REPUBLIC OF ESTONIA
ENVIRONMENT AGENCY

EstModel

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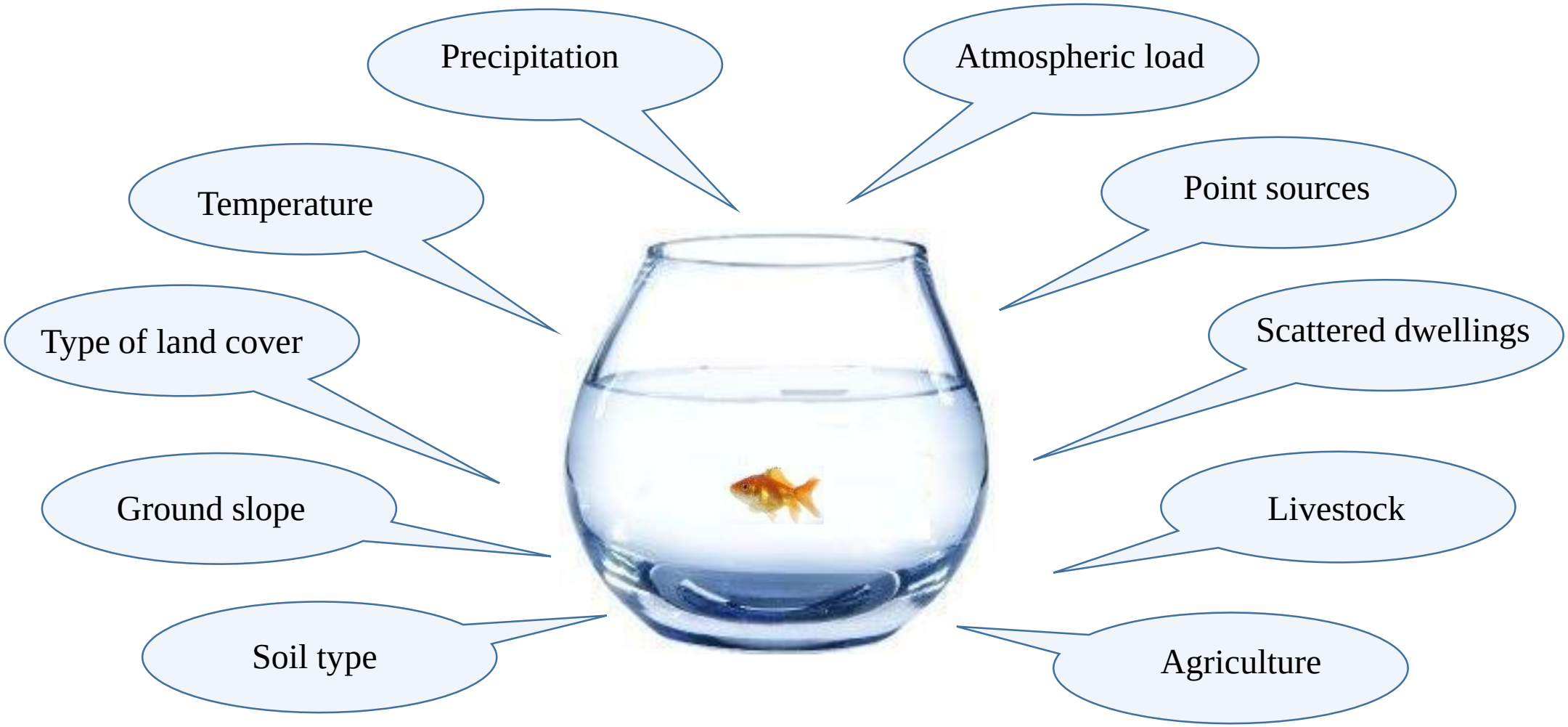
Background

Project „Development of the data-modelling system and the decision support tool for the integrated marine and inland water management“

