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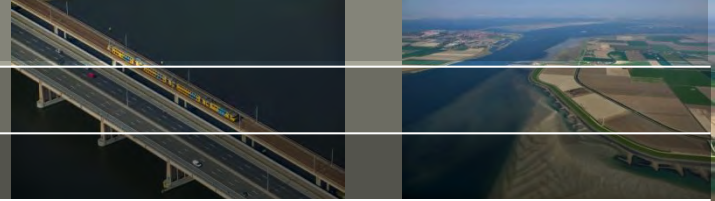


# The added value of passive sampling in monitoring of pesticides

Erwin Roex

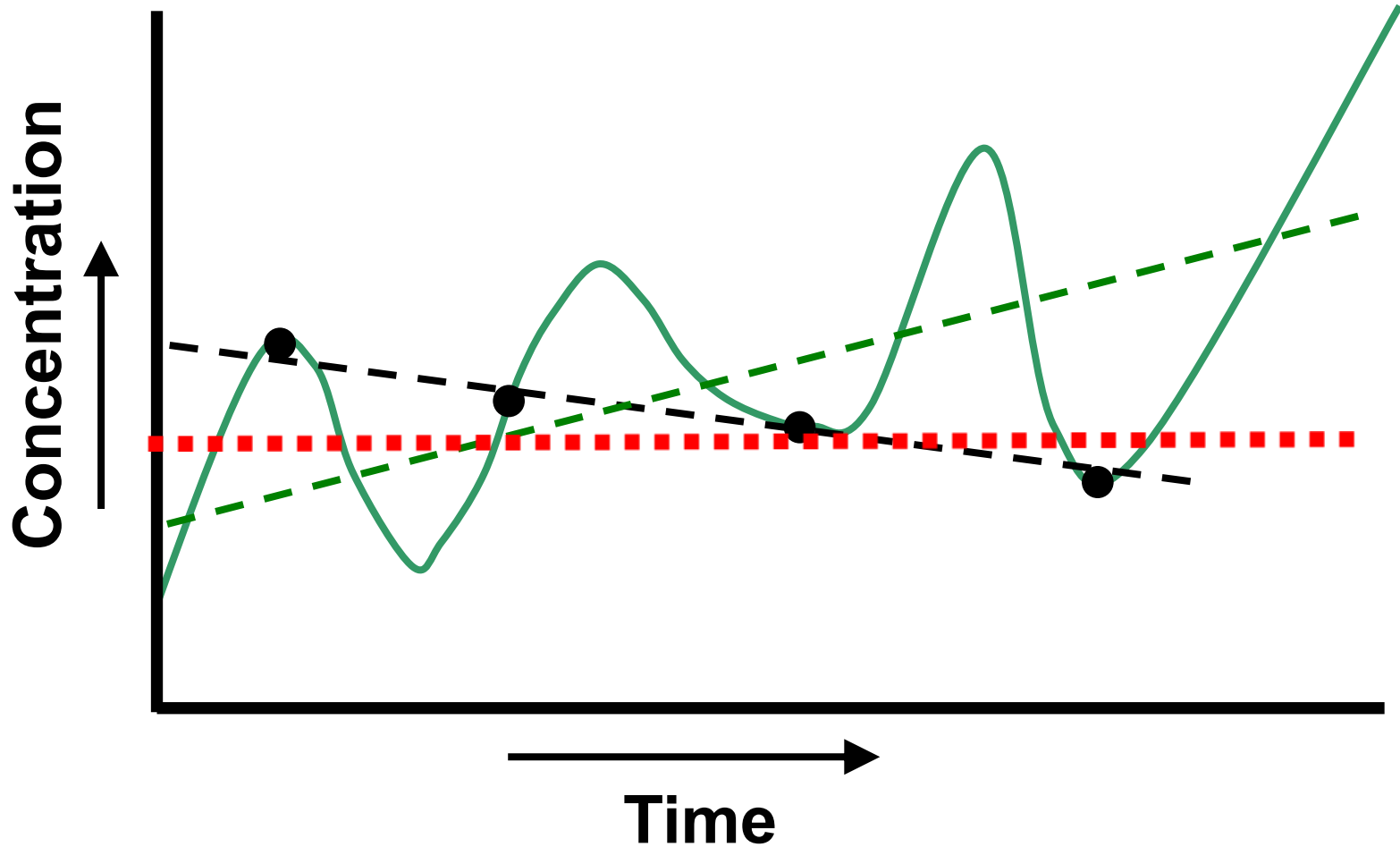
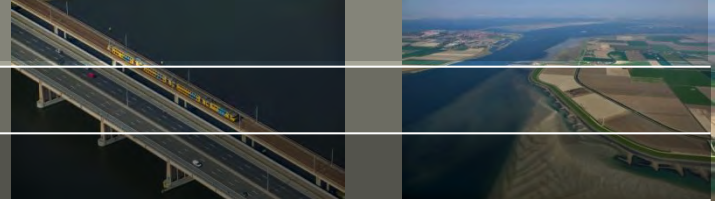
11 augustus 2016

