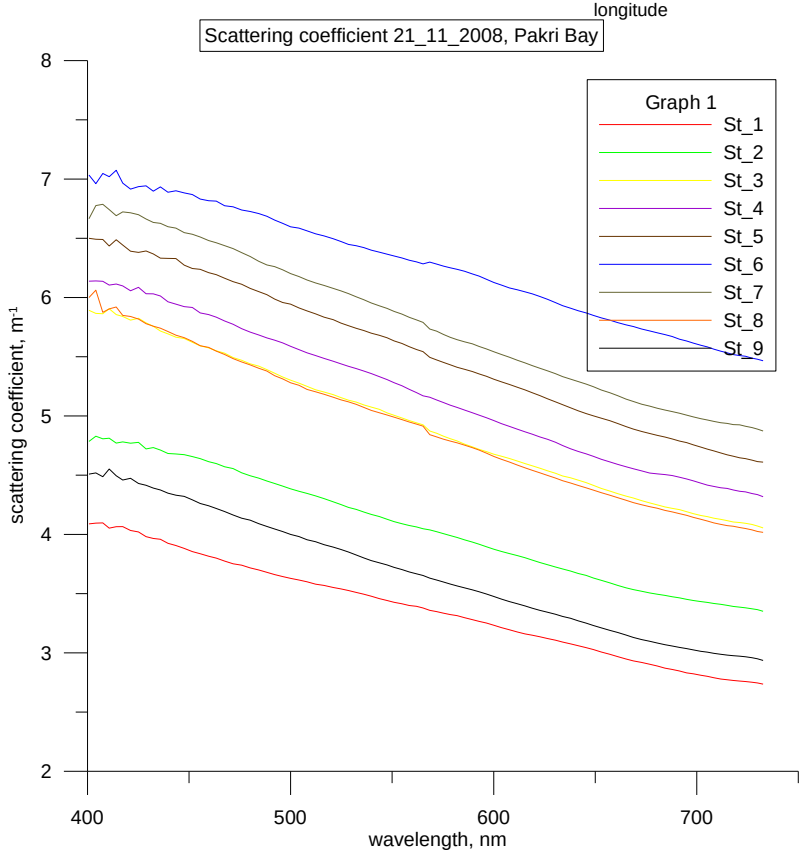


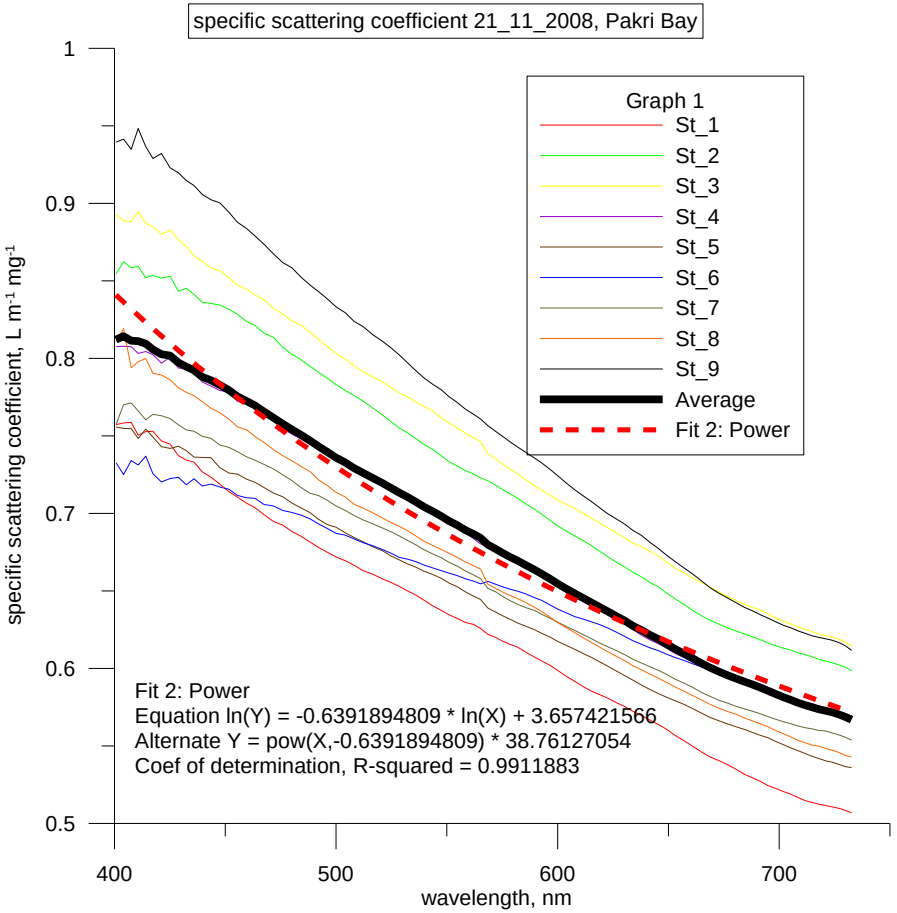


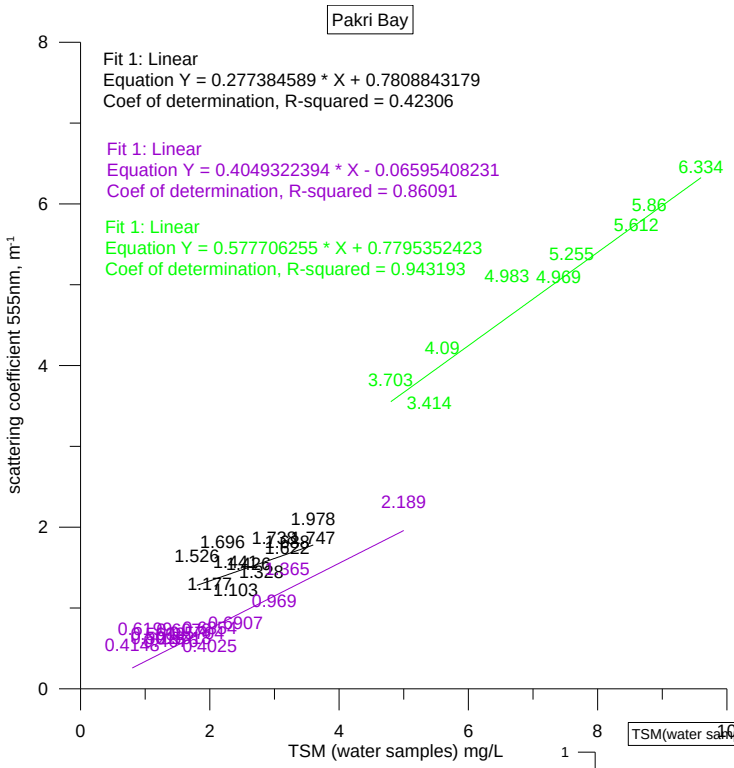
Dredging Pakri Bay 21_11_2008

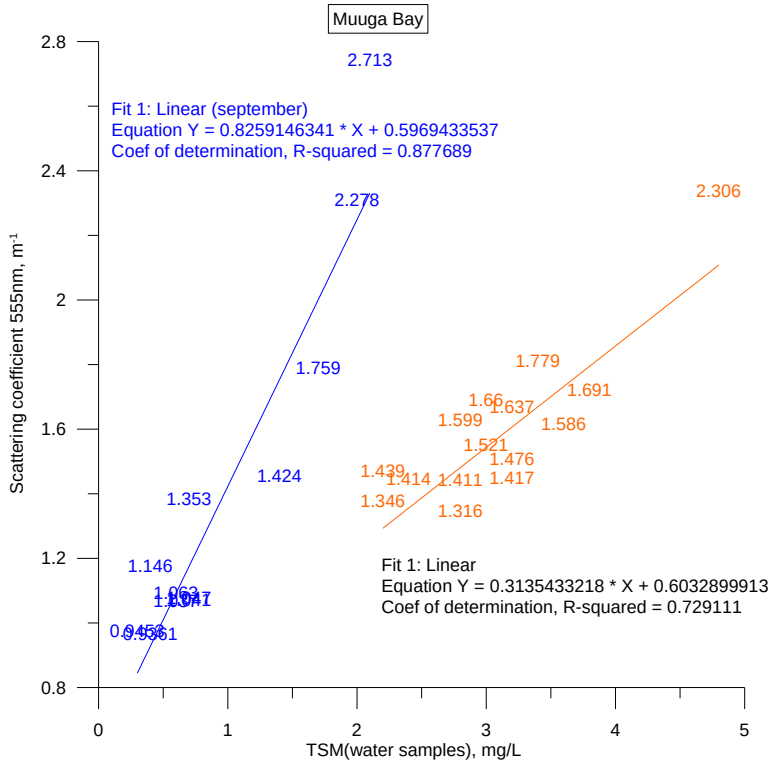
WN wind 8-10m/s,

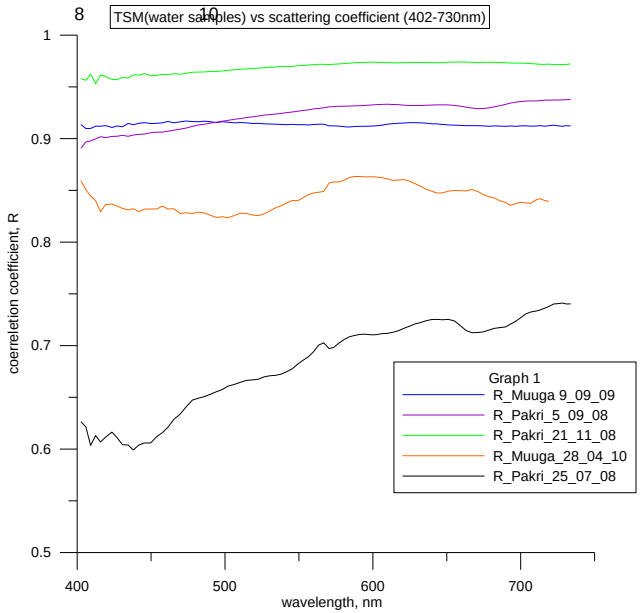
very low phytoplancton content chlorophyll a concentration less than 0.3µg/L






Pakri Bay
Fit 1: Linear
Equation Y = 0.277384589 * X + 0.7808843179
Coef of determination, R-squared = 0.42306
Fit 1: Linear
Equation Y = 0.4049322394 * X - 0.06595408231
Coef of determination, R-squared = 0.86091
Fit 1: Linear
Equation Y = 0.577706255 * X + 0.7795352423
Coef of determination, R-squared = 0.943193
scattering coefficient 555nm, m-1
