The use of satellite data for monitoring water bodies – comparison with ferrybox data

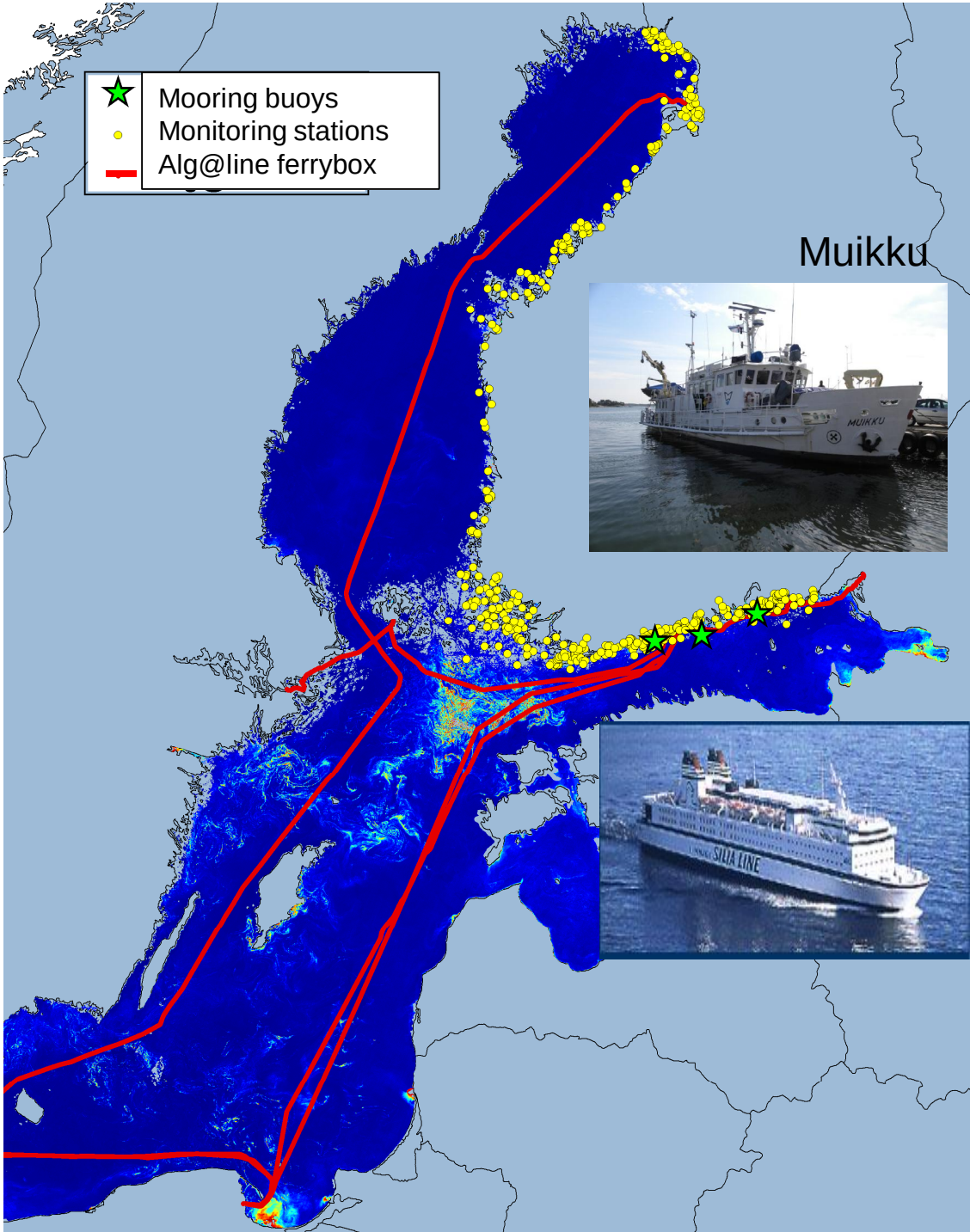
Jenni Attila, Seppo Kaitala, Kari Kallio, Hanna Alasalmi, Mikko Kervinen, Pirkko Kauppila, Juhani Kettunen

SYKE

5th FerryBox Workshop, 24.-25.4.2013

Different methods of monitoring

- Traditional monitoring station measurements since 1960/70
- 20 years of Alg@line – ferrybox - since 1993
- Earth observations from satellite instruments,
- Mooring buoys on the coast



