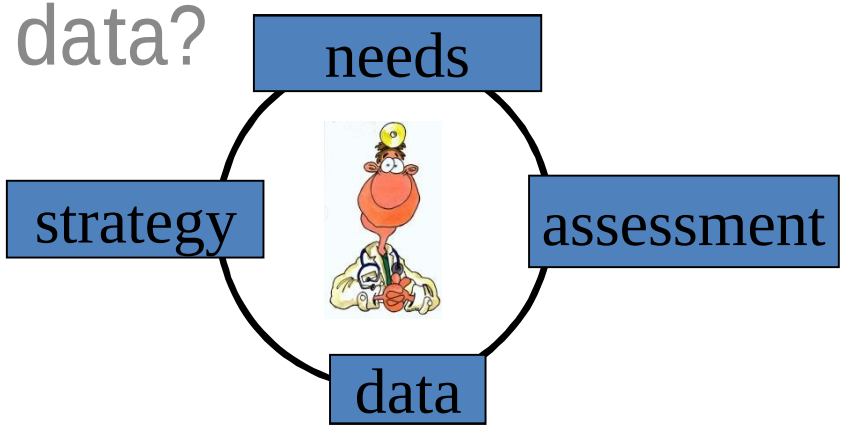
From data to decisions (chlorophyll-a)

Quality of data?



JERICO summerschool, Delft, , 18 juni 2014

Prof. Remi Laane (Deltares, University of Amsterdam, Uva)

Questions

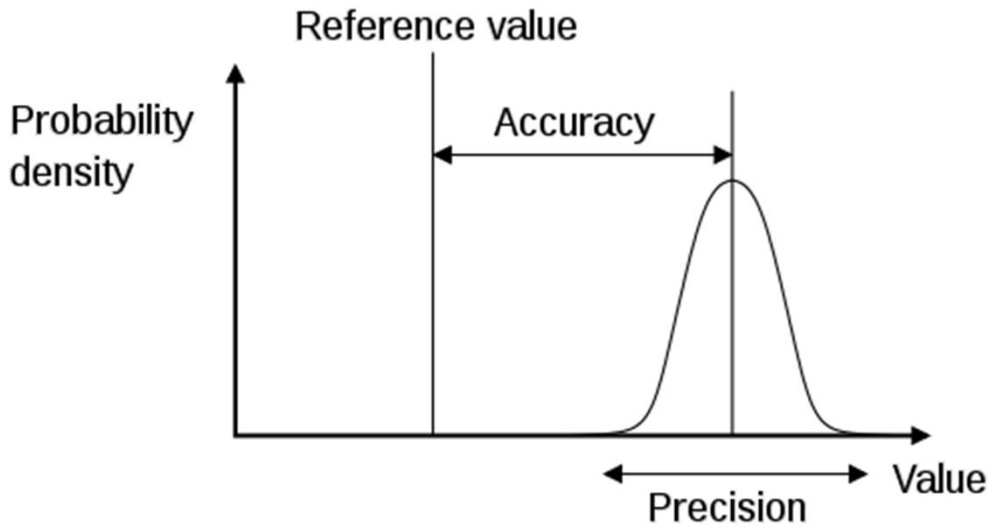
What is influencing the quality of data?
Which quality is needed?

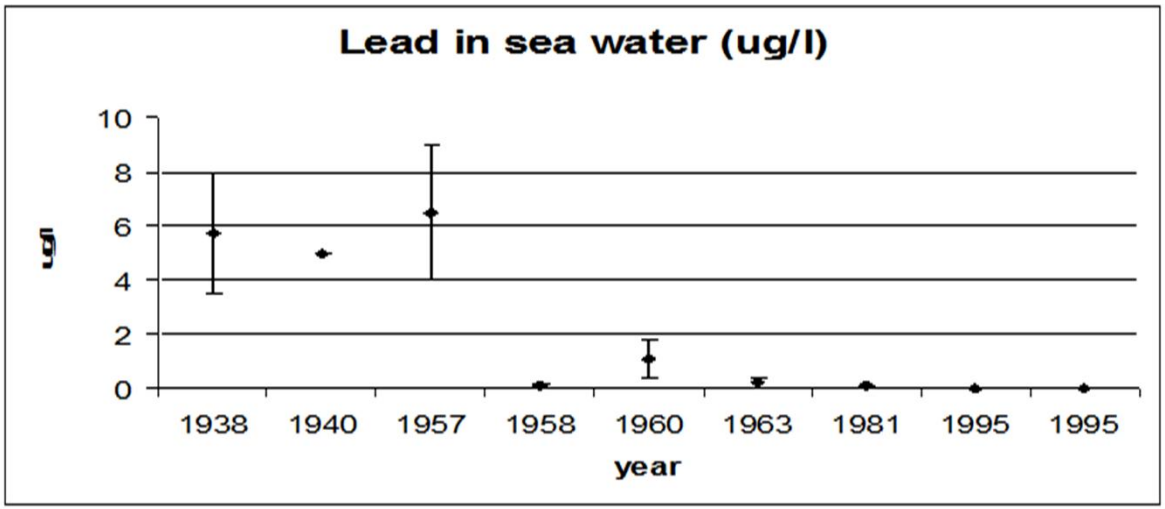
Why??

- Science
- To improve advice to policymakers and managers

Quality of the data

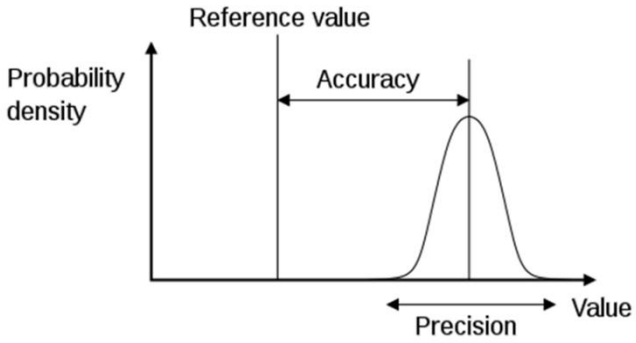
- Sampling strategy
  - Compartment
  - Gradient
  - Frequency
- Sampling method
- Handling of samples
  - Filtering
  - Extraction
  - Storage
  - Fixation
- Analytical method
- Storage of data
- Assessment method





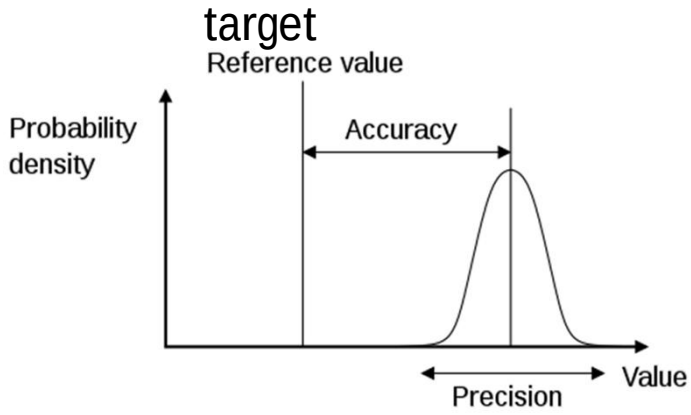
Information needs

- Trend detection



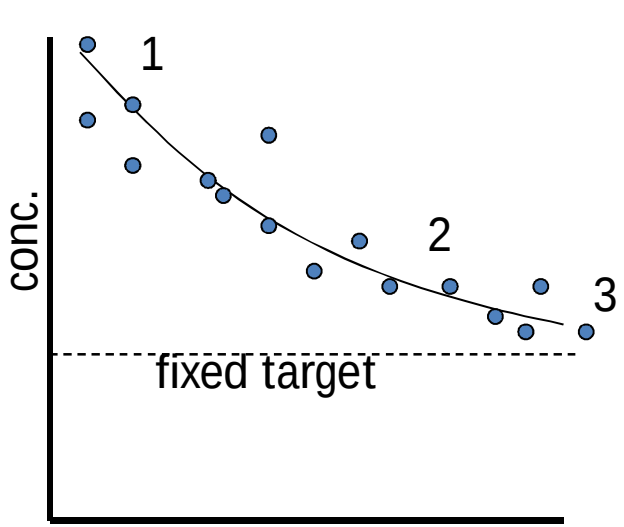
Constant systematic error
Always the same trend!

