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Towards Near Real Time Validation of Chlorophyll Fluorescence

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5th FerryBox Workshop
- Celebrating 20 Years of Alg@line
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Finnish Environment Institute (SYKE), Helsinki, Finland

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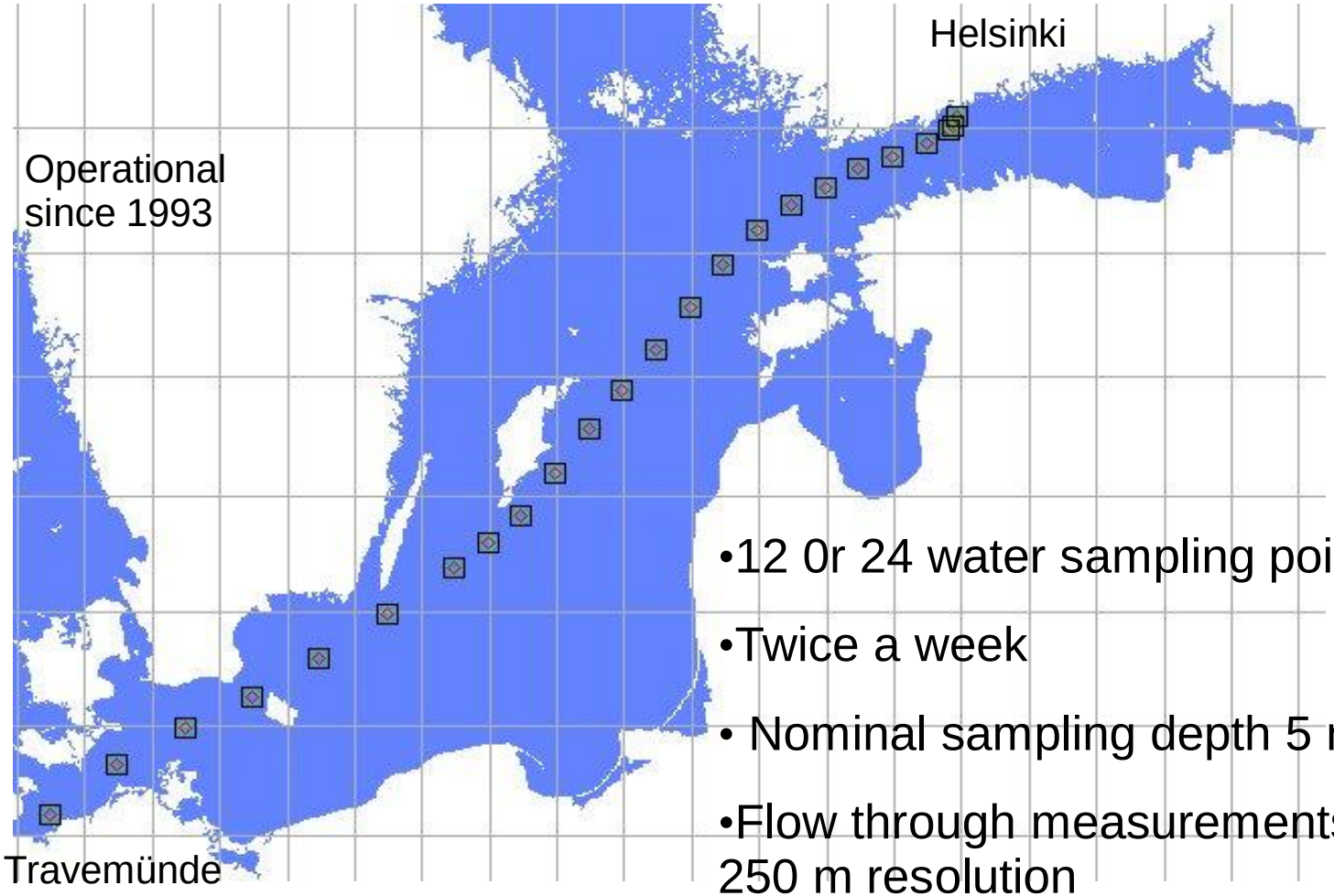
Alg@line Flow-through recording and water sampling points by M/S FINNMAID



- 12 0r 24 water sampling points
- Twice a week
- Nominal sampling depth 5 m
- Flow through measurements with 250 m resolution