# Outline

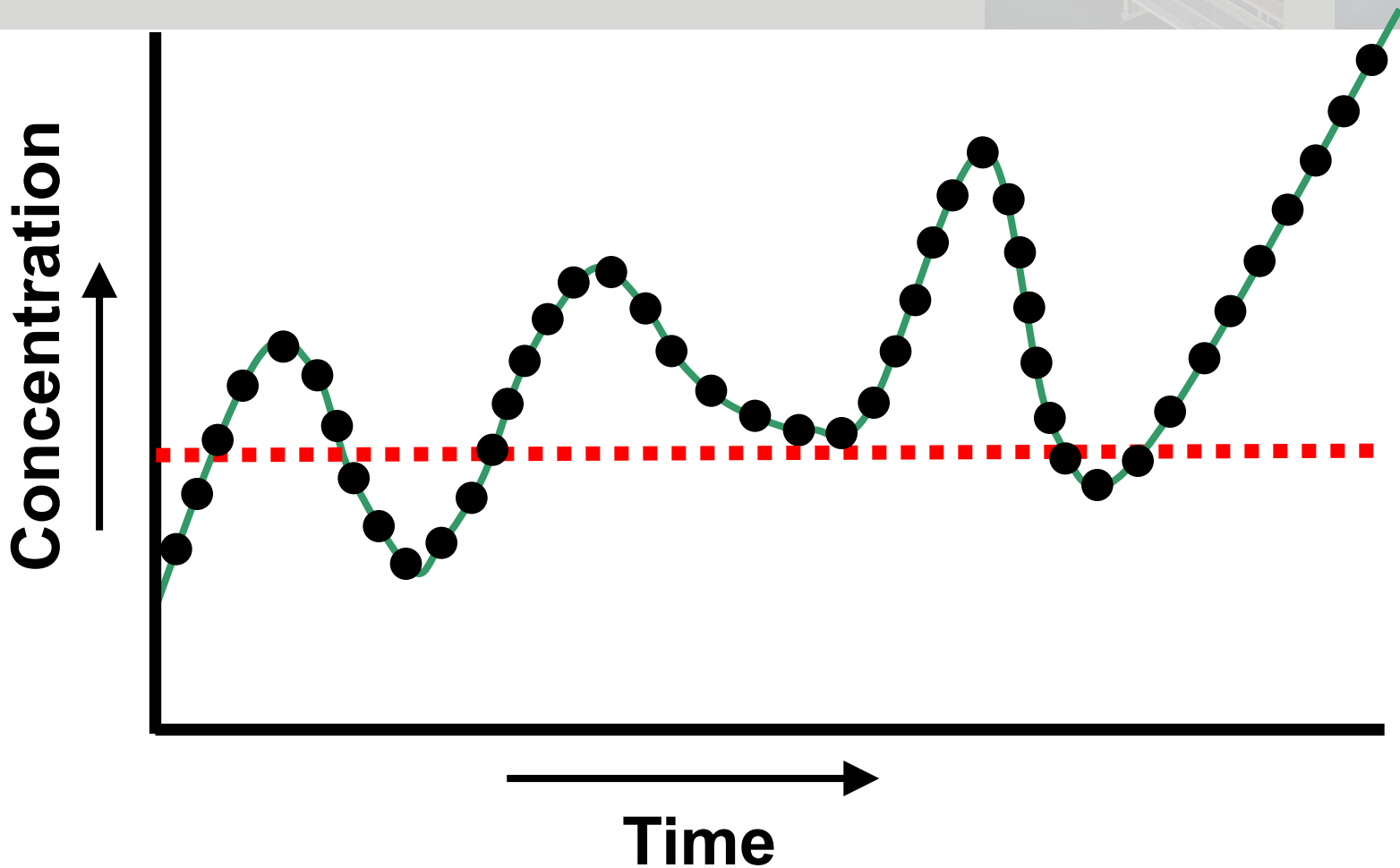


- Why passive sampling ?
- Principle behind passive sampling
- Project results