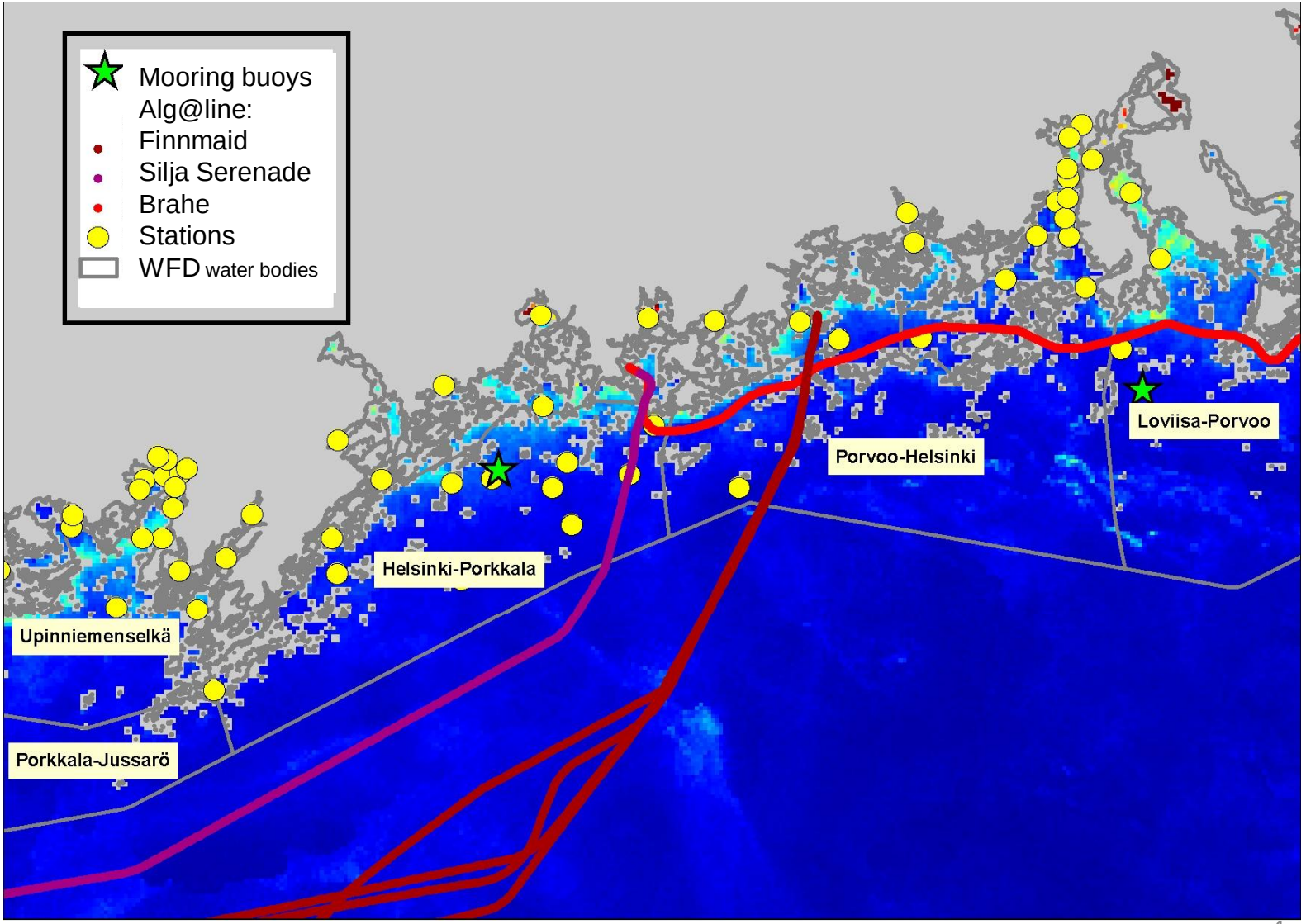
SYKE

The use of satellite data for monitoring water bodies

- The increased monitoring demand and reporting activities by WFD and MSFD call for the development and implementation of all currently available monitoring methods.
- Currently available data on the coastal waters of Finland consists of traditional monitoring stations, Earth observations (EO), ferrybox and mooring buoys.
- In on-going EOMORE project different monitoring methods and their usability to WFD/MSFD reporting are compared and their accuracy is evaluated.
- The northern Baltic Sea is characterized by fragmented coastline and thousands of islands of various sizes. This sets specific requirements for monitoring methods and on the use of EO data.