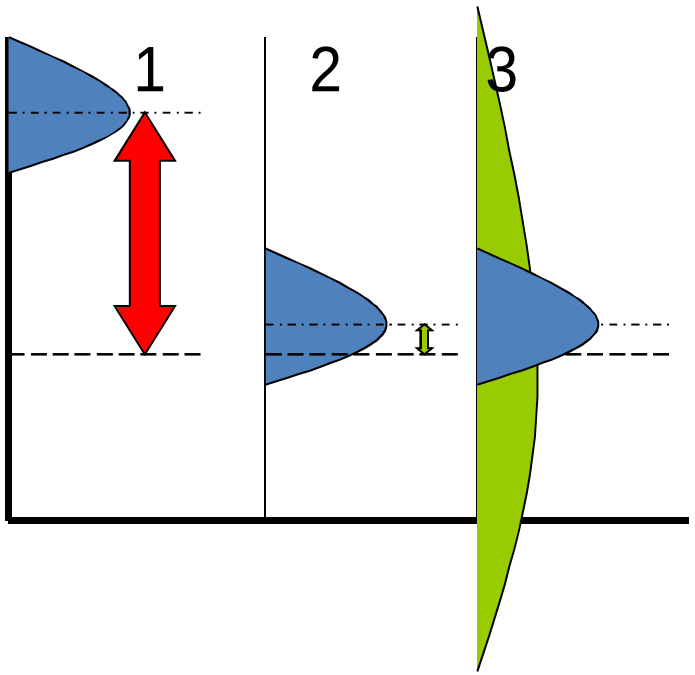
- Compliance check



One sample
Triplicate?
Monitoring paradox

Monitoring strategy
Compliance checking

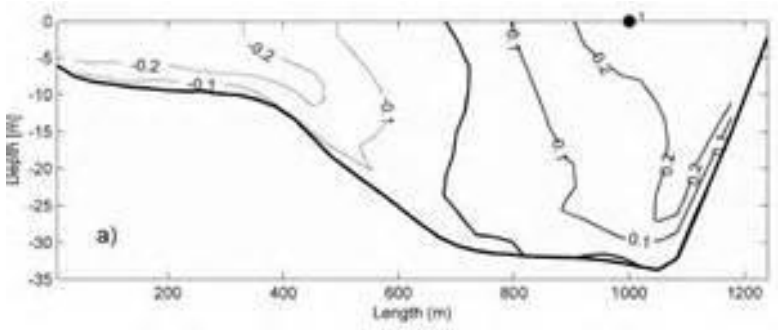




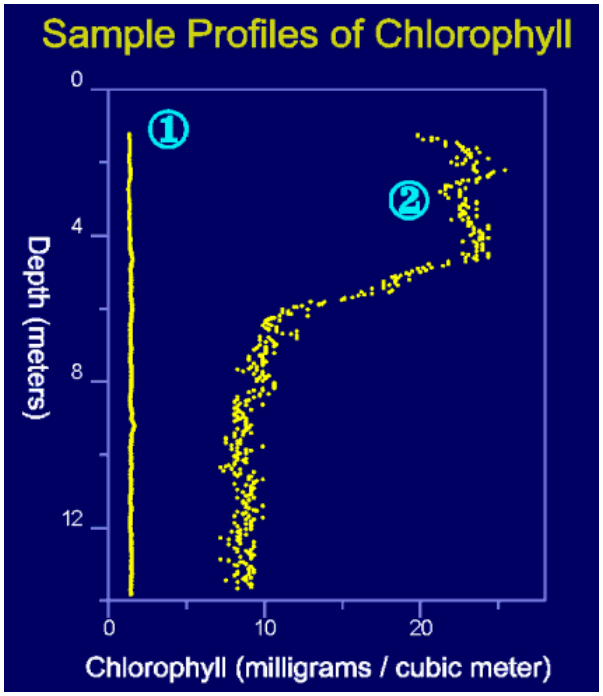
paradox:
the closer to the target
the more samples are
needed

Sampling strategy

- Compartment
- Gradient
- Frequency



Estuarine gradient



Vertical gradient

Compartment

Watersystem

- Dissolved
- Particulate
- Sediment
- Organism(s)
  - Pelagic
  - Benthic
- Micro surface layer

Air

- Aerosols
- Rain
- Snow
- gass

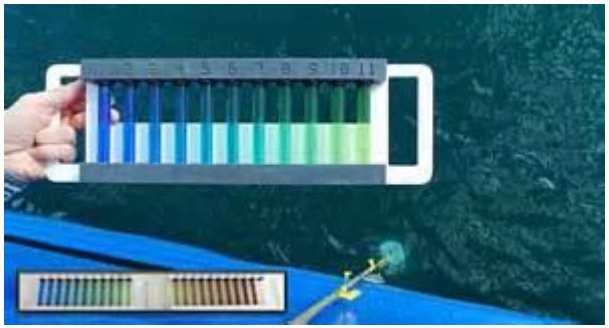
Sampling method

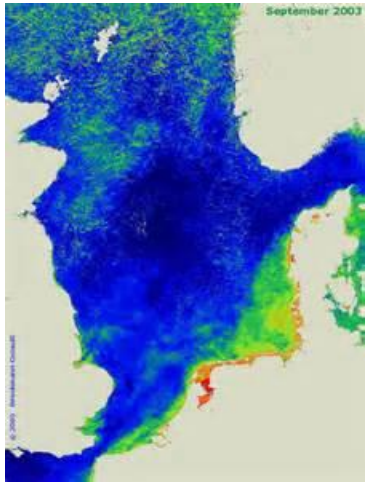
- Bucket
- Underwater inlet
- Rosette sampler
- Sensor

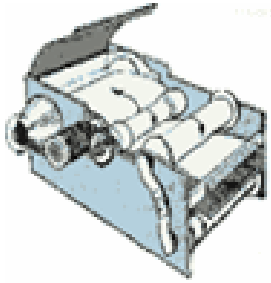
What are pro’s and cons?

Sampling method (chlorophyll)

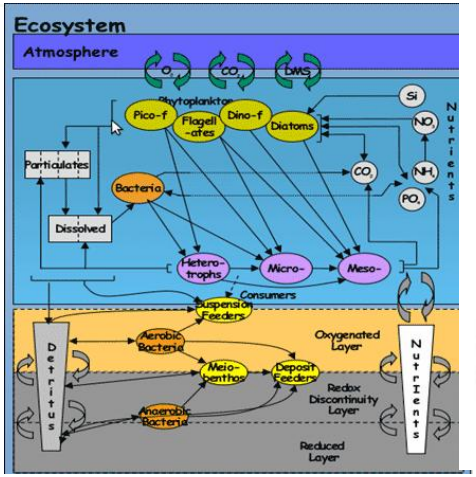
- Remote sensing
- Continuous Plankton Recorder (CPR)
- Color
- Models
- Secchi disk