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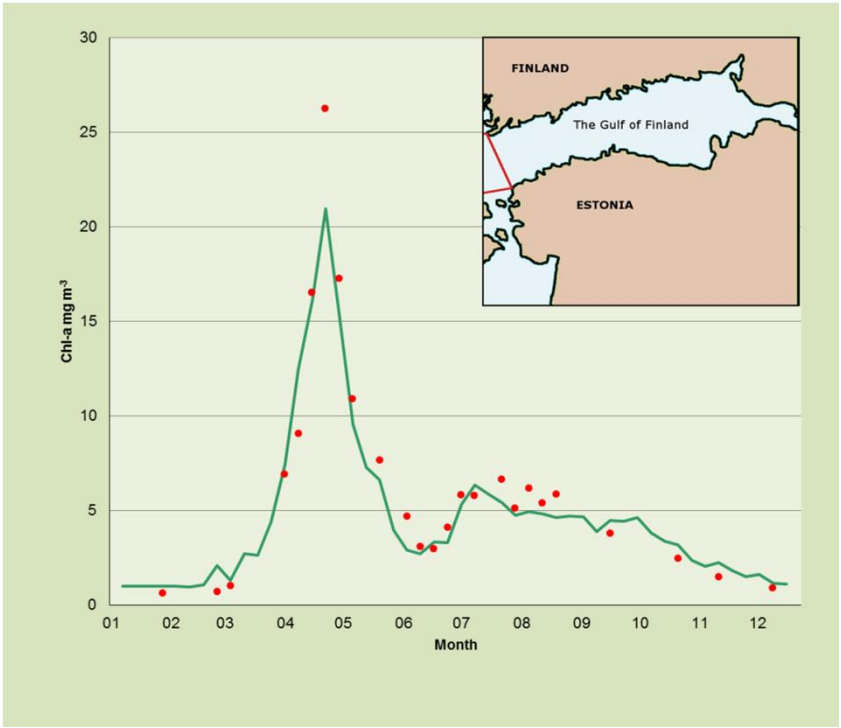
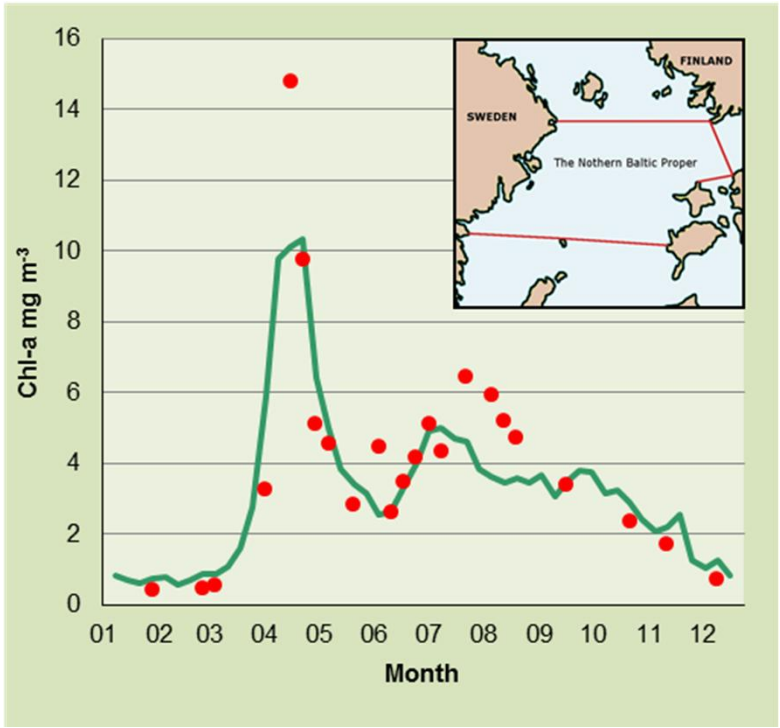
Annual succession 2012
Chlorohyll from water samples
Gulf of Finland and Northern Baltic





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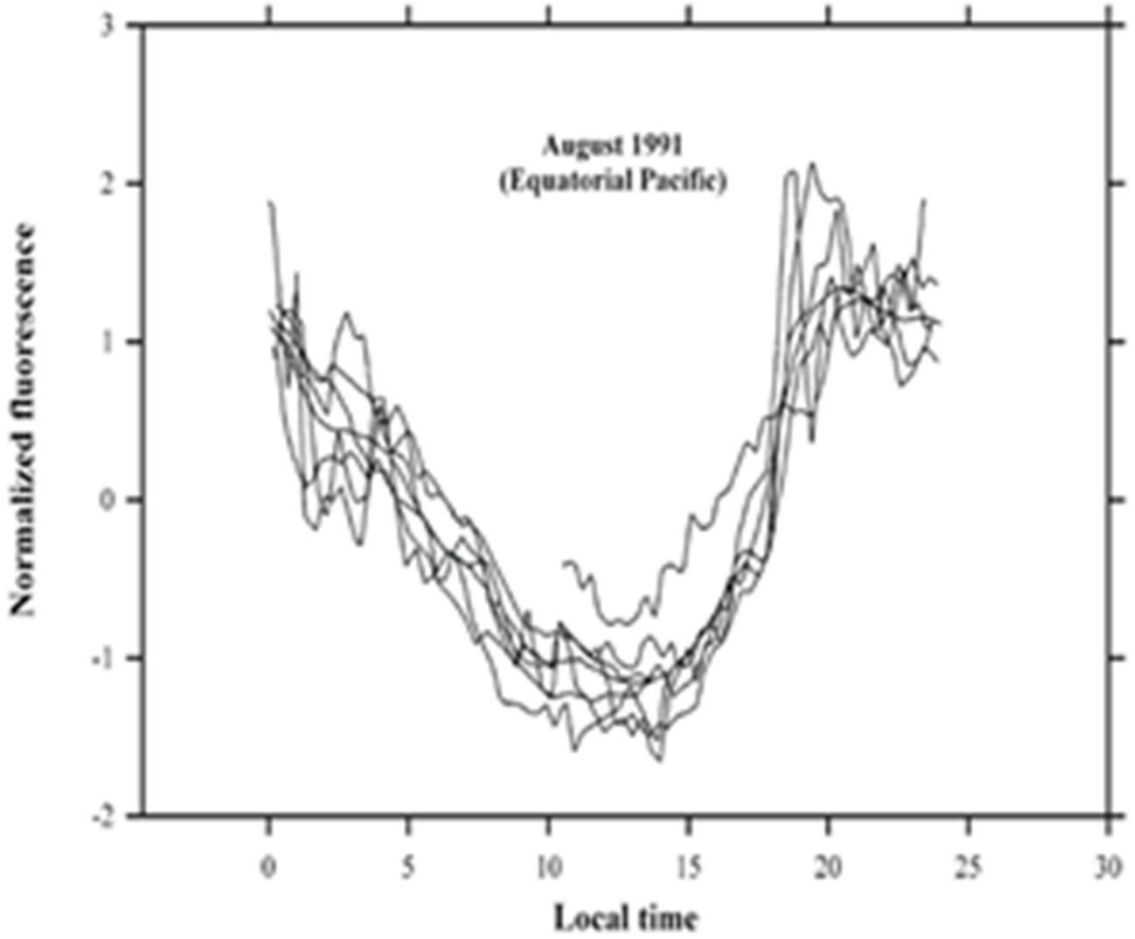
Strong light induced quenching of fluorescence during day-time in the Equatorial Pacific. As shown in Hout and Babin 2010, originally in Dandonneau et al. 1997