SYKE

Monitoring methods on the coastal waters of Finland



SYKE

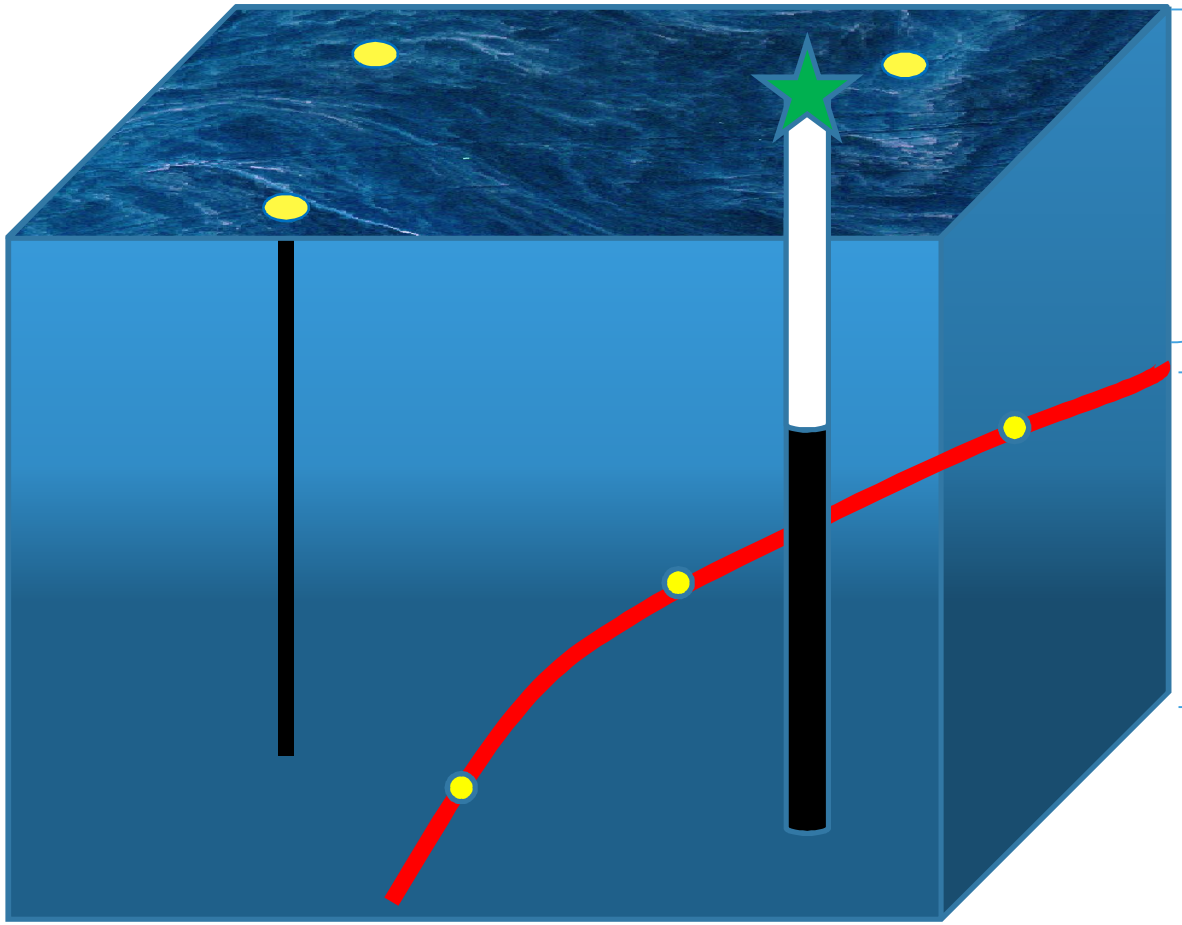
Measurements at different depths: Alg@line, EO, mooring buoys and monitoring stations

Monitoring stations
- Depth profile (0-10 m)

Alg@line
- Transect & water samples (5 m)

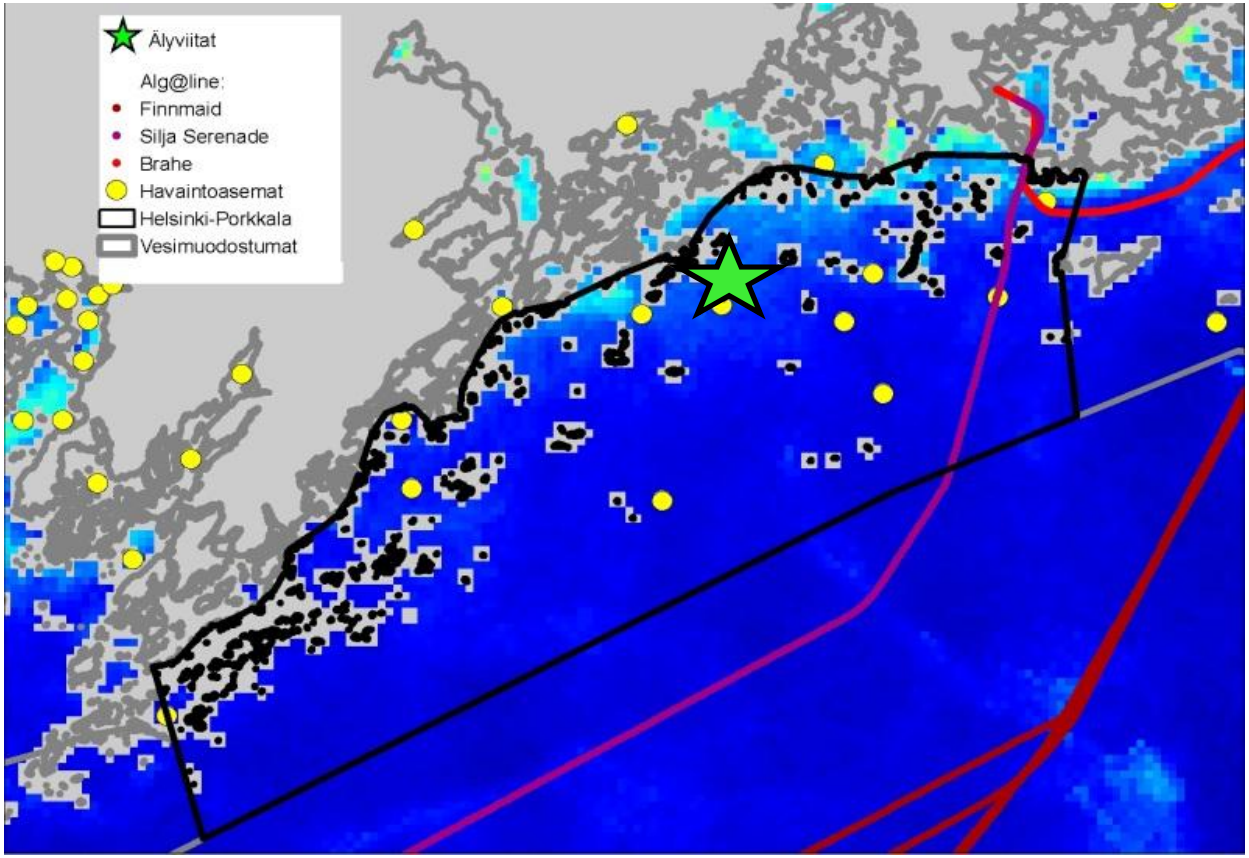
Mooring buoys
- Constant (2 m)