SWAT
HYPE
INCA
COUP
POLFLOW
MESAW
ESTMODEL

Monitoring – not the full truth



The monitoring data reflects only the point at which the sample is taken and only the time moment when the sample is taken

Model characteristic scales

MONITORING FREQUENCY

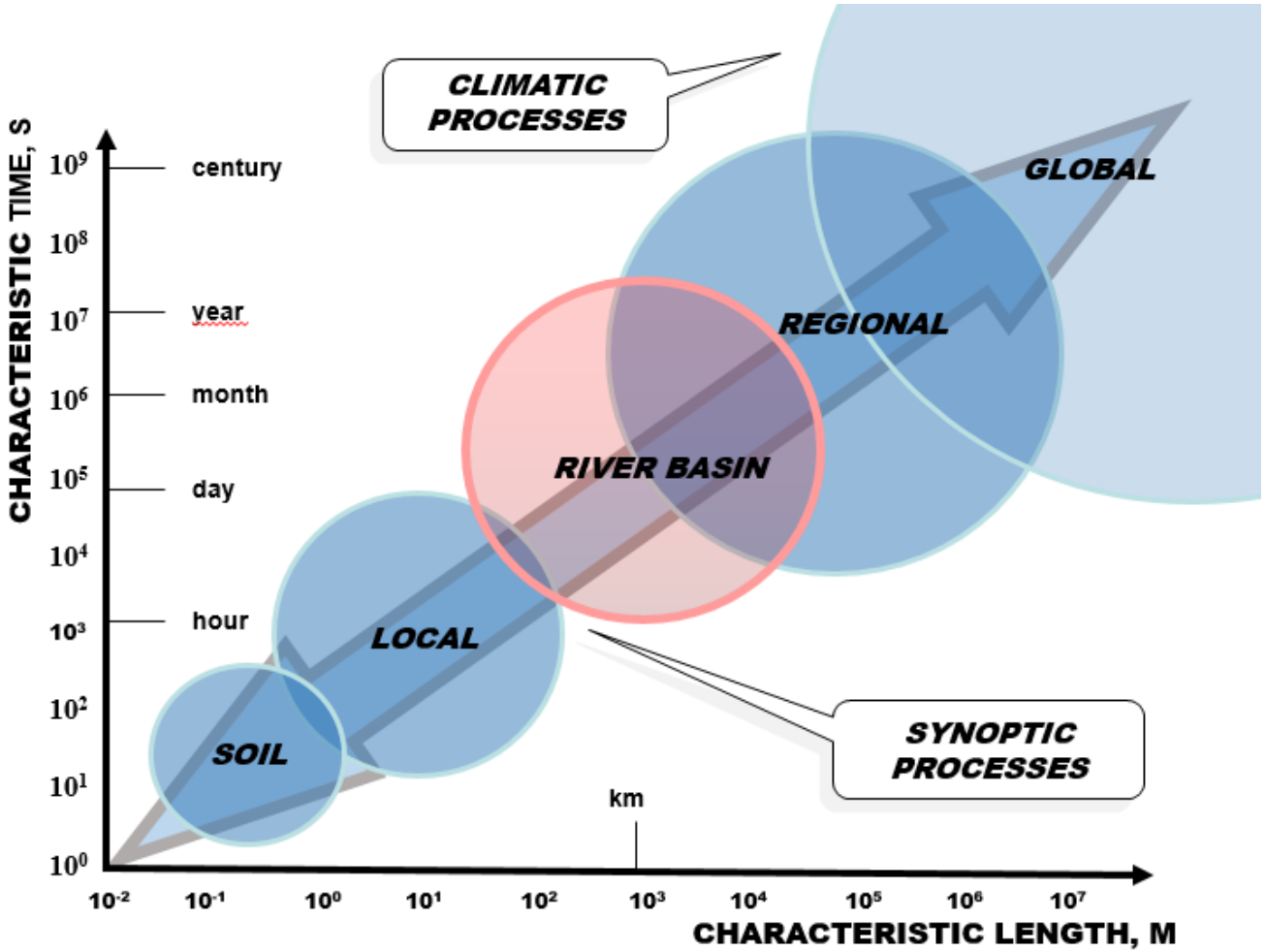
CORINE LAND USE

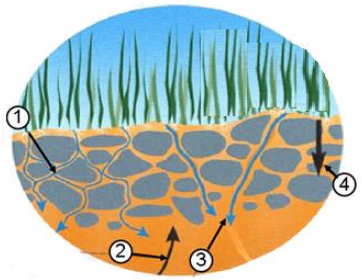
AGRICULTURE

POINT SOURCES

HYDROCHEMISTRY

HYDROLOGY

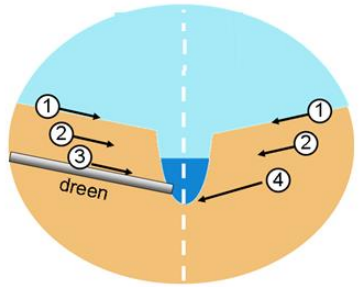




Soil scale - cm

1 sm

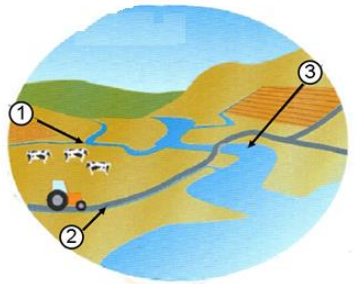
1. Interstitial water
2. Macro-porous water
3. Leaching