# What is the problem?



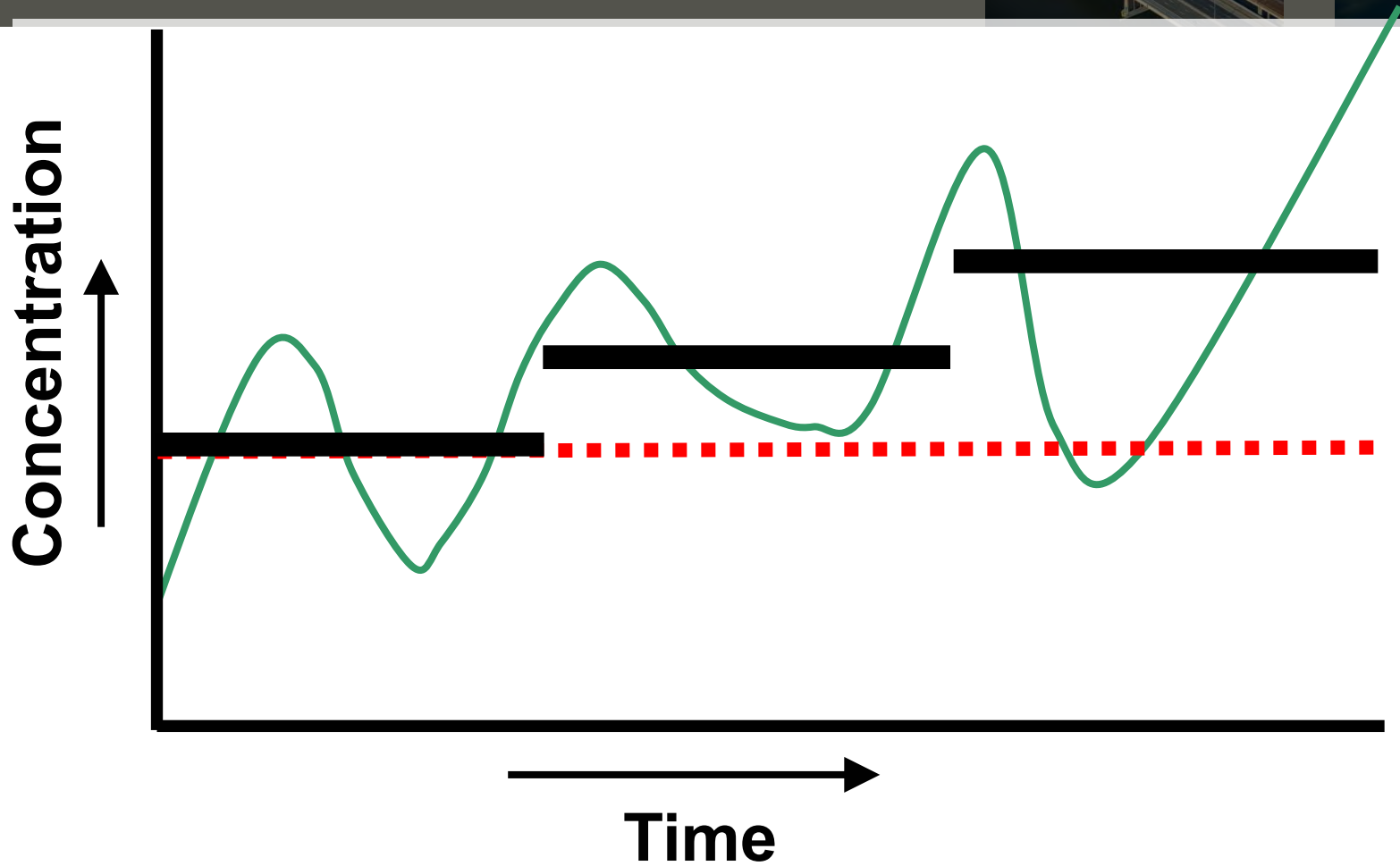
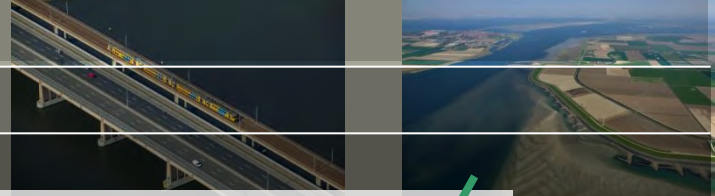
**'snapshot' monitoring can give wrong picture!!**