EO
- Cloudless scenes (upper layer)



SYKE

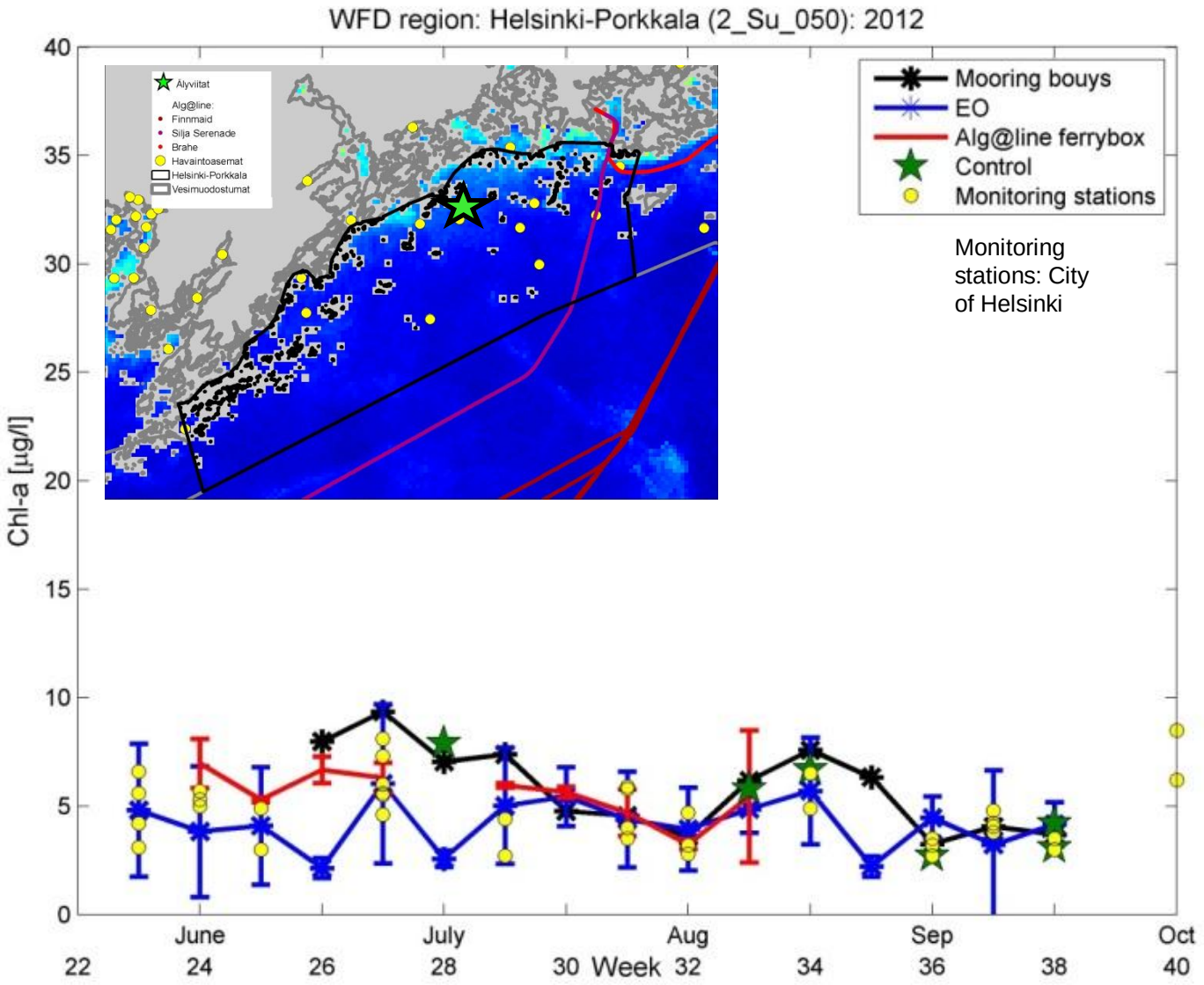
WFD region Helsinki-Porkkala, 2012



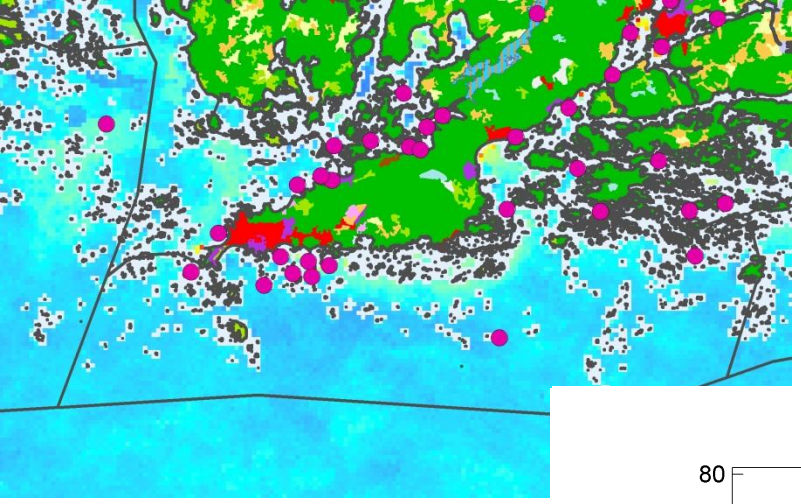
SYKE

Information from different data sources:
timeseries of mean and std during summer 2012