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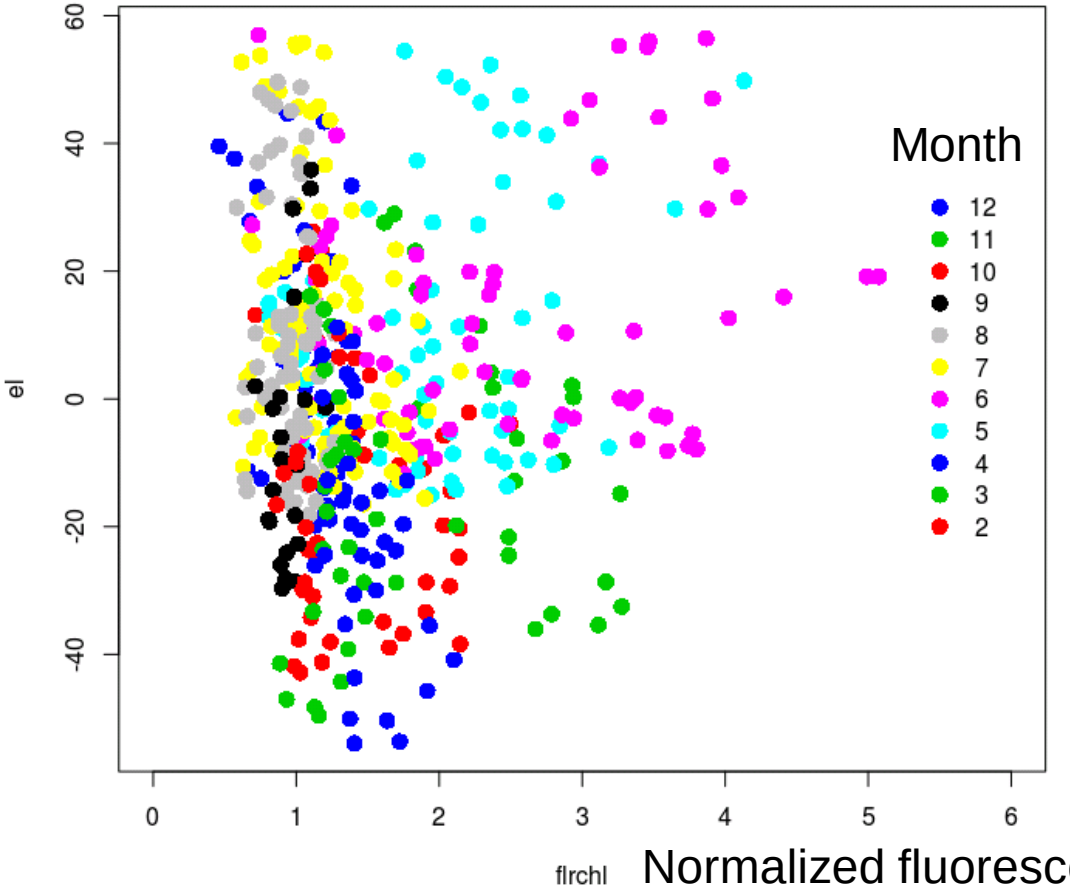
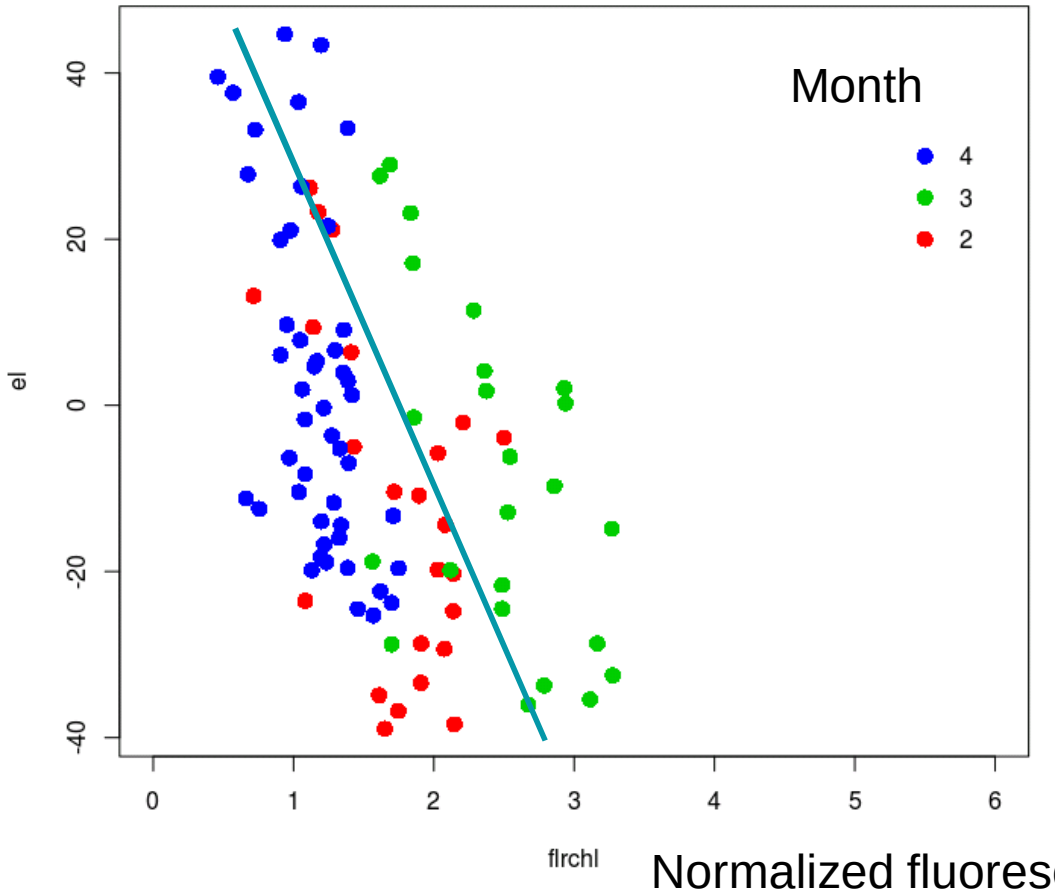
Normalized chlorophyll-a fluorescense against sun elevation, Finnmaid data 2012