**Elevate monitoring frequency (costly)**

**Deltares**

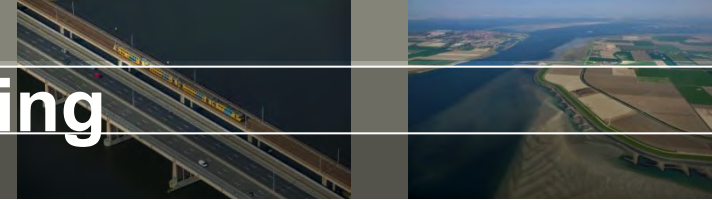
**Solution:**



**Time integrated measurement**

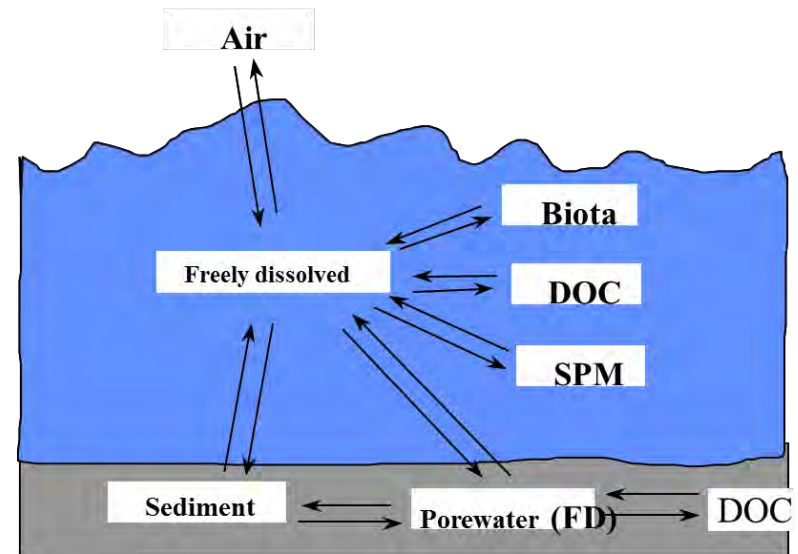
**Deltares**

# Advantages of passive sampling

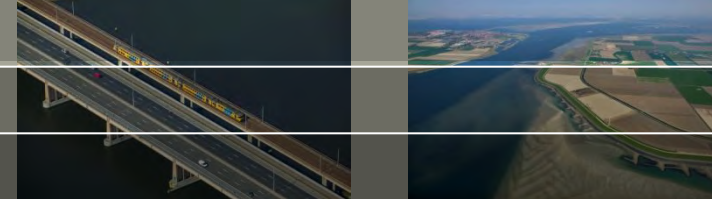


## Time-integrated concentration (several days- months)

- No missing of events (although not measured as peak)
- Lower Limit of Detection, because of larger sampling volume (5-6 times more compounds)
- Easy to transport
- Easy to store (events)
- Freely dissolved concentration



## 2 types of passive sampling:



- Absorption sampler, based upon partitioning theory, also called hydrophobic sampler (SPMD, silicon sheets)
- Adsorption sampler, based on strong binding on sampler, also called hydrophylic sampler (POCIS, speedisk®)