- The overall correspondence between different monitoring methods is good although measurements are taken on different parts of water body
- Weeks 26, 28 and 35 are partially cloudy MODIS scenes: observations only from the outer parts of the water body

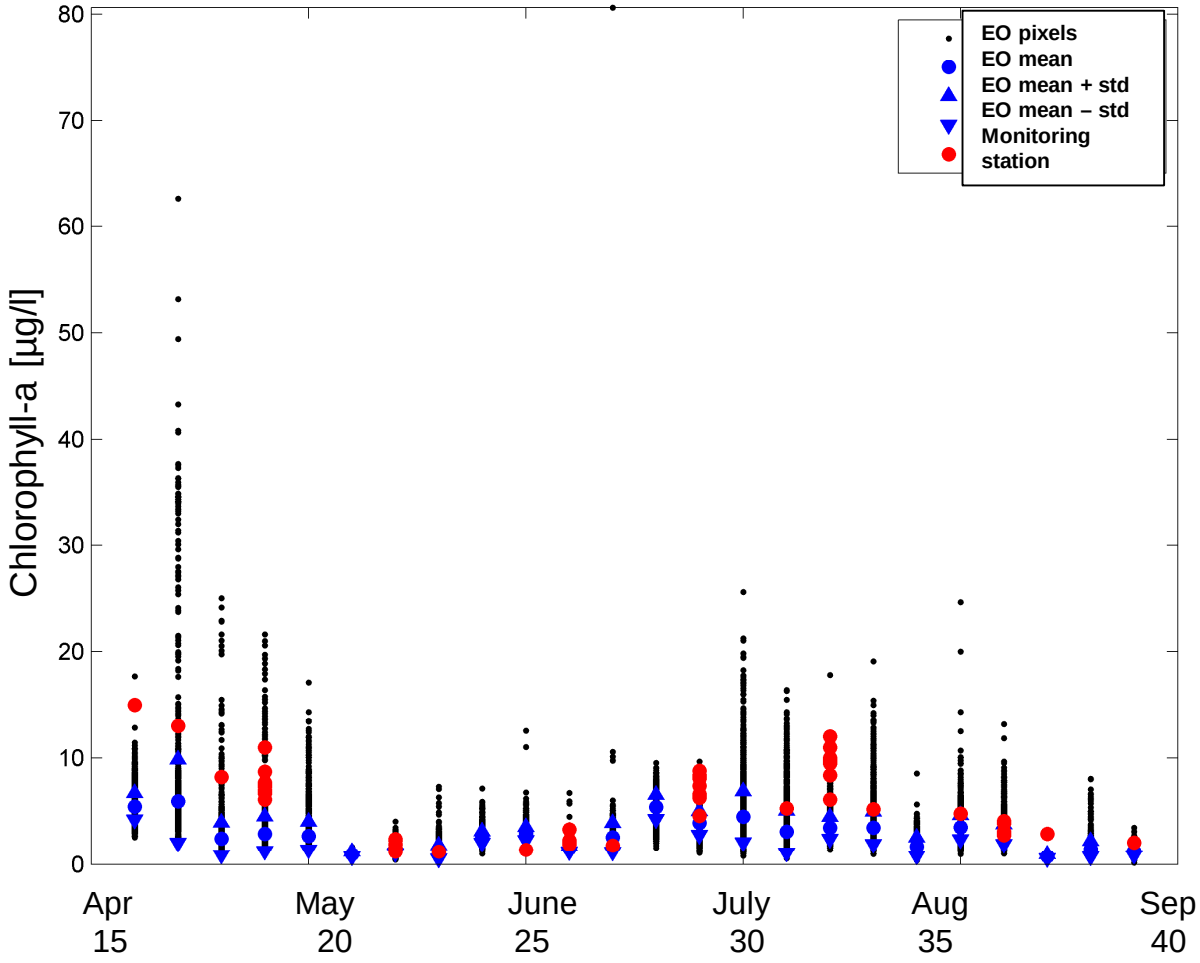


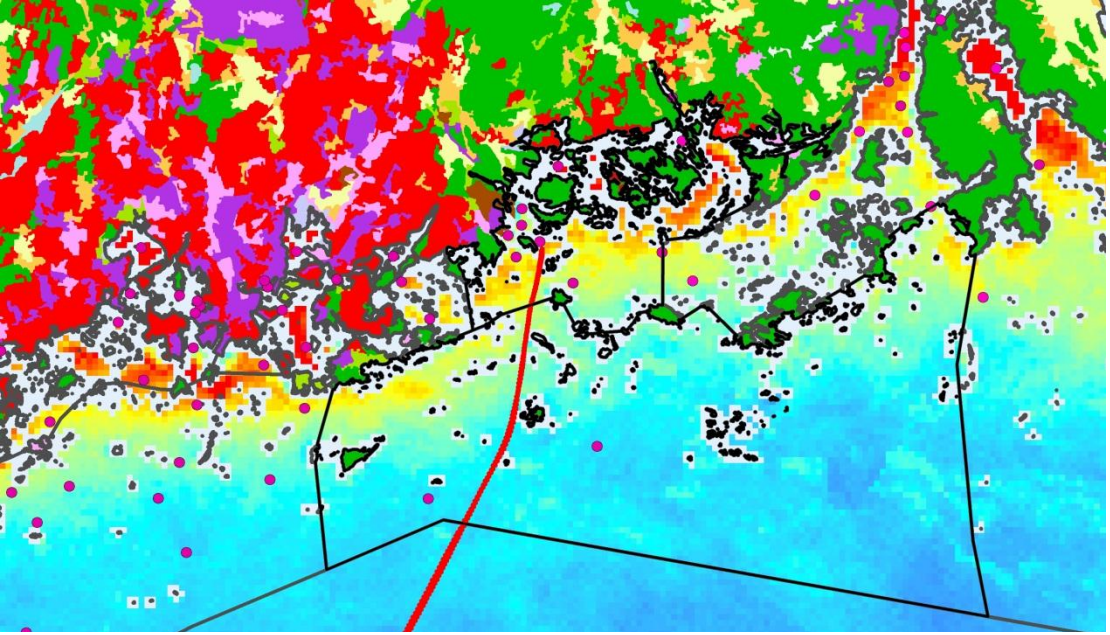
SYKE