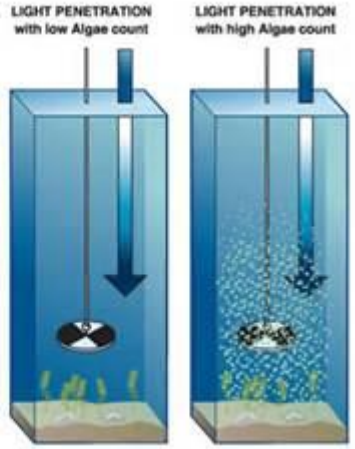






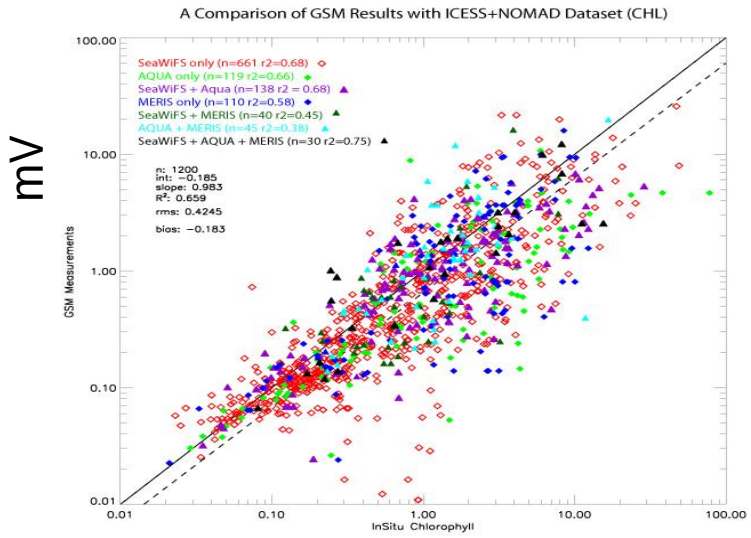
greening scale





Conversion of electronic signal -> chlorophyll

- RS, sensor



mV

in situ

Calibration curve

- Secchi disk

$C = 457\ D^{-2.37}$

- Models

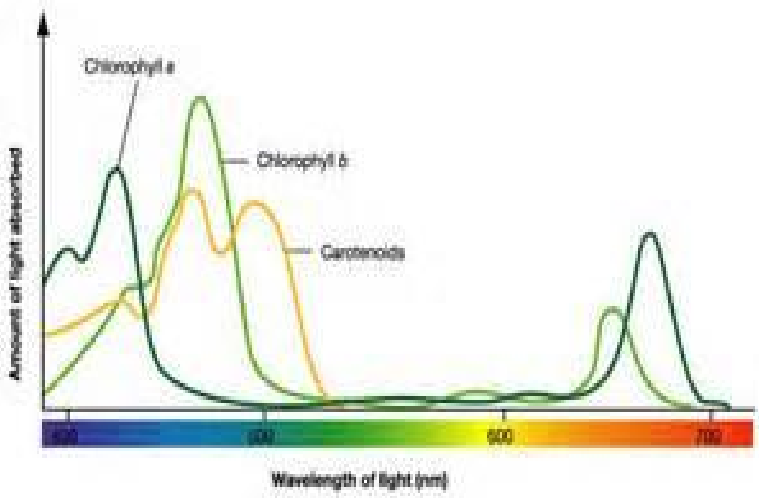
C_{algae} → chlorophyll

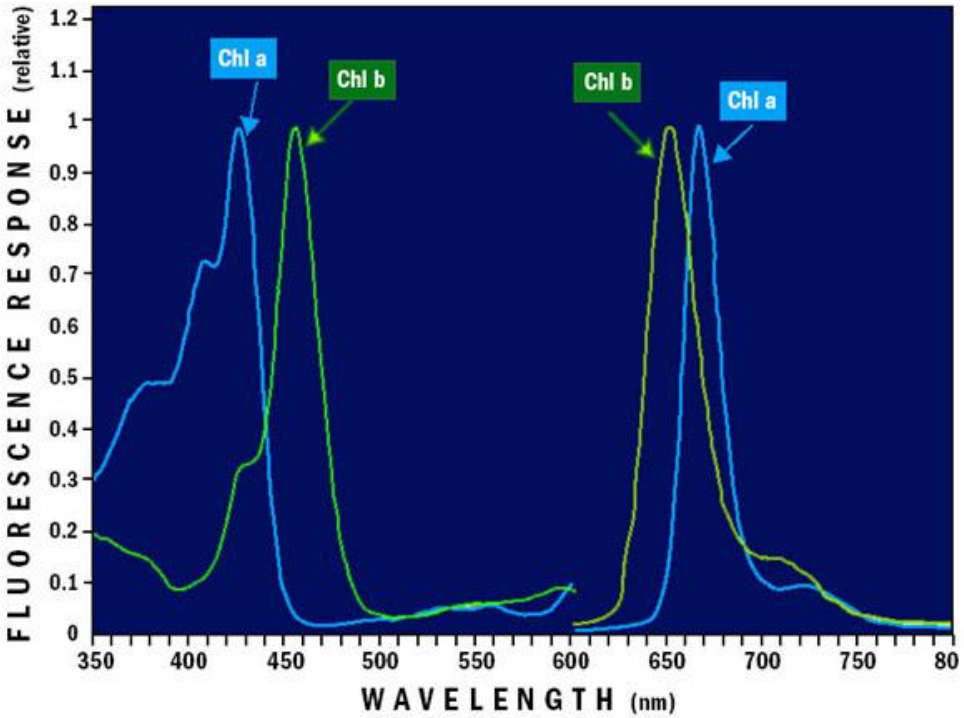
Handling of the sample

- Filtering
- Extraction
- Fixation
- Storage
- Back to room temperature

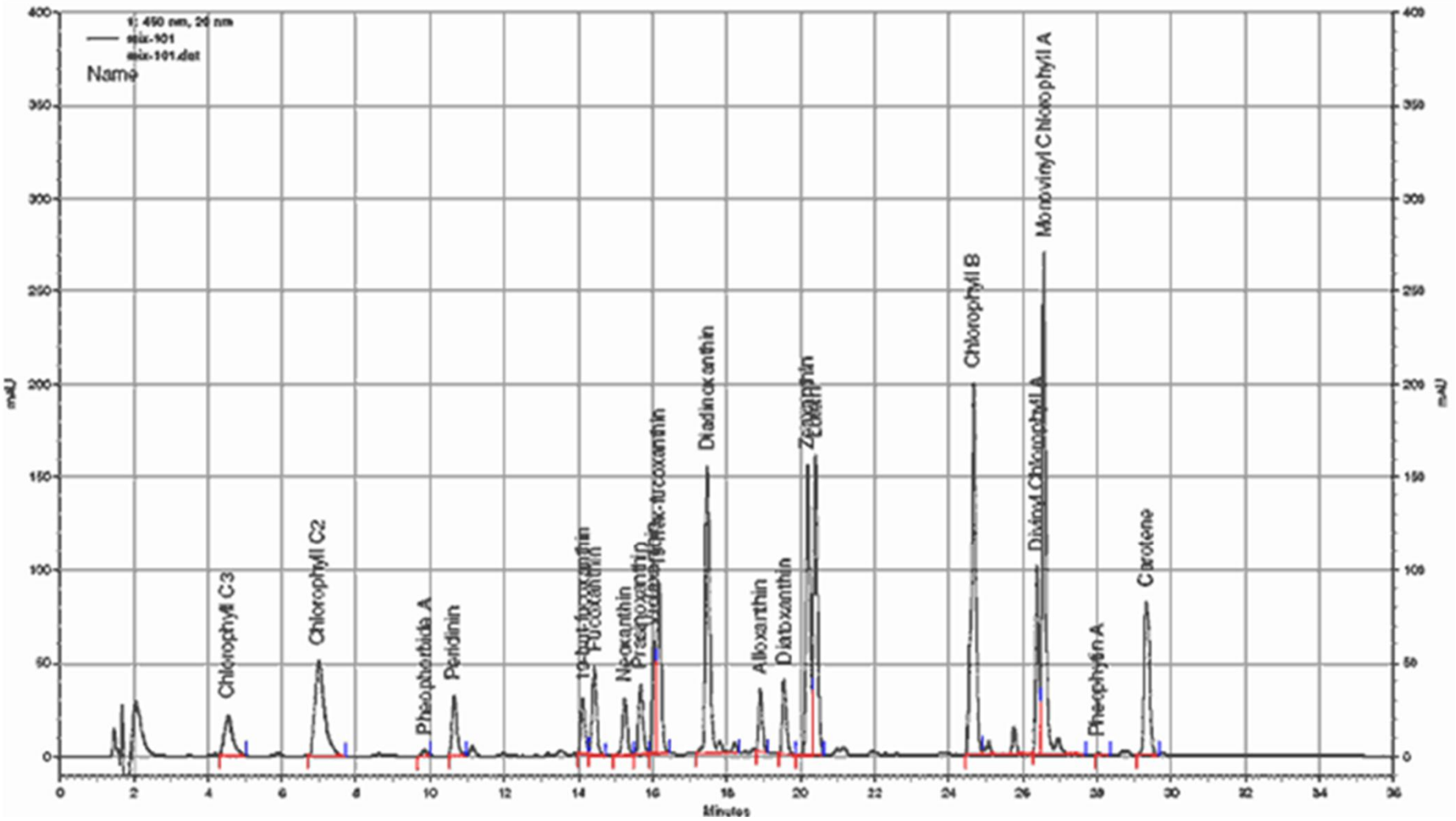
Analytical method (1)

