Water Quality Status – perspectives on surface waters in the past

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Water Quality

› Water Quality contains different aspects:
  – Ecosystem: which animals, which plants?
  – Chemical components
  – Different quality for different purpose: bathing water, drinking water, irrigation water,…

This presentation
› Only chemical component Nitrogen (N) and Phosphorus (P)
› Only in rivers
Water Quality

Nitrogen concentration Rhine

Source: Rijkswaterstaat
Discharge of Rhine

Source: Rijkswaterstaat
Observations

**Observations (concentrations)**

Long time series can show a trend

But

Often no long time series available

Representativeness: space and time? Location, discharge, depth, frequency of sampling,...

No explanation why this trend is occurring?

What is the source of N or P in water?

No future projection possible, but could be available up to last month

To answer these questions:
A model represents real-world processes in a simplified way. So a proxy!

Concentration: mass N/mass water. Both must be correct (100/20 = 5 and 110/18=6.1!)

Mass modelling of N and P: IMAGE-GNM model of PBL/Utrecht University

IMAGE: IAM model which contains climate change, land use changes, agricultural production, lifestyle changes, energy changes, etc on a consistent way

Mass modelling of water: PCRGLOBWB of Utrecht University
Integrated assessment model

- Land cover
- Vegetation
- Hydropower

Runoff+
Volume of water body

- Surface runoff
- Shallow and deep groundwater
- Riparian zone

Water

Nutrients

Runoff partitioned

In-stream retention (spiraling)

Coastal Sea

- Stream, river
- Lake, reservoir
- Wetland

Atmospheric deposition

Aquaculture

Human sewage

Soil N/P Budget

Natural N and P sources

Surface runoff

Leaching

Groundwater

Consistent SSPxRCP combinations

SSP

Storylines and drivers

RCP climate

Integrated assessment model

PCR-GLOBWB

Hydrological model

Based on scenario variables

Global Nutrient Model (GNM)

Global Nutrient Model

Aquaculture

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Soil N/P budget

Soil/subsurface fluxes

Diffuse sources

Point sources

Ammonia emission

Soil N/P budget

Atmospheric deposition

Vegetation

Surface runoff

Aquaculture

Human (sewage)

Soil

Shallow groundwater

Deep groundwater

0.5 by 0.5 degree resolution, annual time step

Beusen et al, 2015, 2016, 2022
Delivery

1970 – 2015:
Cropland: + 2Mkm2
N fertilizer: 3X
P fertilizer: 2X
Production: 3X
Pointsources: 2X

Beusen et al. 2015
Concentrations

1970

Nitrogen concentration

1970

Phosphorus concentration
Conclusions

N and P concentration is changing due to:

- Conversion from natural land to agricultural land
- Pointsources: First people are connected to a pipe, and treatment is following later
- Aquaculture is small, but is growing (China)
Sources


Discussion question

What are sources of water pollution in your own home country? And Why?

www.menti.com
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