Local scale - m

10 m

1. Surface runoff
2. Soil runoff
3. Drainage runoff
4. Groundwater



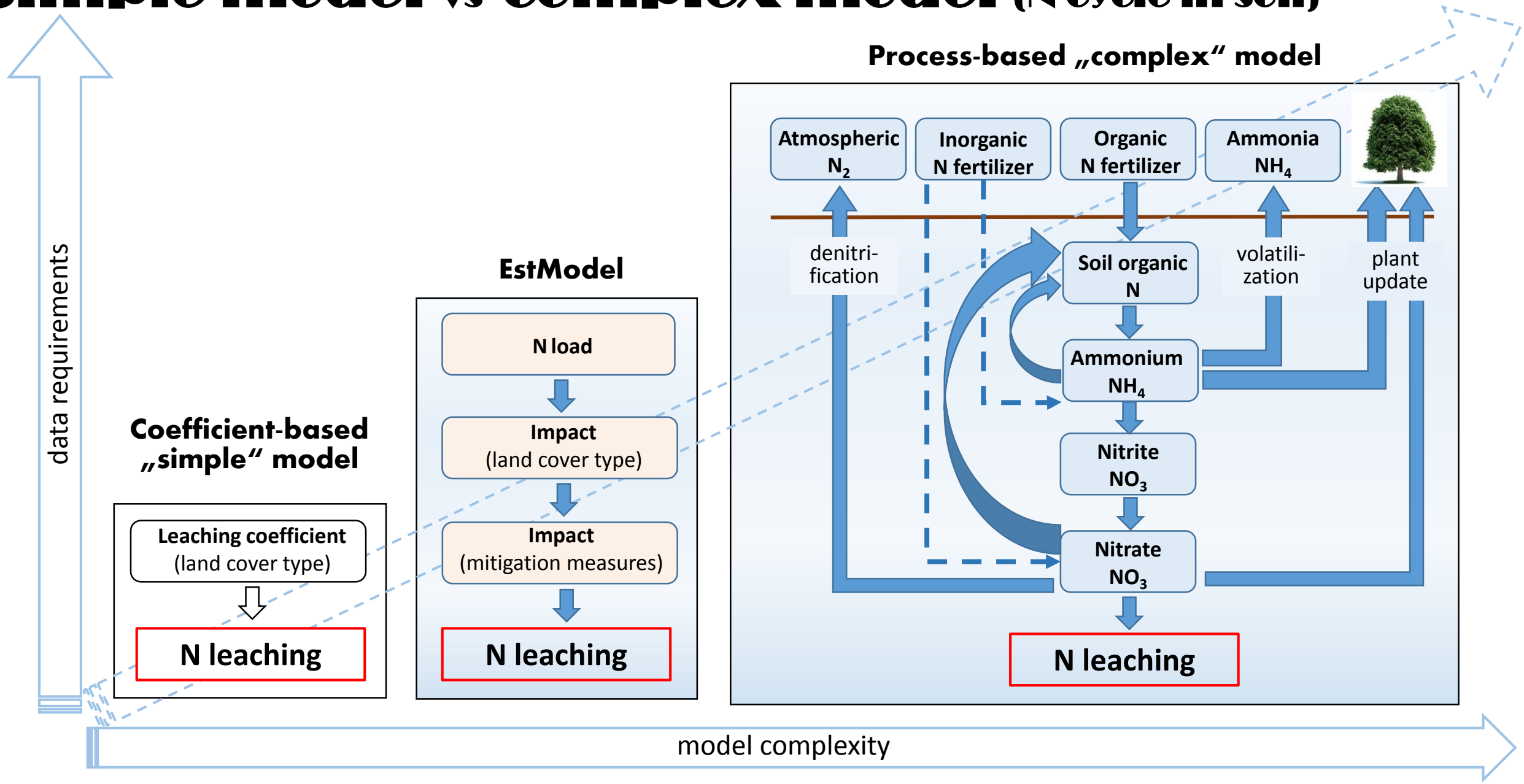
Basin scale - km

1 km

1. Land cover (fields, forests etc.)
2. Artificial surfaces (roads etc.)
3. Rivers, lakes, streams, ditches

Every problem has a *characteristic time* t_c, which is the smallest interval of time in which a notable change can be observed in the physical quantities.