- Extraction with organic solvent (water-aceton)
- Adsorption UV spectrometry
- Fluorometry
- HPLC





HPLC separation



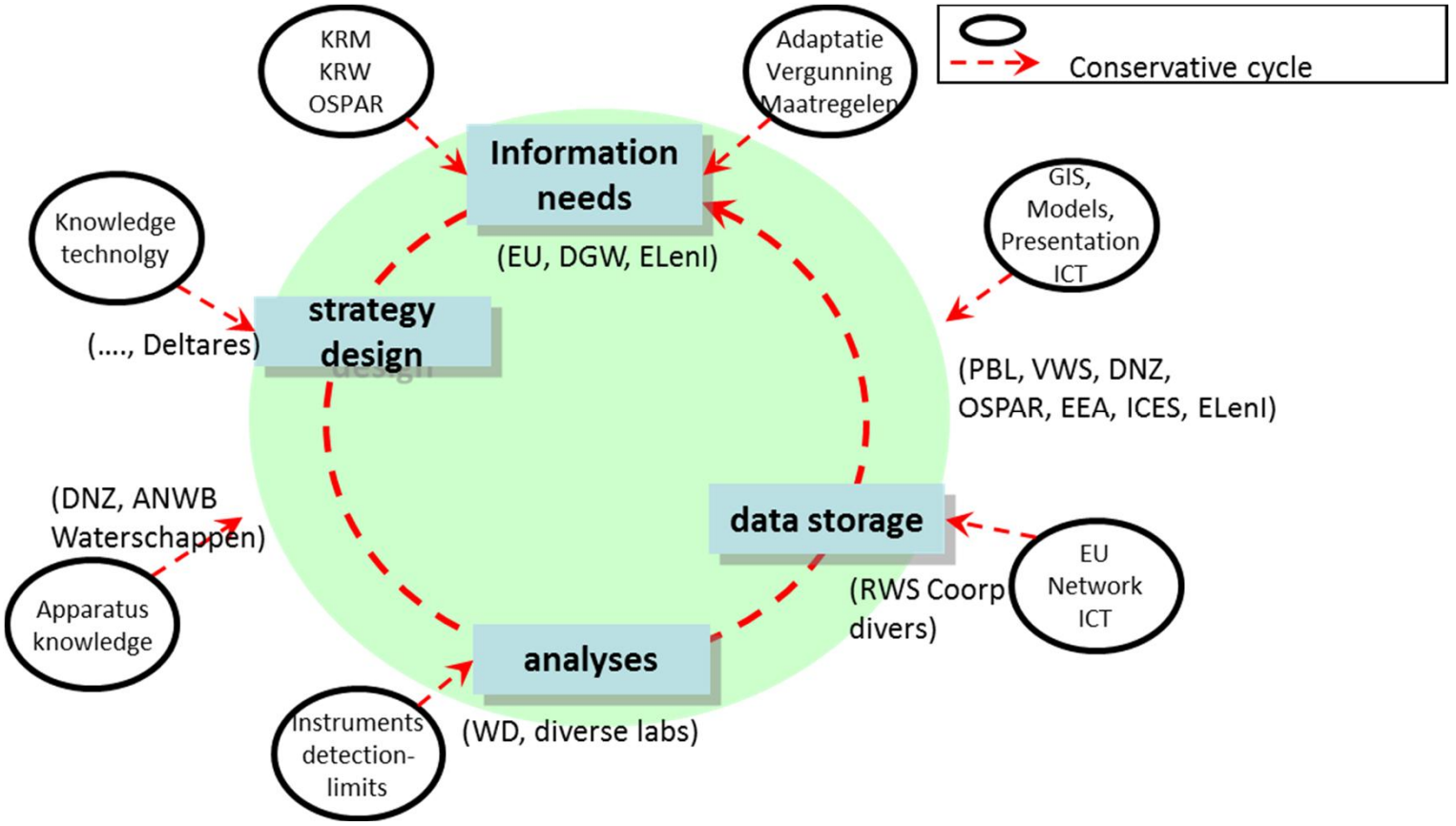
Analitical method (2)

- Total sample
  - Chlorophyll = series of pigments: Chlorophyll (a,b,c), cartenoids and degradation products
- HPLC
  - Individual pigment separate from the rest

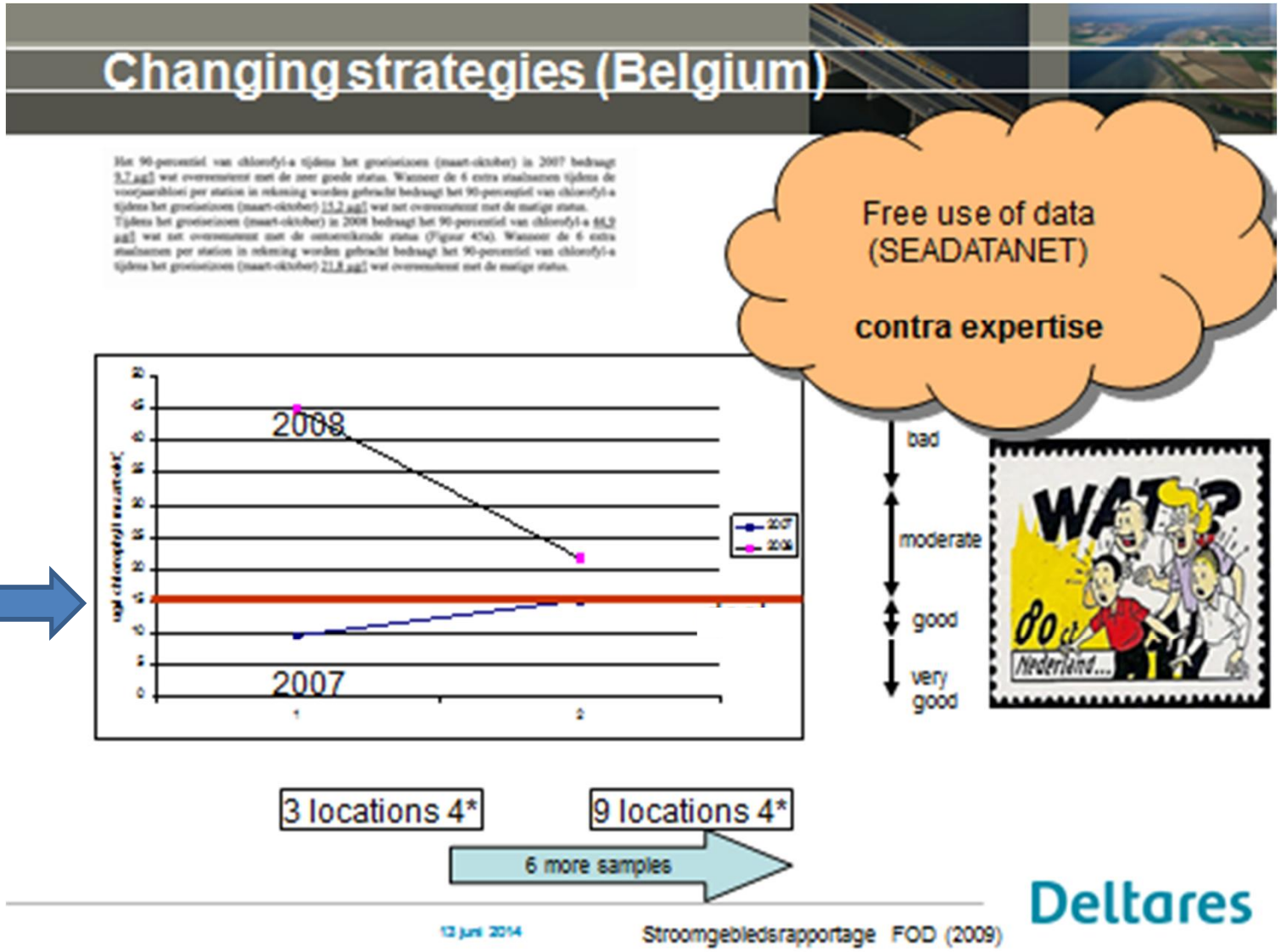
Benchmarking (ICES, Quasimeme): intr- en intralaboratorium