TSM (water samples) mg/L


Muuga Bay
Fit 1: Linear (september)
Equation Y = 0.8259146341 * X + 0.5969433537
Coef of determination, R-squared = 0.877689
Fit 1: Linear
Equation Y = 0.3135433218 * X + 0.6032899913
Coef of determination, R-squared = 0.729111
Scattering coefficient 555nm, m-1
TSM(water samples), mg/L


TSM(water samples) vs scattering coefficient (402-730nm)
coerretion coefficient, R
wavelength, nm
Graph 1
R_Muuga 9_09_09
R_Pakri_5_09_08
R_Pakri_21_11_08
R_Muuga_28_04_10
R_Pakri_25_07_08

MERIS case-2 processor products are reliable for describing the SPM distribution in case when dominant particles in water are resuspended particles.

In PECS project “Environmental monitoring of harbour dredging” are planed:

1. Analysis of SPM distribution in two largest harbours in Estonia using entire MERIS mission data (from CoastColour database) for detection of long term changes. Relating the data to ship traffic intensity and dredging activities.

Interesting datasets:

- SPM maps for cloud free days
- If possible some estimate of particles size distribution would be very interesting for the environmental impact evaluation.

2. Interactive software tool for harbour authorities with dataset from: (1)MERIS, (2) in situ measurements and (3) hyrdodynamical model for monitoring SPM distribution during dredging operations.