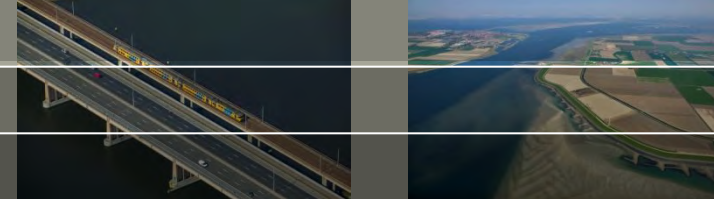
Silicon sheets

speedisk®





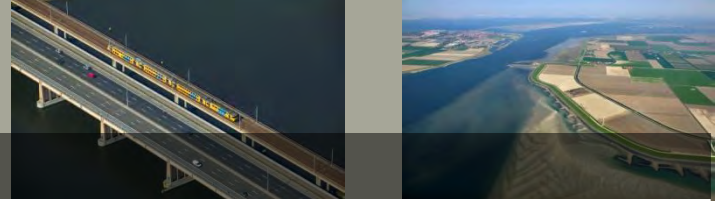
# Process constants



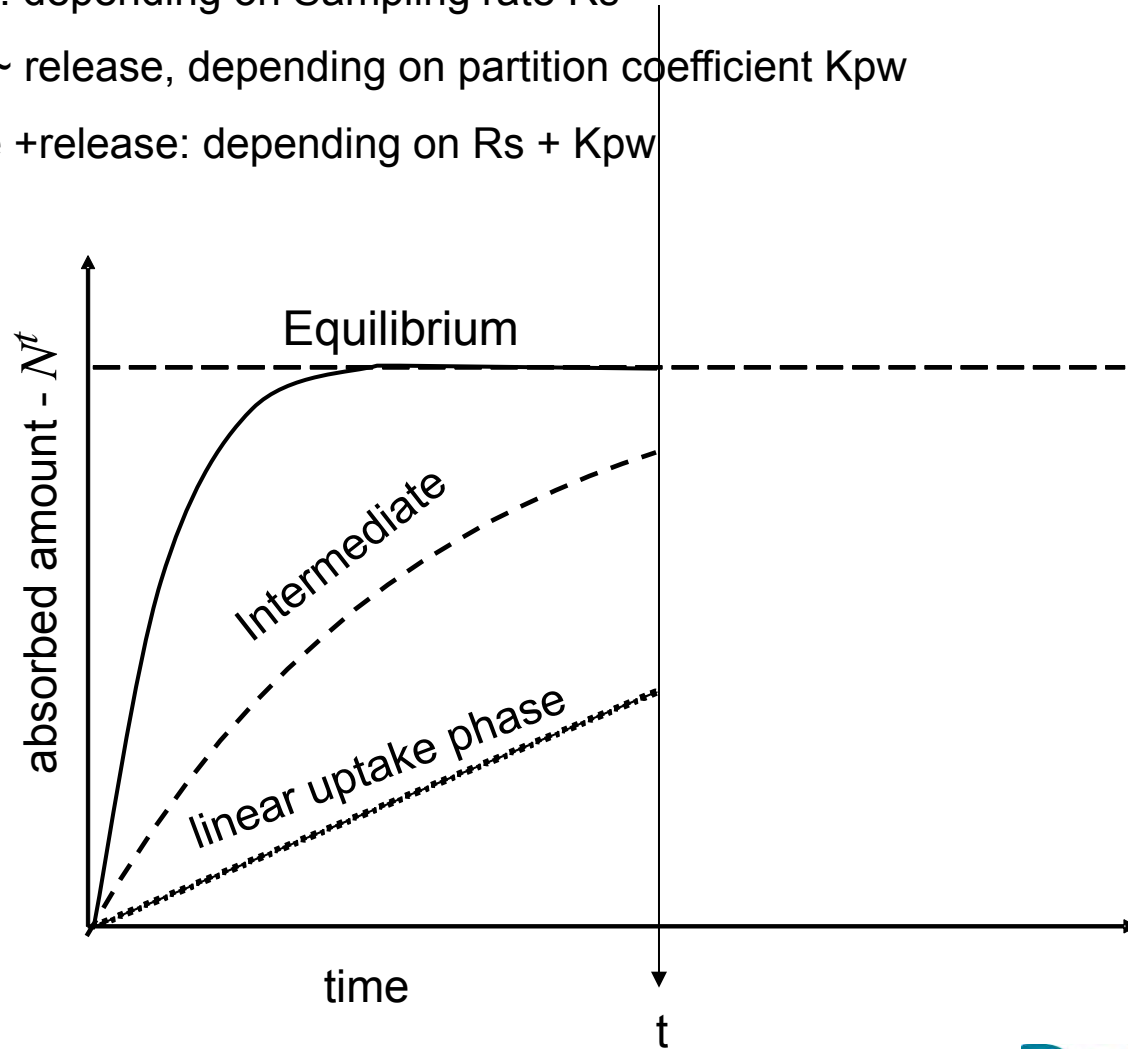
- Sampler Water Partition coefficient  $K_{pw}$ , substance specific ( $K_{ow}$  estimate) in l/kg
- Sampling rate (l/day), depending on
  - local water movement
  - diffusion constant (also substance specific)
- Sampling rate calculated with Performance Reference Compounds (PRC's)