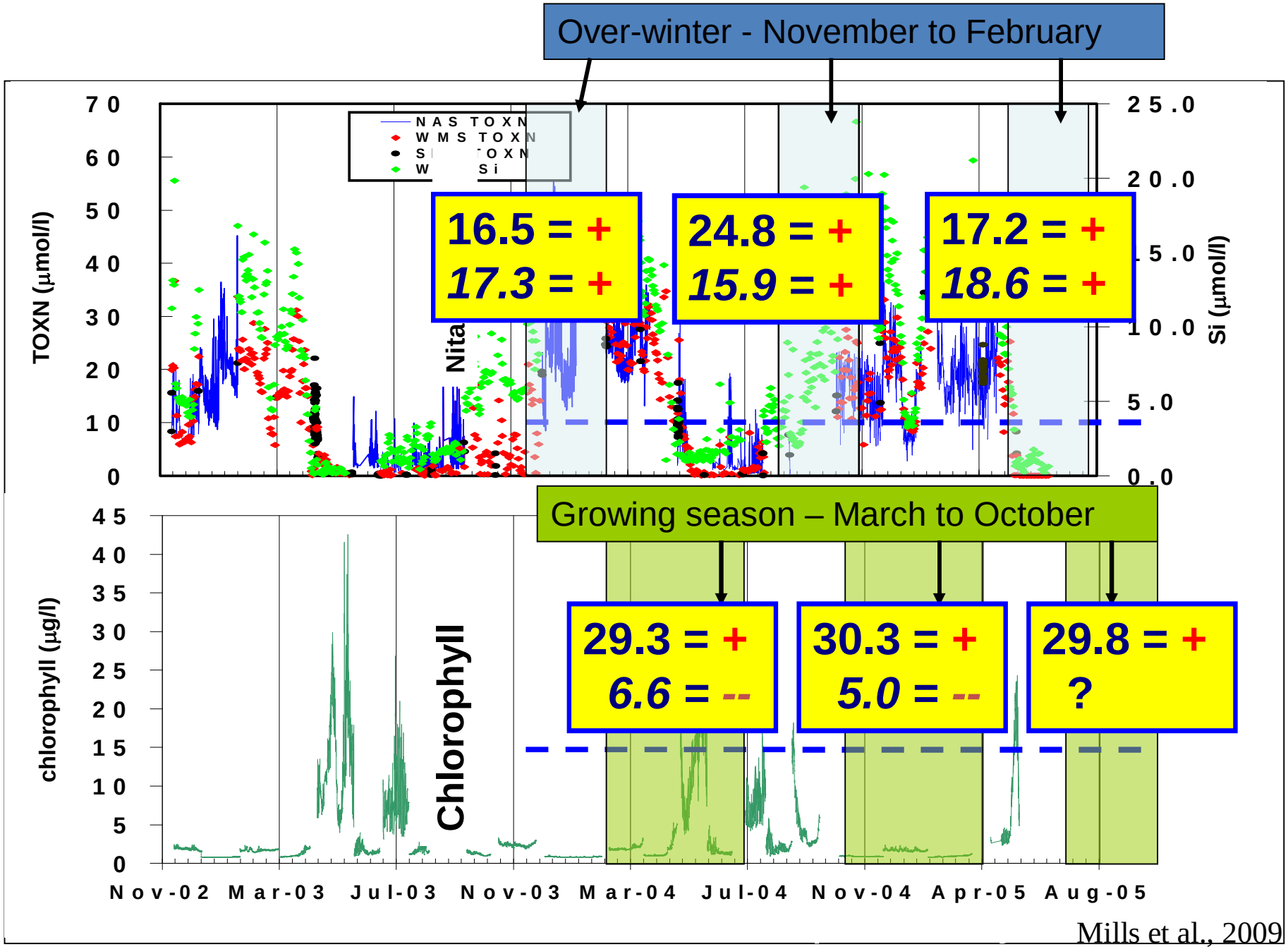
Information needs

- Policymakers: trend detection and compliance
- Scientific: system knowledge