Sun elevation



Normalized chlorophyll-a fluorescense against sun elevation, February, March, April, 2012

Sun elevation



Normalized fluorescence

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Regression estimates
February, March, April, 2012

```
chla1<-lm(formula = chla ~ Sochlfl)

summary(chla1)
Multiple R-squared: 0.964
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.47047    0.17701  -2.658  0.00924 **
Sochlfl      0.92820    0.01847  50.247  < 2e-16 ***


chla2<-lm(formula = chla ~ Sochlfl+elevation)
summary(chla2)
Multiple R-squared: 0.969
```

Contribuition of elevation 0.5% !

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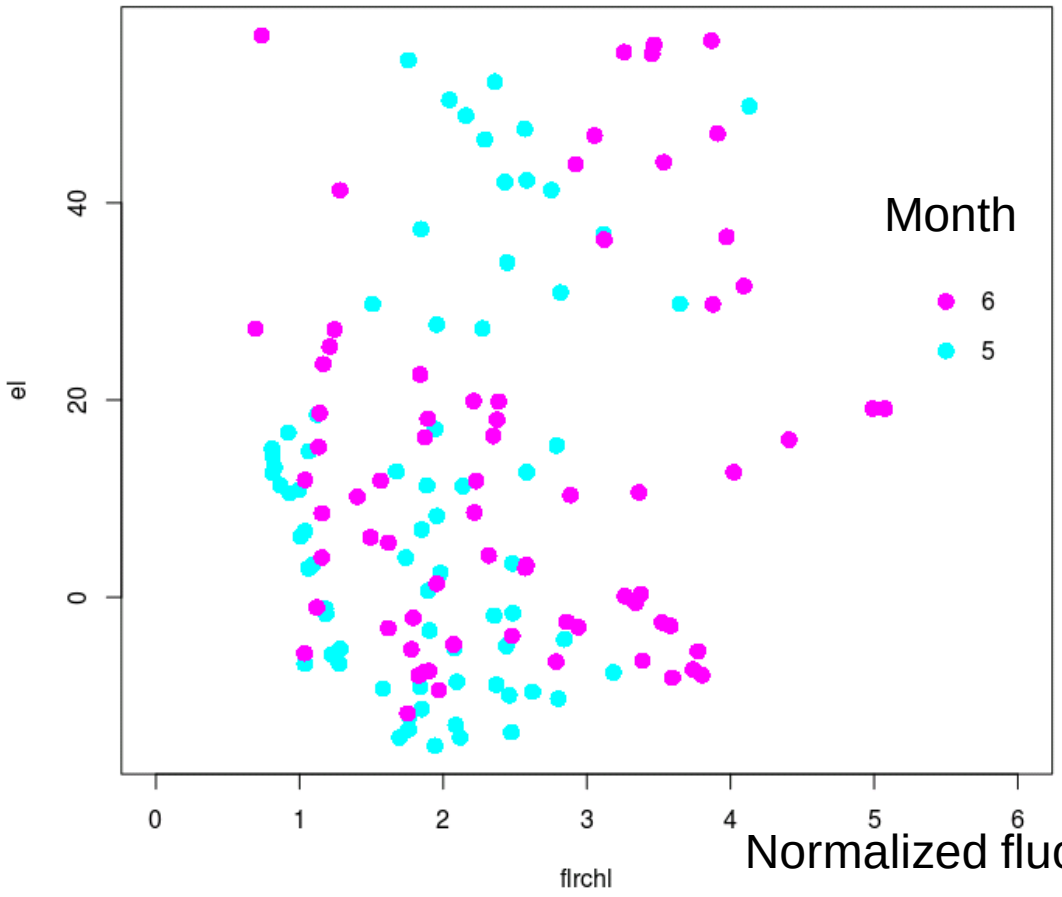
Normalized chlorophyll-a fluorescense against sun elevation, May, June, 2012