Simple model vs complex model (N cycle in soil)



EstModel

Characteristic features:

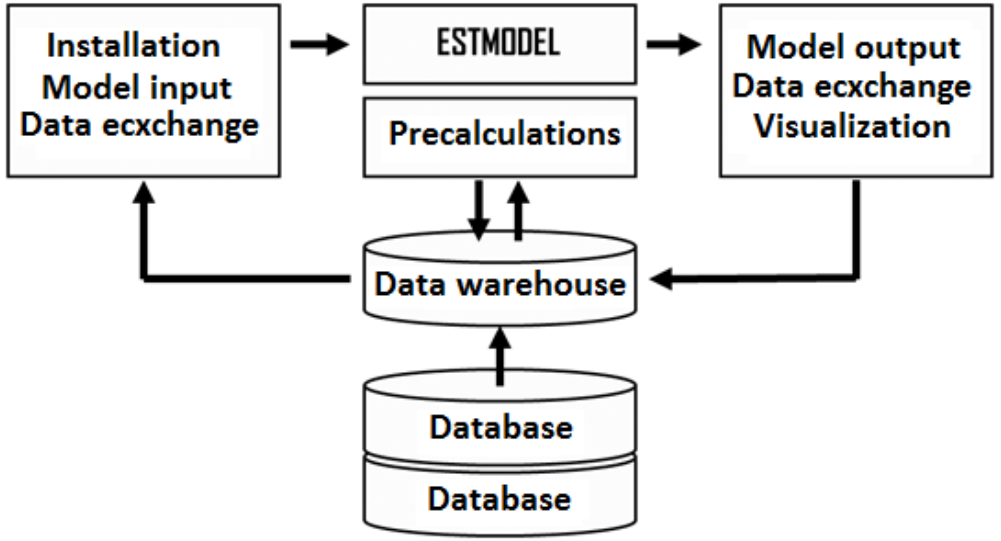
- nutrients runoff assessment;
- calculation unit is subcatchment;
- automatic model calibration with monitoring data;
- automatic installation in selected area;
- automatic national monitoring data retrieval;

Assumptions:

- stationarity (constant conditions in the region);
- homogeneity (similarity of parameters in the region).