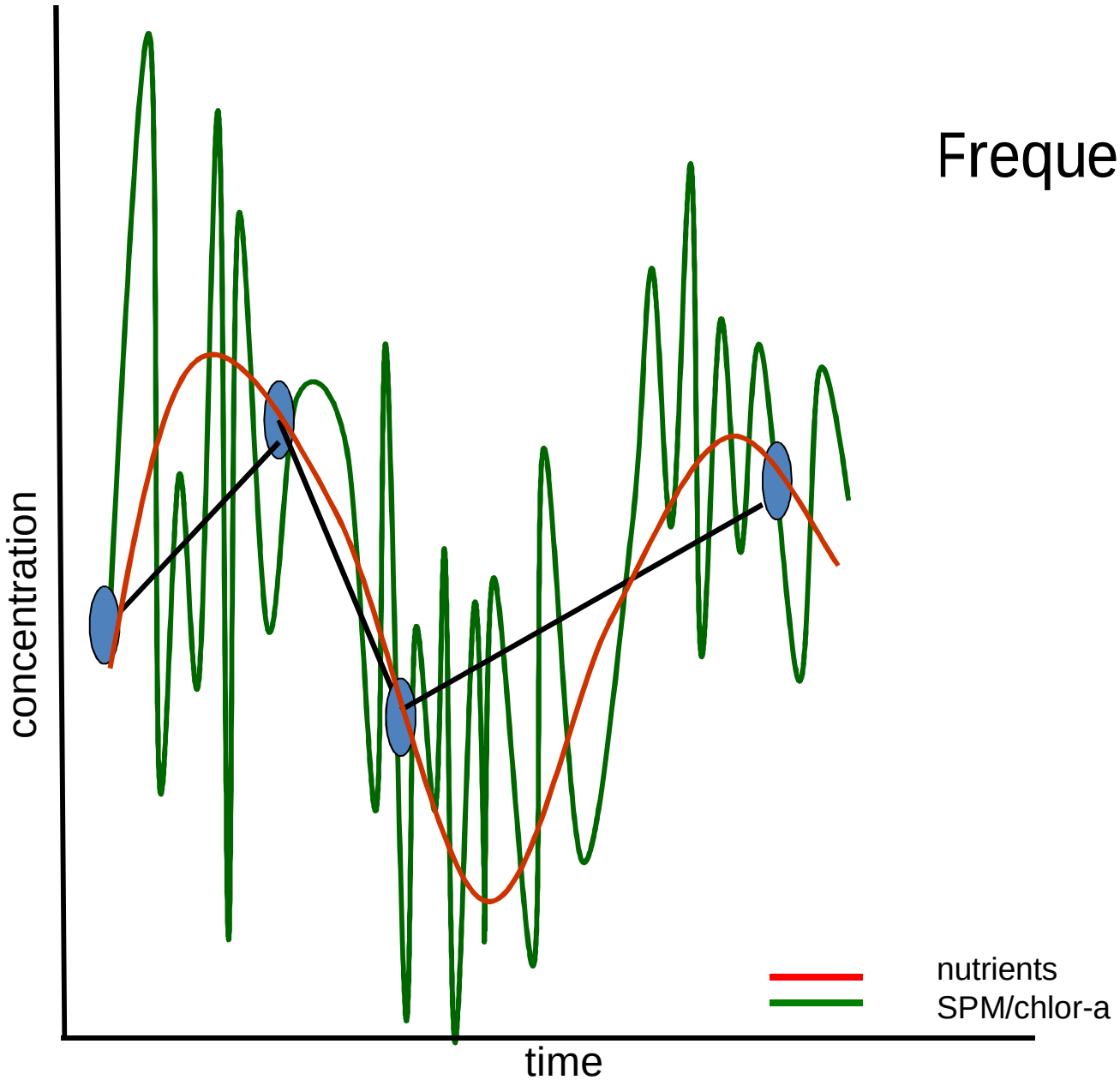
Compliance checking





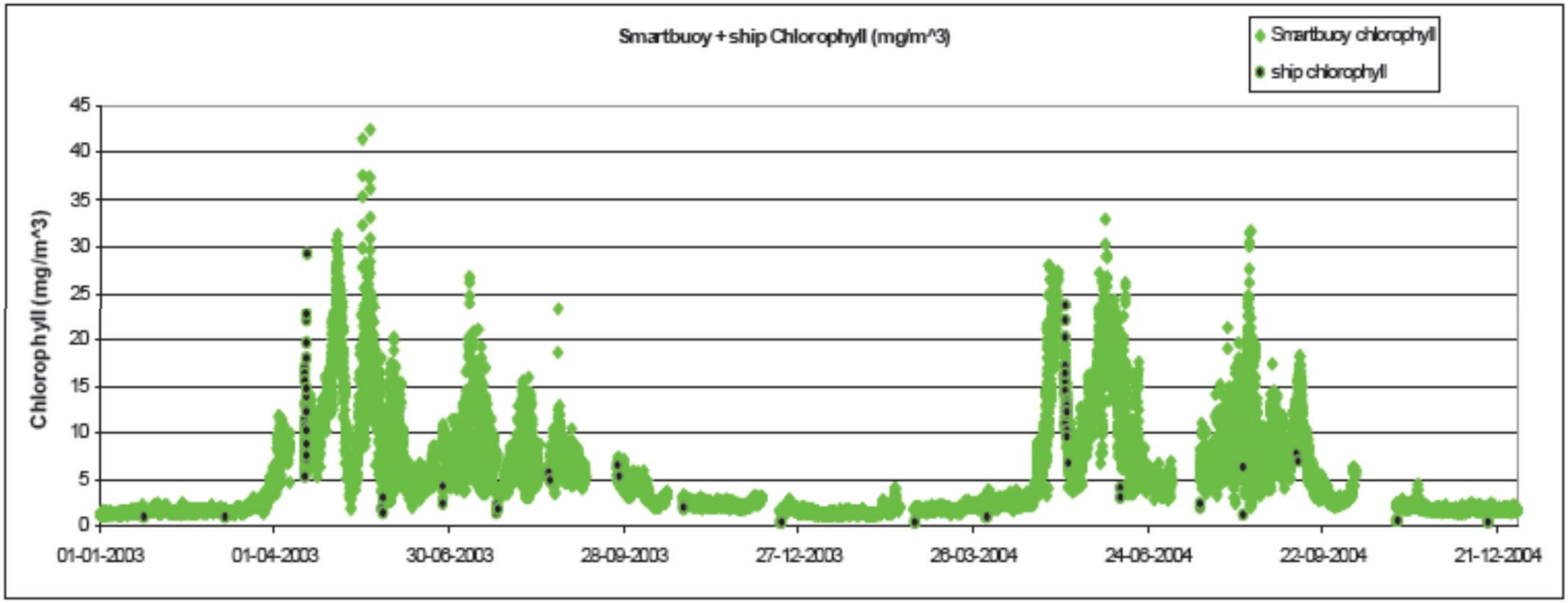
Mills et al., 2009

Frequency of sampling??