release rate  $\approx$  uptake rate

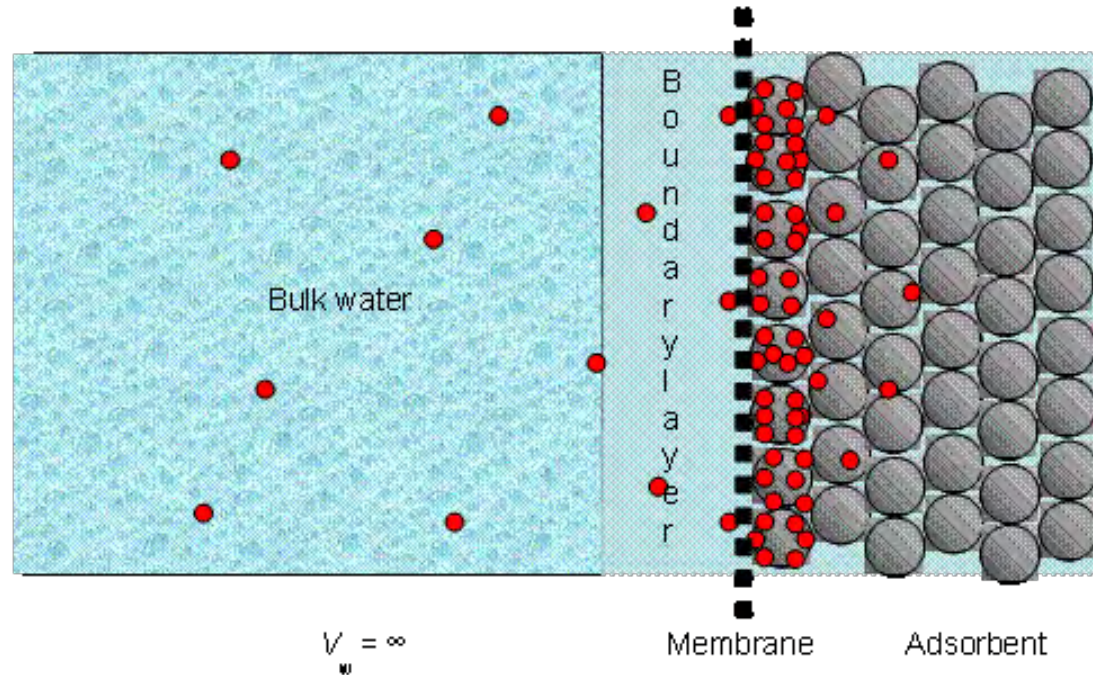
Calculate aqueous concentrations



1. Linear uptake phase: depending on Sampling rate  $R_s$
2. Equilibrium: uptake  $\sim$  release, depending on partition coefficient  $K_{pw}$
3. Intermediate; uptake +release: depending on  $R_s + K_{pw}$