Time series of EO and monitoring stations

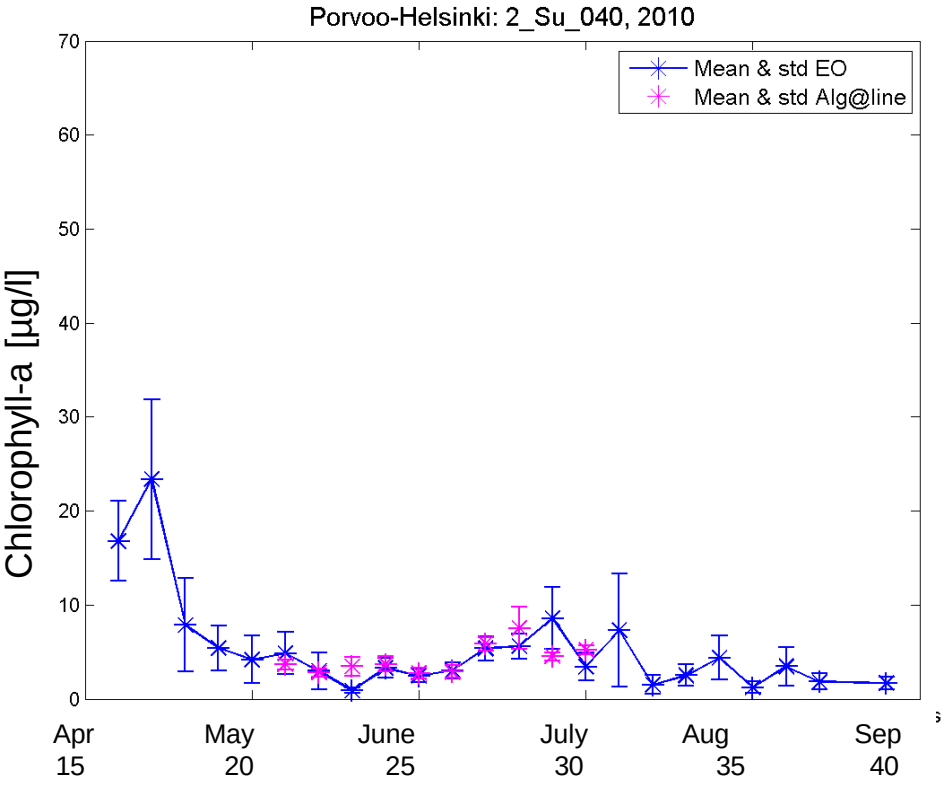
- On the outer water bodies the mean and std of EO chl-a interpretations are typically smaller than chl-a measurements taken at the monitoring stations.
- However, the variation in the chl-a concentrations is high when all pixels in the water body are concidered