Core modules:

- hydrological flow module;
- hydrochemical load module;
- estimation module;



Authors:

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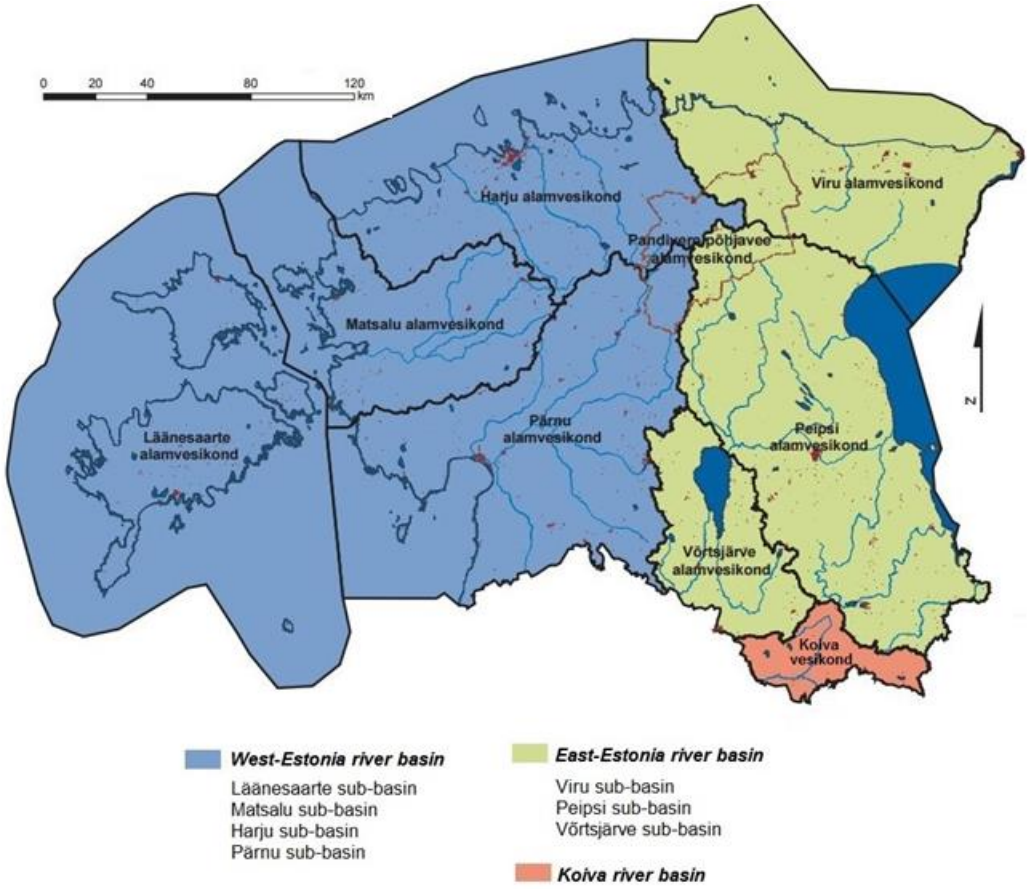
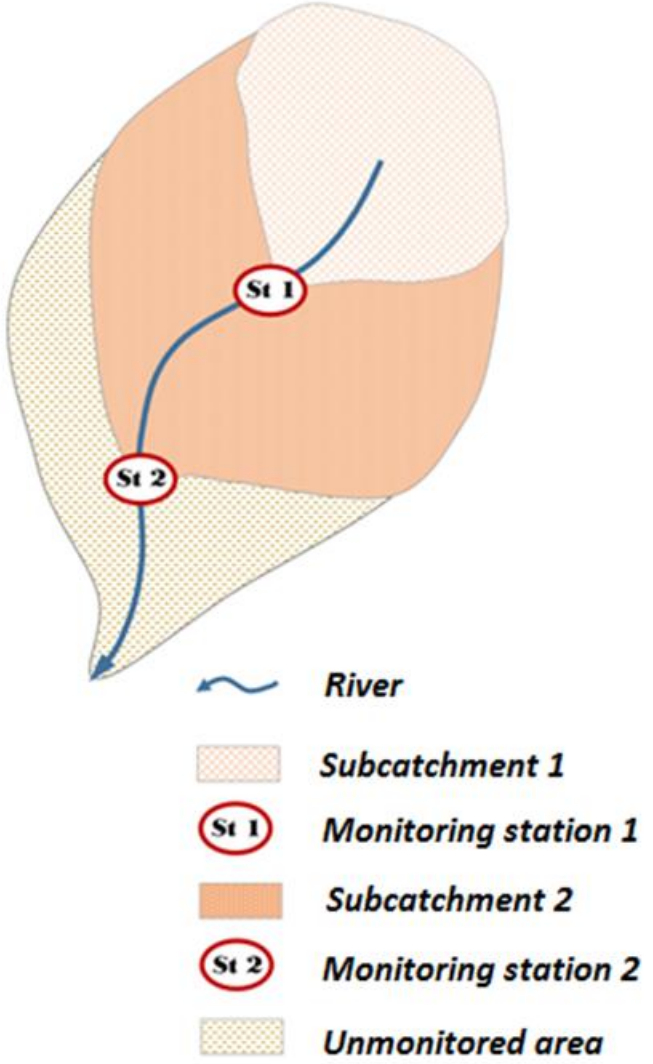
EstModel – calculation units (subcatchments)