Sun elevation



Normalized fluorescence

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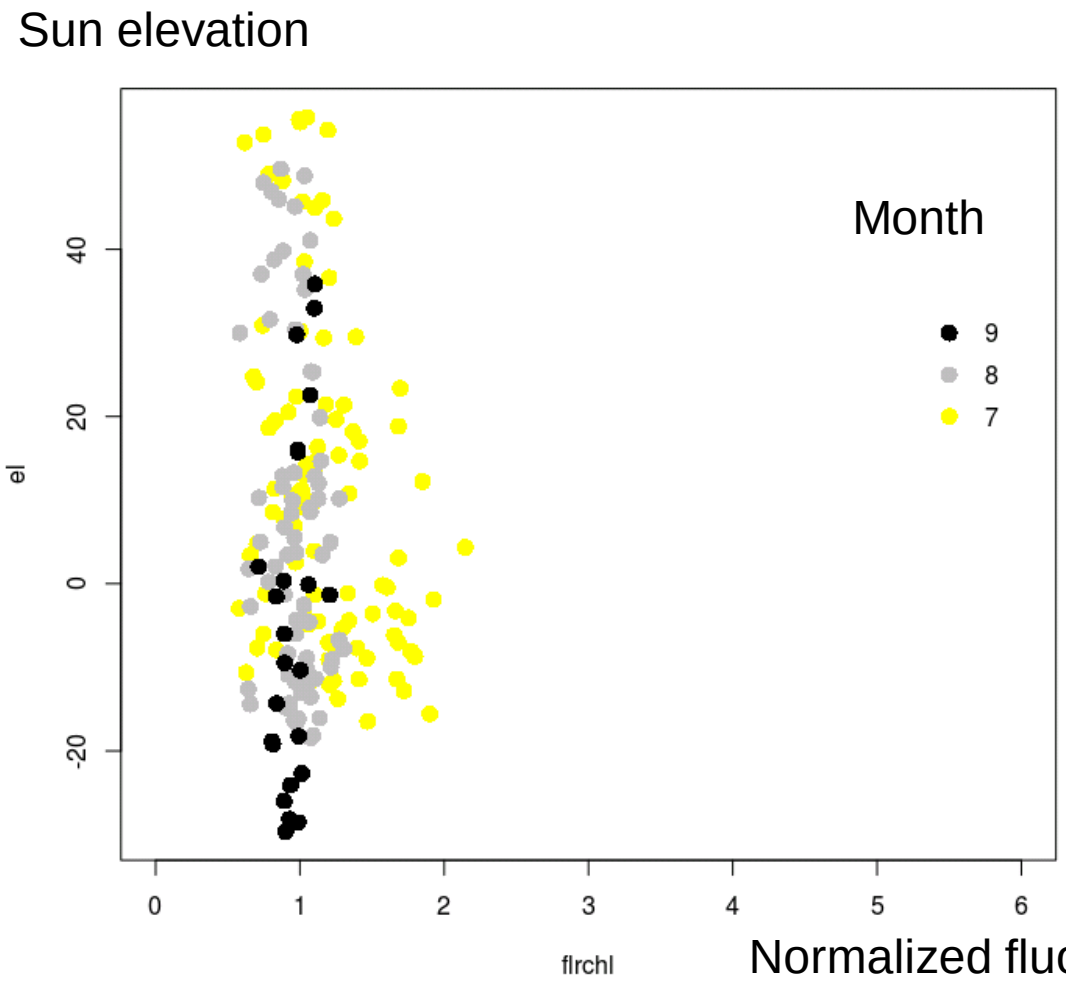
Regression estimates
May, June, 2012

chla1<-lm(formula = chla ~ Sochlfl)
summary(chla1)
Multiple R-squared: 0.870,

chla2<-lm(formula = chla ~ Sochlfl+el)
summary(chla2)
Multiple R-squared: 0.8769,

chla3<-lm(formula = chla ~ Sochlfl+Soturb)
summary(chla3)
Multiple R-squared: 0.8877

Normalized chlorophyll-a fluorescense against sun elevation, July, August, September, 2012