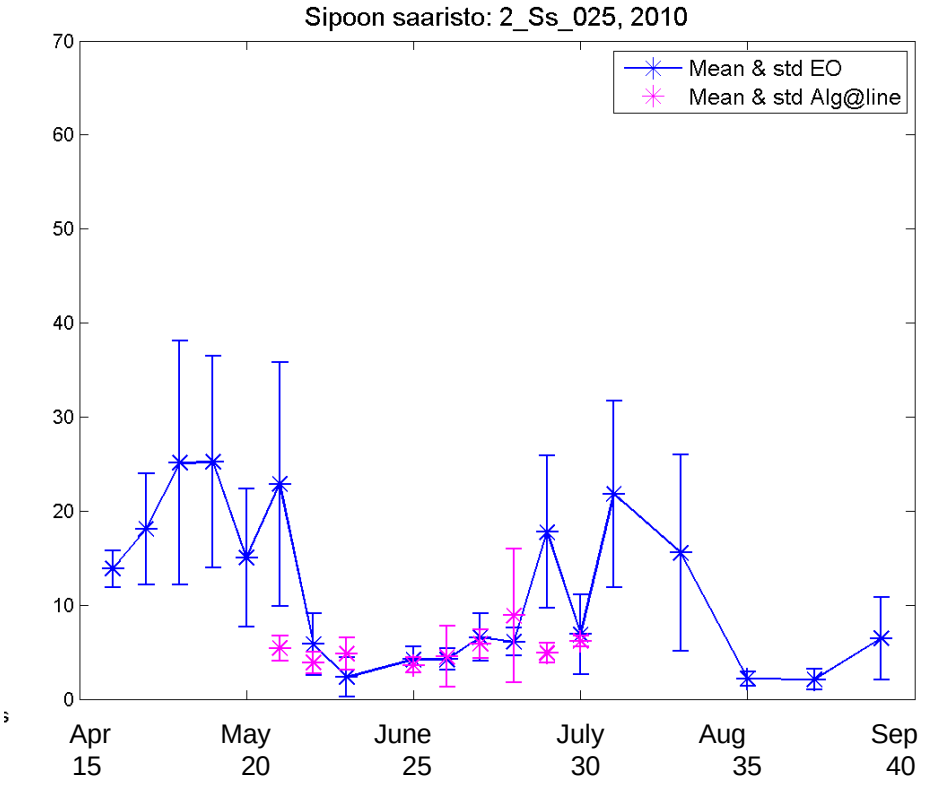


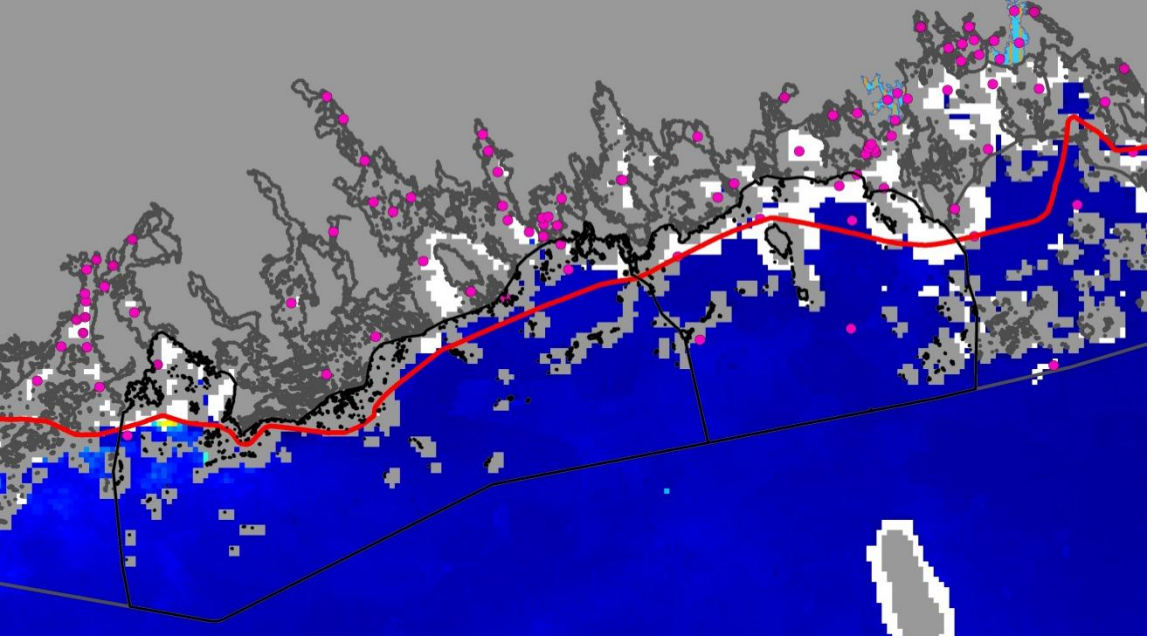


Coastal water bodies near the City of Helsinki

- Alg@line transect
- EO (MERIS, 300m)