# Adsorption samplers

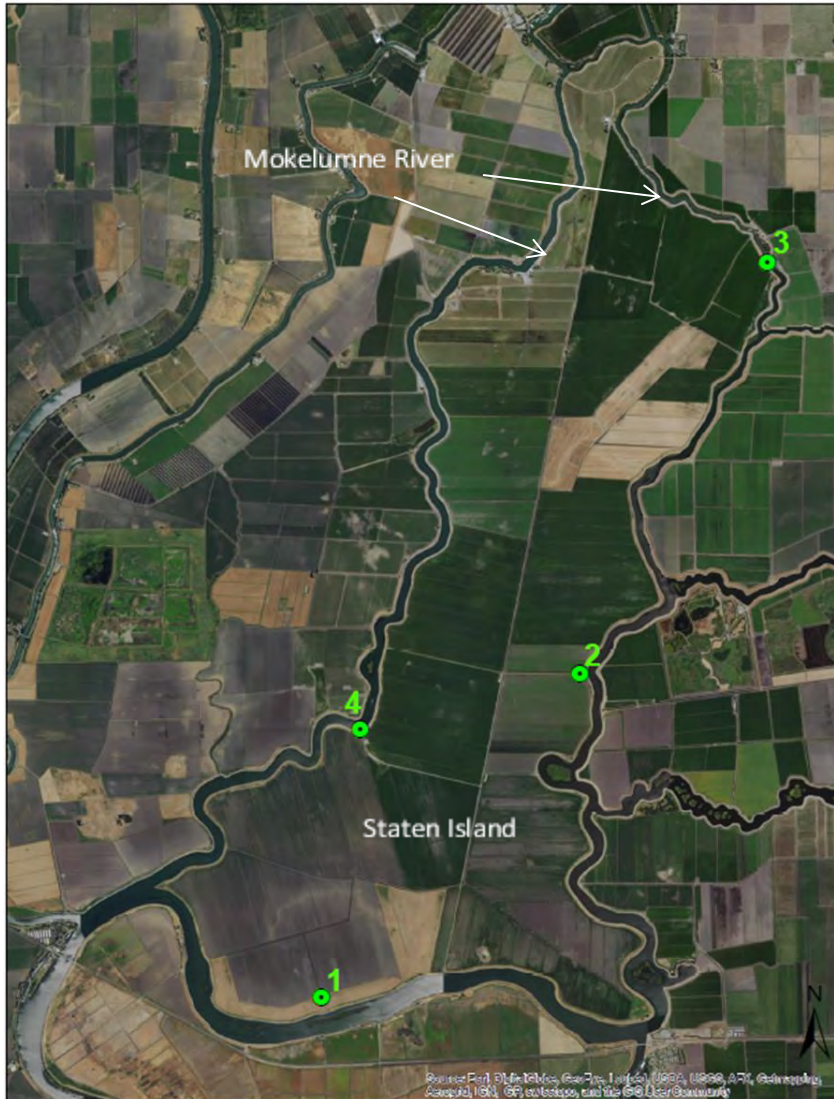
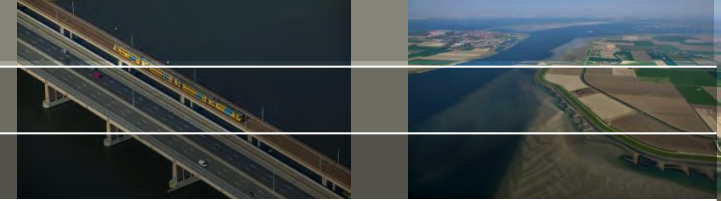


three factors determining transport from water to sampler :

1. Boundary layer
2. Diffusion through membrane
3. Diffusion inside sampler

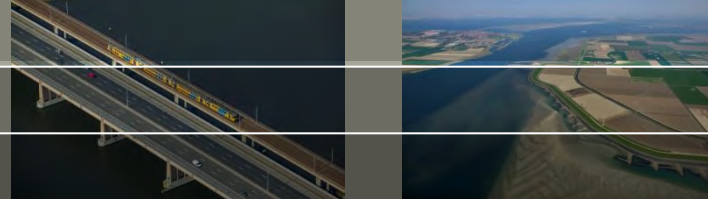
} Difficult to quantify, no equilibrium

# Monitoring on Staten Island



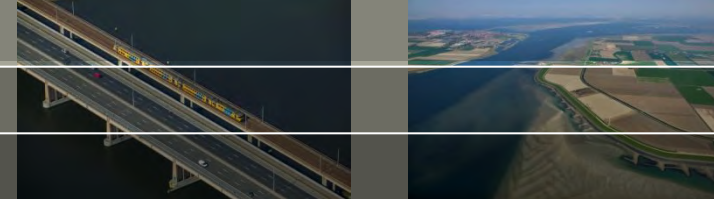
- 2 executive rounds
  - summer period 2015
  - winter period 2015/16
- 4 locations :
  - 1,2 pumping stations inside
  - 3,4 river outside
- Silicon rubber and speedisk®
- Analysis broad range pesticides