Regression estimates
July, August, September, 2012

chla1<-lm(formula = chla ~ Sochlfl)
Multiple R-squared: 0.5435

chla2<-lm(formula = chla ~ Sochlfl+Sopcfl)
Multiple R-squared: 0.5502

chla3<-lm(formula = chla ~ Sochlfl+Sopcfl+Soturb)
Multiple R-squared: 0.5553

chla4<-lm(formula = chla ~ Sochlfl+Sopcfl+Soxtemp)
Multiple R-squared: 0.5689

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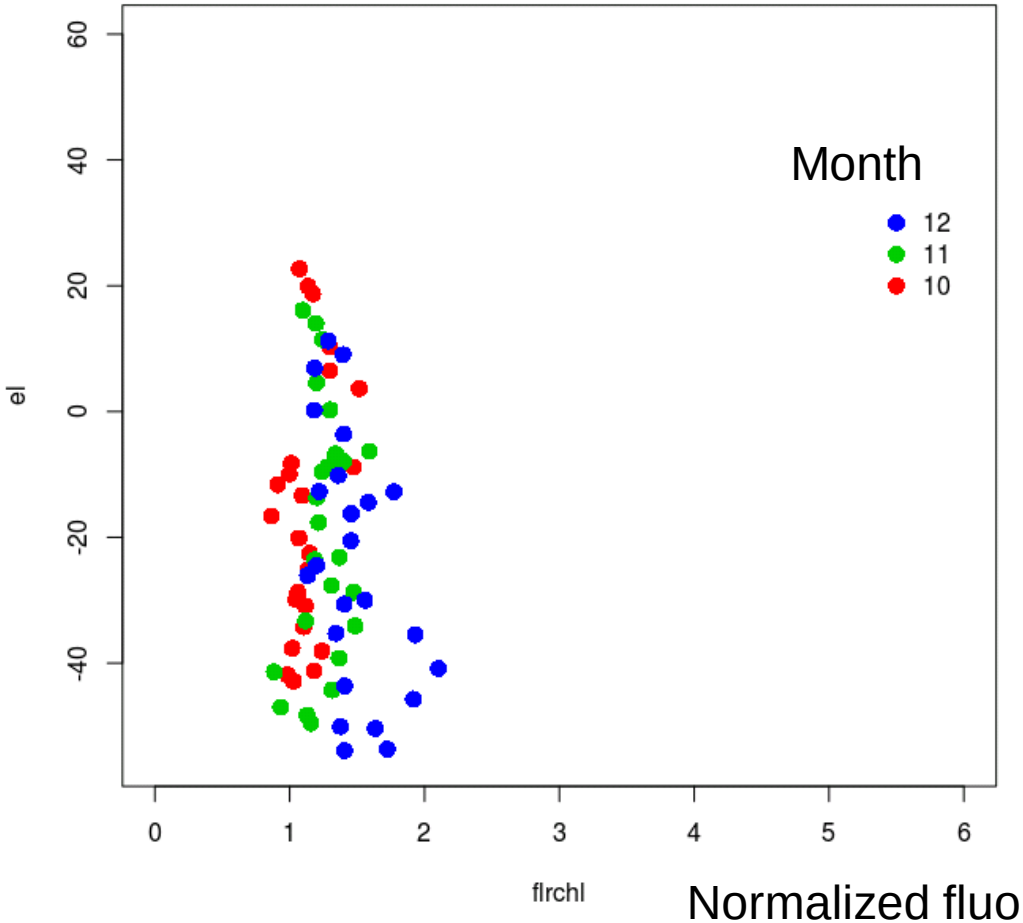
Normalized chlorophyll-a fluorescense against sun elevation, October, November, December, 2012

Sun elevation



Normalized fluorescence

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Regression estimates
July, August, September, 2012

chla1<-lm(formula = chla ~ Sochlfl)
Multiple R-squared: 0.8388

chla2<-lm(formula = chla ~ Sochlfl+Soturb)
Multiple R-squared: 0.8491

chla3<-lm(formula = chla ~ Sochlfl+Soturb+Soxtemp)
Multiple R-squared: 0.8876

Conclusion

Light induced quenching of chlorophyll fluorescence during day-time has minor effect in the Baltic Sea