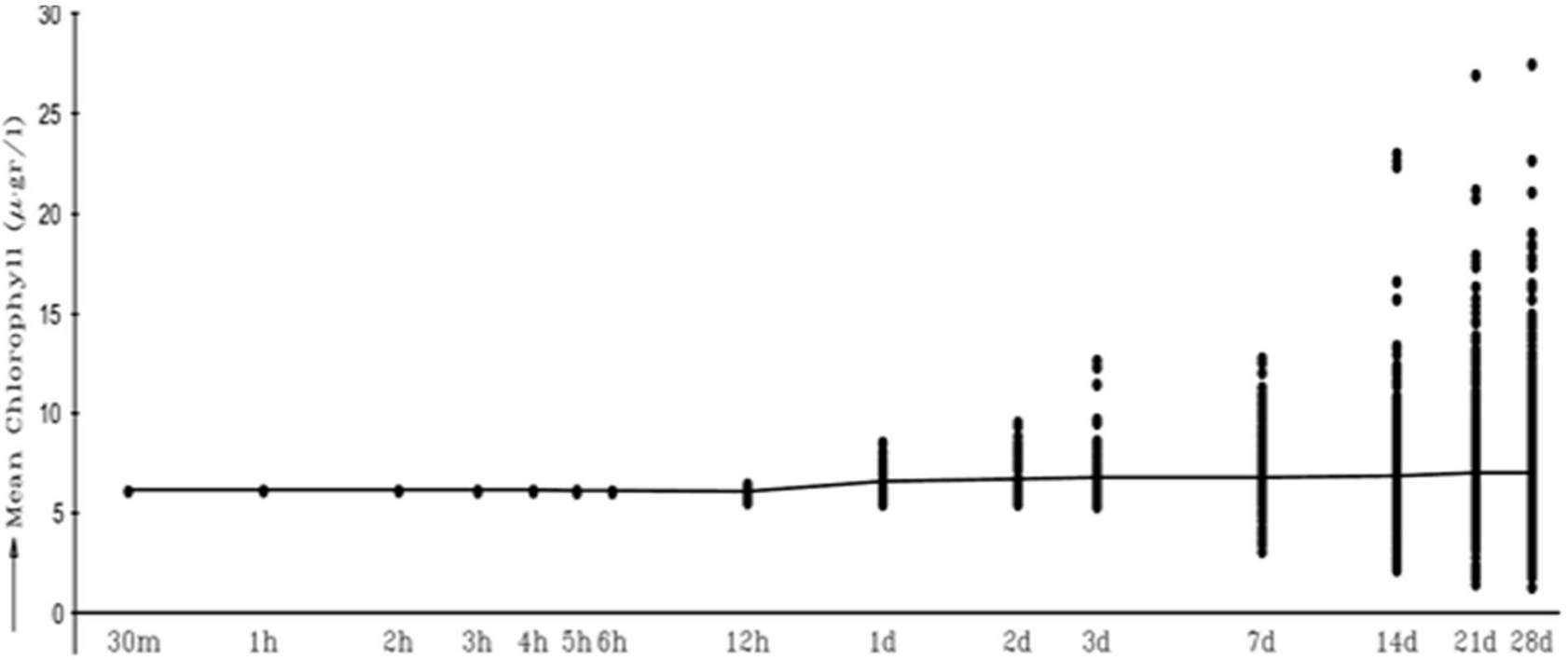


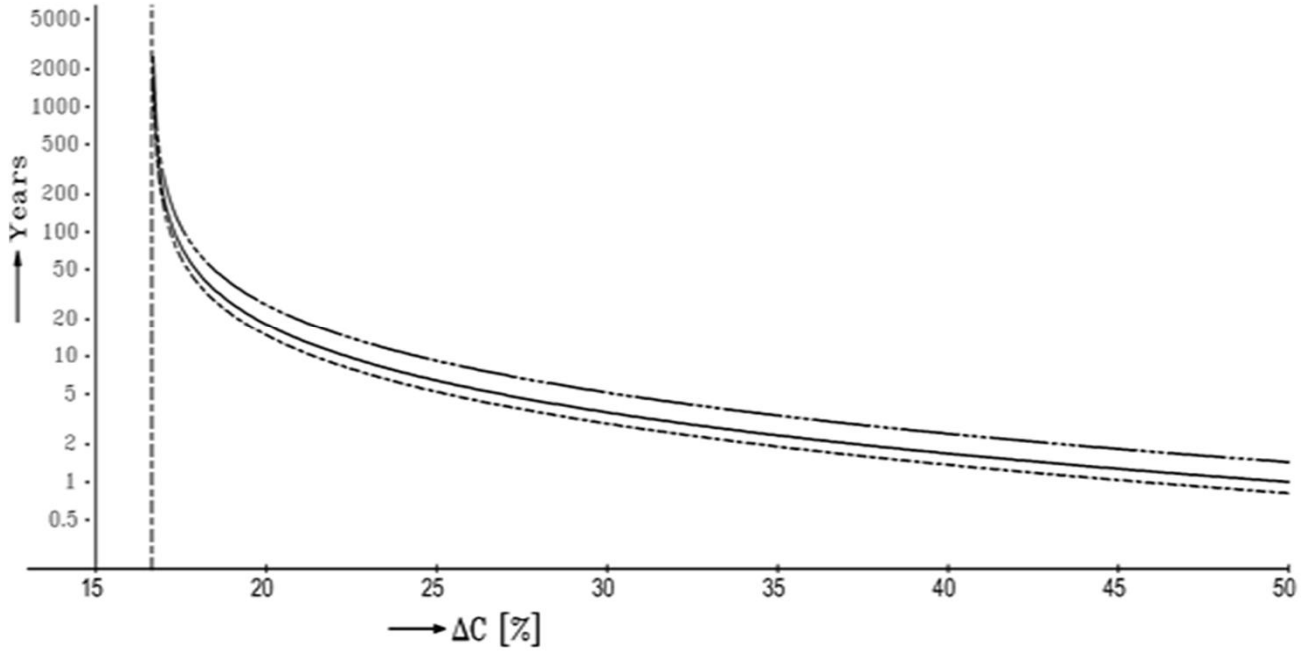
18 juni 2014

Time series



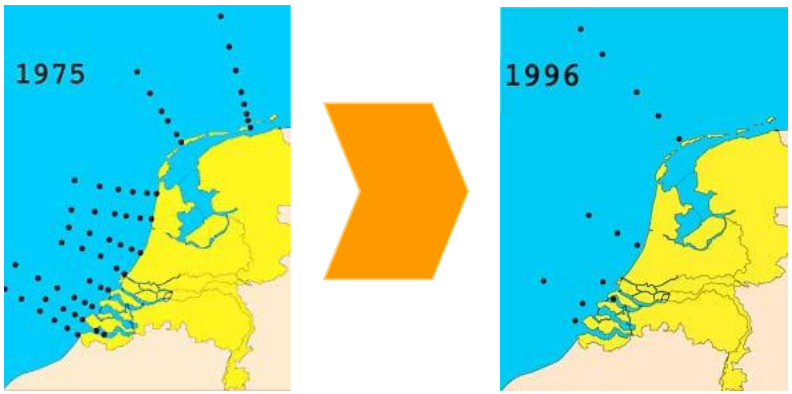
Subsampling many times

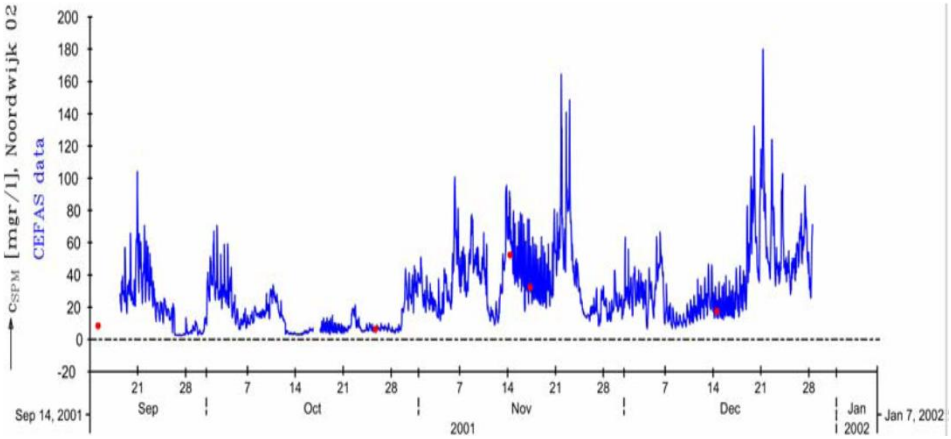




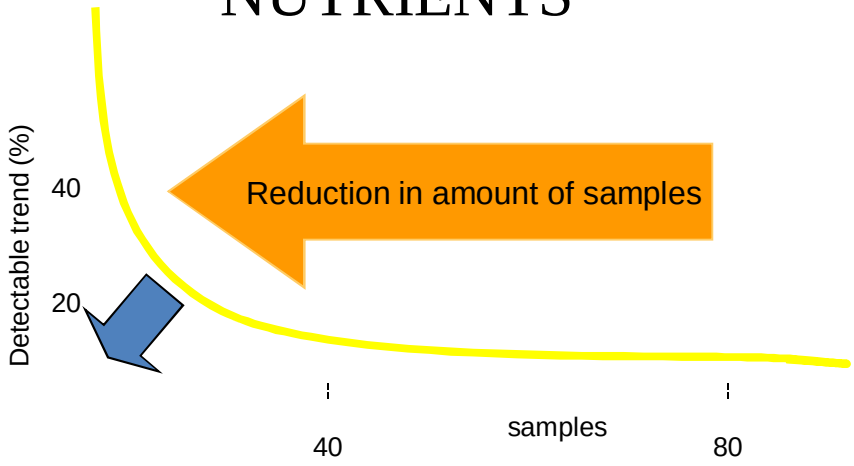
Lowest line = 6 h
Middle line = 2 w
Highest line = 6w