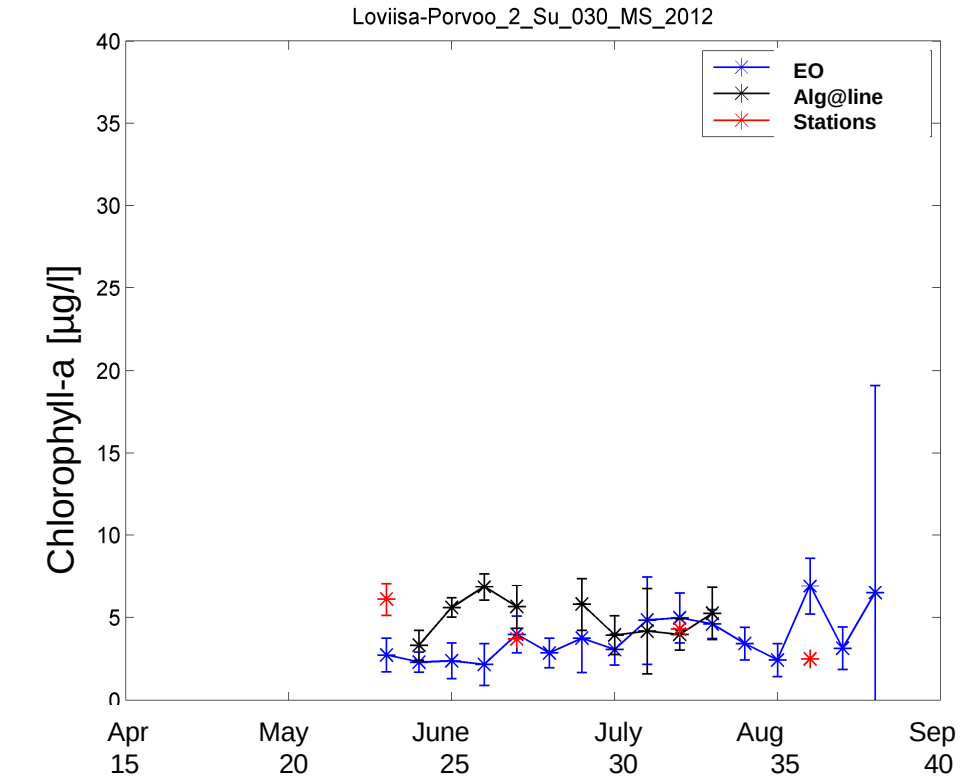


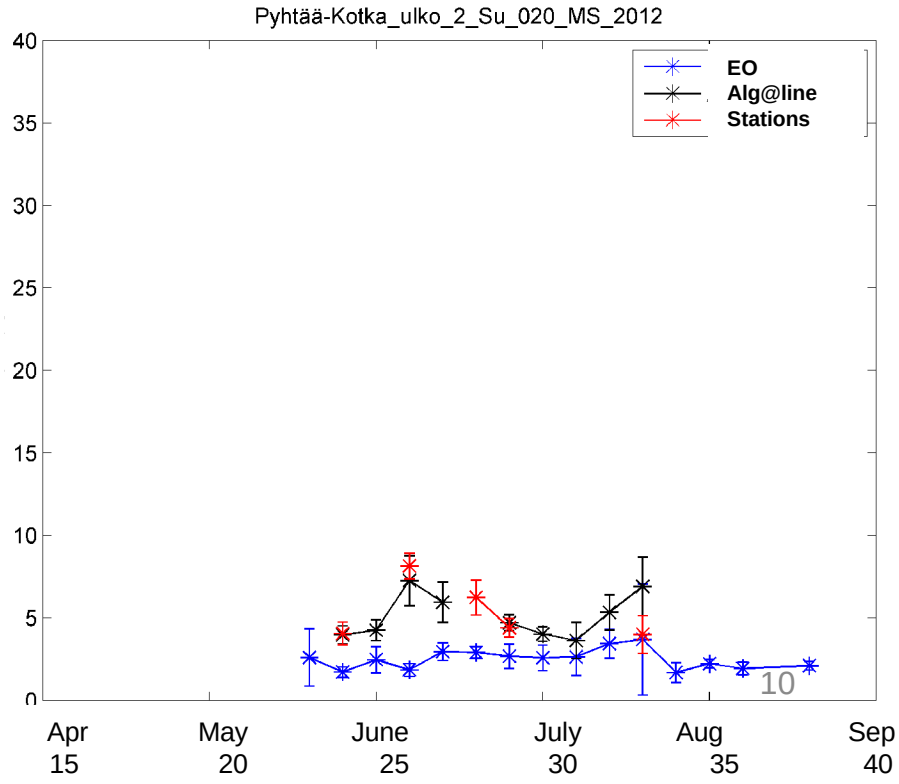




Water bodies on the Eastern Gulf of Finland

- Alg@line transect
- Monitoring stations
- EO (MODIS, 1000m)





Aspects on use of EO data on the coastal waters of Finland

- Among the satellite instruments in the past and near future MERIS and its follow-up instrument OLCI (onboard Sentinel-3a satellite) can provide the best functionality for the estimation of parameters related to chl-a.
  - This is related to both the spatial resolution of 300m as well as their band combination.
- The inner water bodies in Finnish coastal waters cannot be monitored using instruments with 1 km resolution, such as MODIS and VIIRS.
- The outer water bodies can be monitored using MODIS (and VIIRS) during 2012-2014 (period between MERIS and Sentinel-3A OLCI).
- The cloudiness partially hampers the use of EO data.
- However the number of observations throughout the spring-summer period is substantial.

SYKE

Conclusions and future aspects

- The increased monitoring demand calls for the development and implementation of all currently available monitoring methods.
- The inclusion of EO methods along with Alg@line and other efficient techniques of measuring can greatly complement the required monitoring actions, particularly in areas out of reach of traditional methods.
- The interpretations of chl-a by different monitoring methods are very similar and support for their joint use as combined monitoring in the future.
- The differences in results can be mostly explained by different measurement time, depth and spatial differences in measurement locations – and cloudy situations.

SYKE

Thank you!

Special thanks to :
Alg@line
Sofia Junttila, Eeva Bruun, Saku Anttila (SYKE/GEO)
Emil Vahtera (City of Helsinki)