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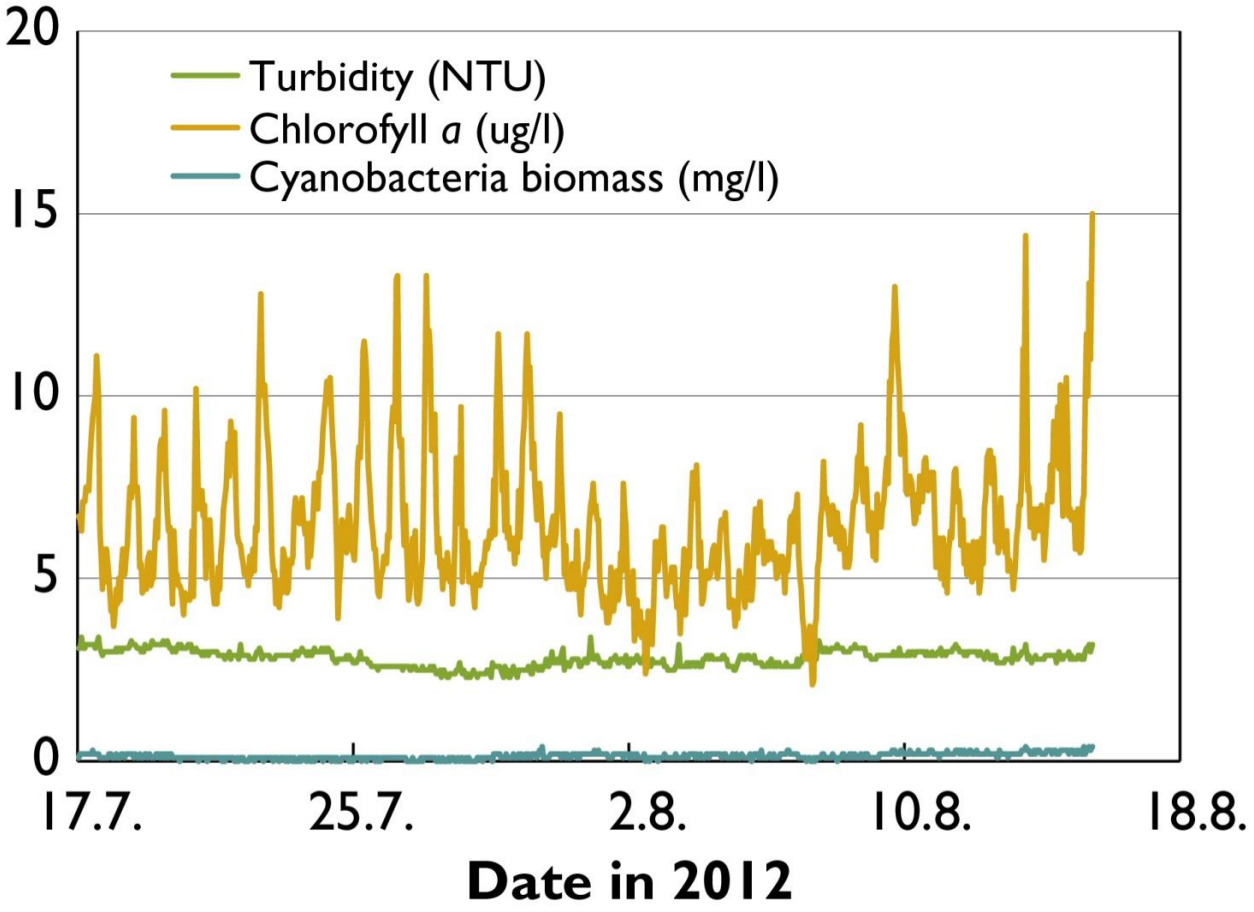
However, records from of Pyhtää buoy, probably indicating phytoplankton migration



www.luodedata.fi/rauto

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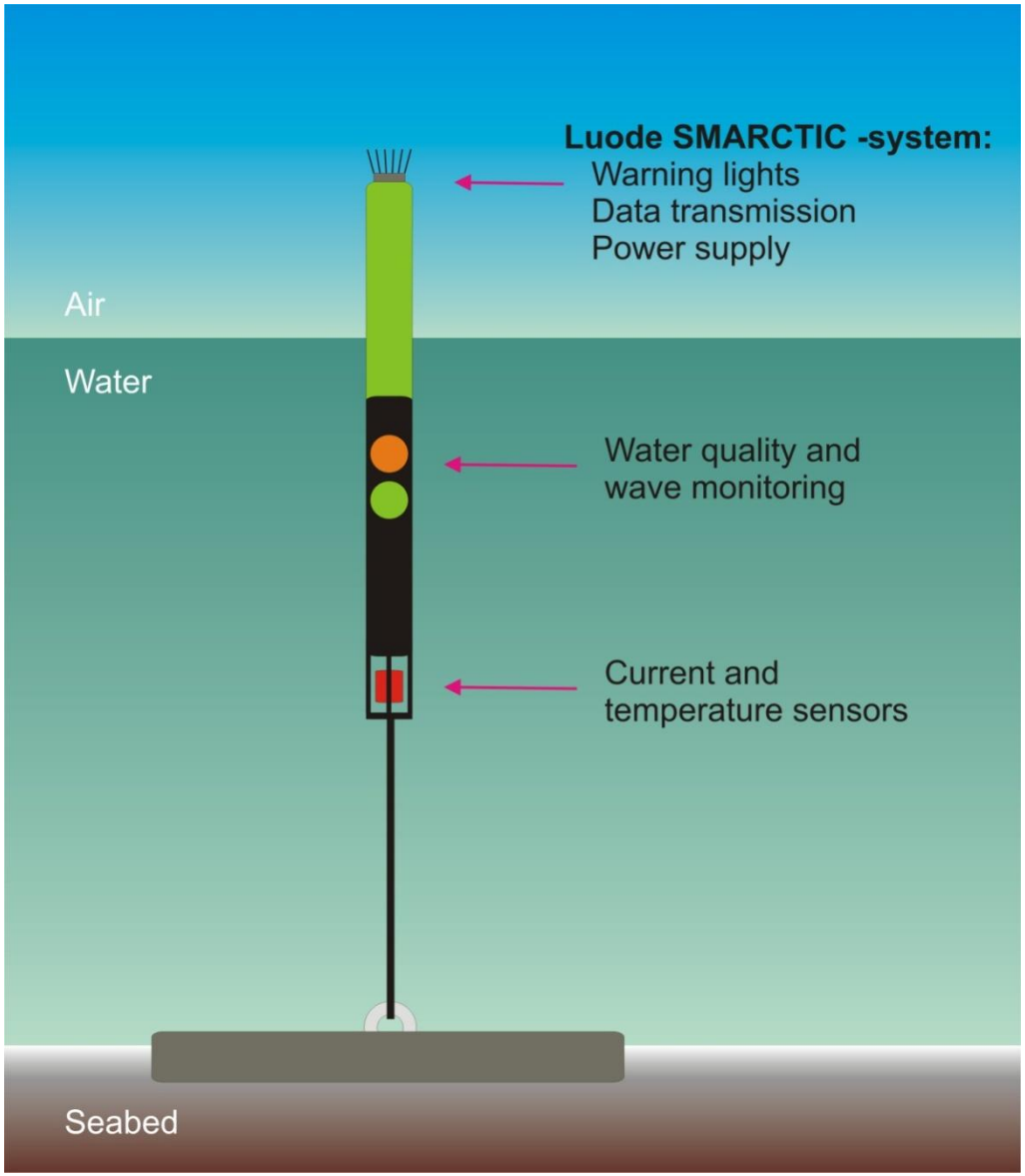
Measurement water quality observations with navigation buoys