# Overview results



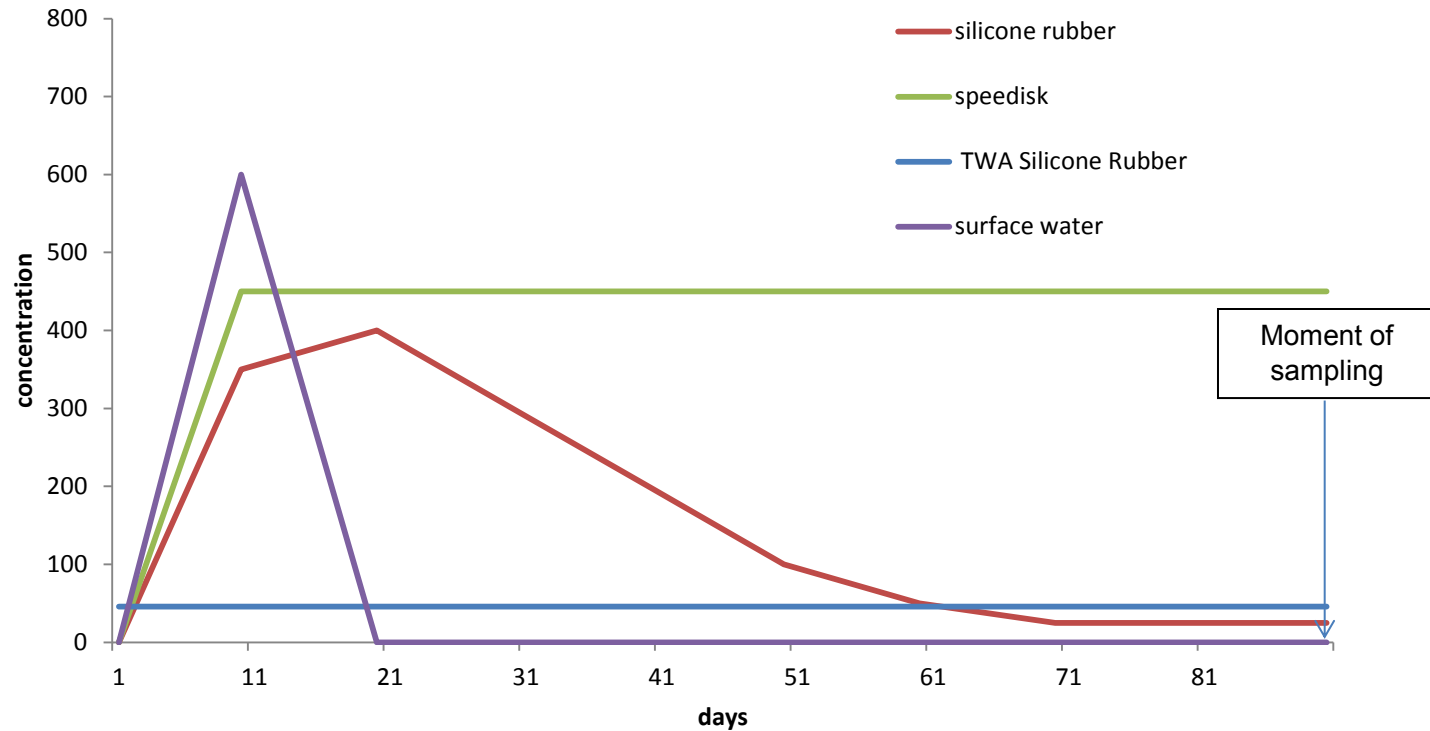
- First round  $\pm$  2000 litres sampled, based on sampling rates. Second round sampled volume was less (less pumping and irrigation)
- Number of pesticides detected high in both periods, lower in second (application period), 80 versus 56
- Passive samplers were complementary
- Some pesticides originate from outside Staten Island (thiabendazol, piperonylbutoxide, pyraclostrobin), some from inside (hexythiazox and indoxacarb, neonicotinoids)
- Neonicotinoids were found in low concentrations in both periods, result of method of application (seed treatment)

# Overview results (II)



Mutual deployment of 2 samplers allows detection of peak concentrations

Example: hexythiazox



# Concentrations → environmental risks



Comparison of concentrations with Dutch EQS (US/CA EQS?)

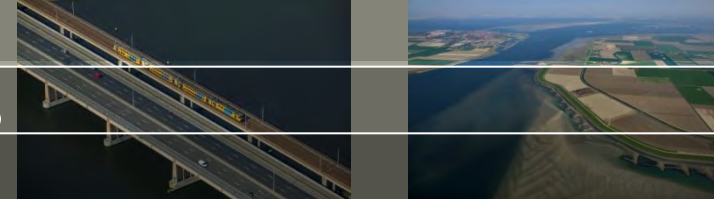
In first round 6 substances exceeded EQS values

3 originating outside area (2,4 D, piperonylbutoxide and pyraclostrobin)

3 originating from inside Staten Island (carbaryl, hexythiazox and indoxacarb)

In second round no EQS exceedings

# Follow-up / recommendations



- In 2016/17 second round to confirm results of 2015 and to “capture” more relevant irrigation period in winter
- Next to 2 types of passive samplers, deployment of new type of hydrophylic absorption sampler.
- Explore possible sources of relevant compounds, both within and outside area and involve relevant stakeholders.





# Questions?

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