trendmonitoring





NUTRIENTS



Laane et al., 2003

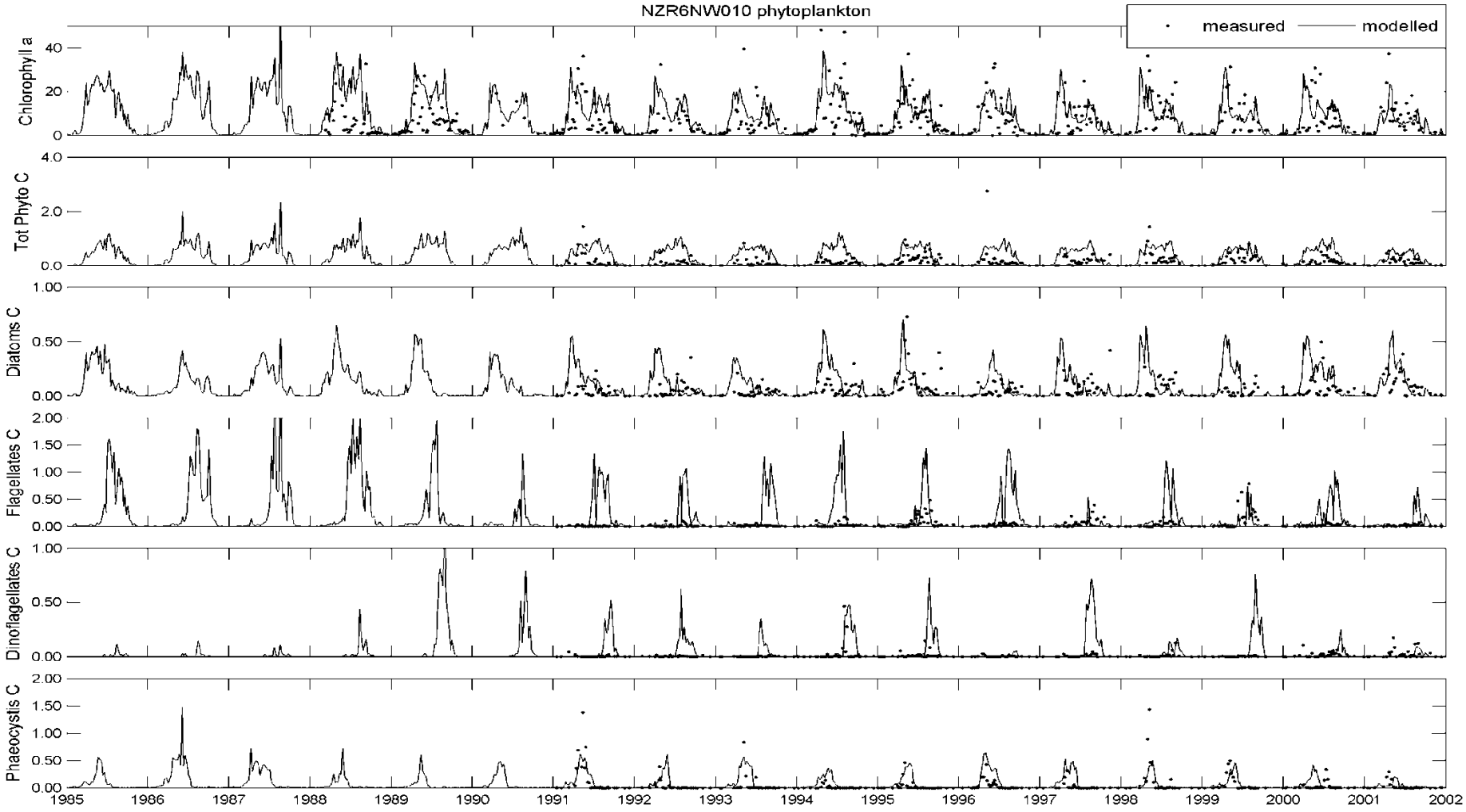
SUSPENDED MATTER

Min. number of years required to assess a given relative change in the mean of the signal at station Noordwijk 20 km

Relative difference to be detected	weekly sampling	bi-weekly sampling	monthly sampling
10 %	78	97	158
15 %	11	14	22
20 %	5	6	10
25 %	3	4	6

Blaas et al., 2005

Modelling


NZR6NW010 phytoplankton
measured
modelled
Chlorophyll a
Tot Phyto C
Diatoms C
Flagellates C
Dinoflagellates C
Phaeocystis C
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002

Data storage

- Databases (national and international)
  - Seadatanet
- EMODNET
  - Chemical, biological and physical lot
  - Meta information (name, method, time etc)

????

Does blending of chlorophyll data bias temporal trends??

Boyce et al. (Nature 2010, 466 (591-596)

Global decrease of 1% per year
1895 – 2005

Blended data
Secchi disk data
In situ chlorophyll data

Wernand et al. PLOS ONE 2013, (8),6, 63766

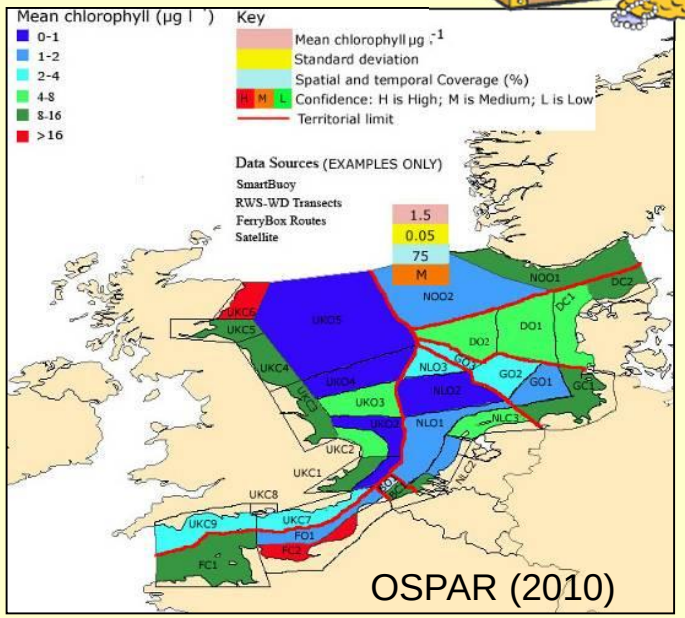
No global decrease
1889 - 2000

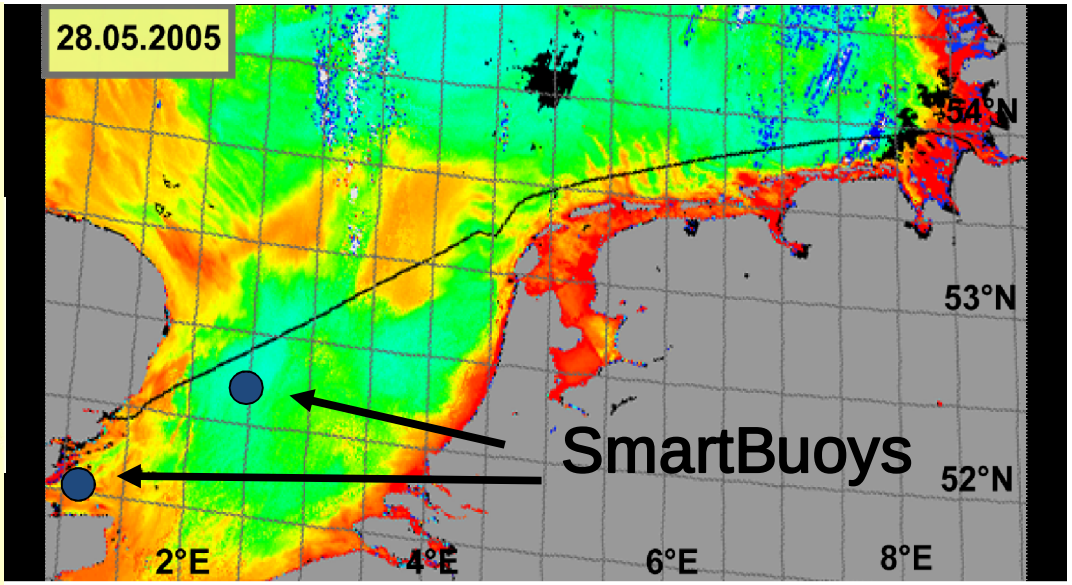
one source
FU scale (conversion)

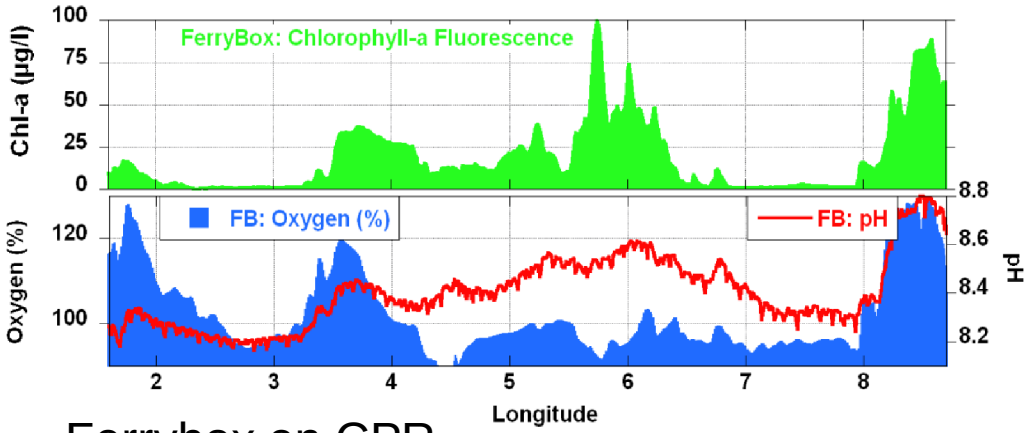
What is influencing the quality of data?
Which quality is needed?

Needed:
10 or 50% reduction in x years
with a certainty (chance) of 90 or 95%)

- no boundaries
  - one North Sea
- Remote sensing
- models







Ferrybox en CPR

18 juni 2014