Buoy structure

Design of water quality system (Smarctic) buoy system: Luode Consulting Oy

Buoys manufactured by MeriTaito Ltd

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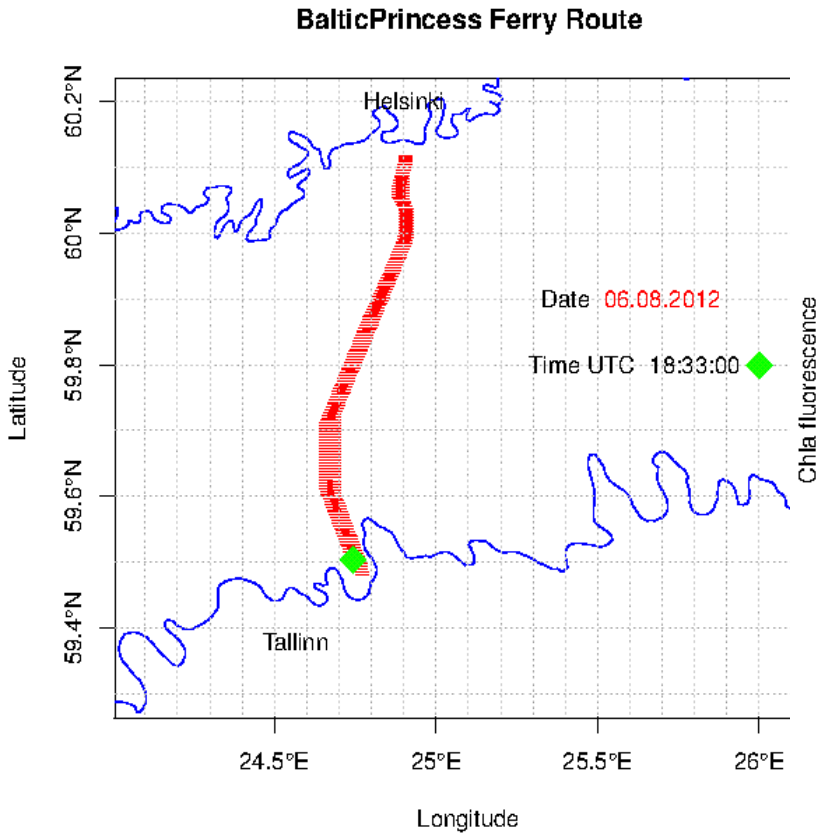
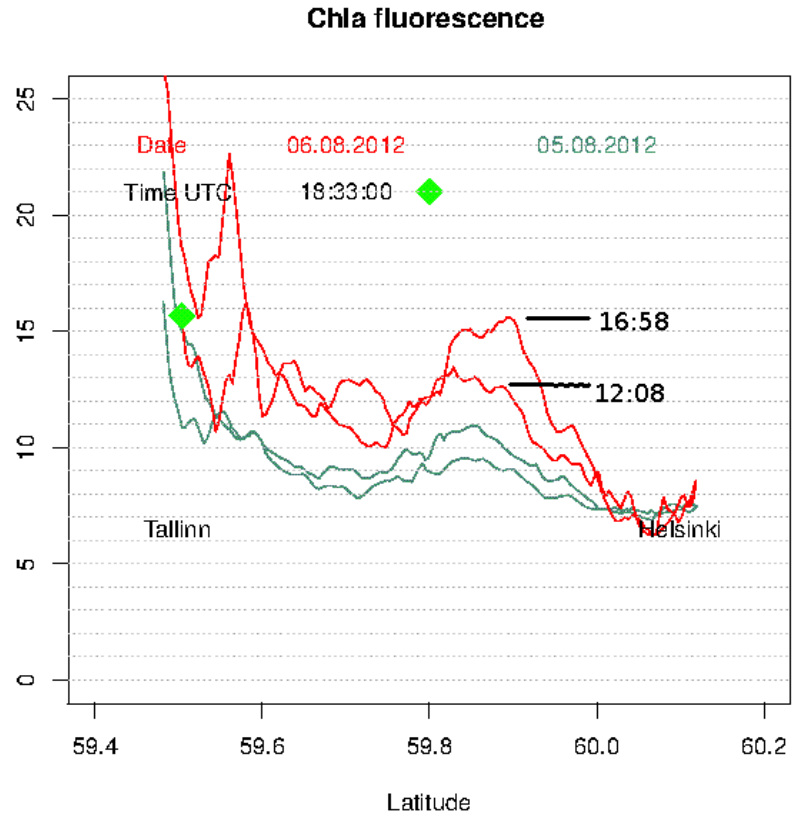
Baltic Princess ferrybox observations
Marine Systems Institute, Tallinn, Estonia





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Thank you

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