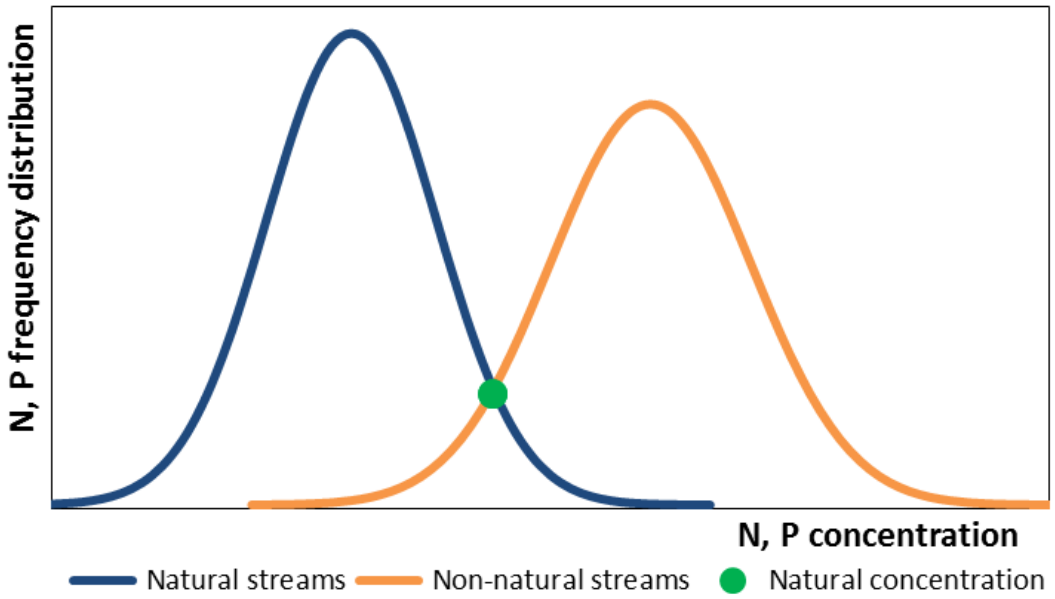
- Estonia is devided into three river basins and eight sub-basins
- For each subarea the average specific runoff is calculated
- For unmonitored area the average specific runoff of its subarea is used



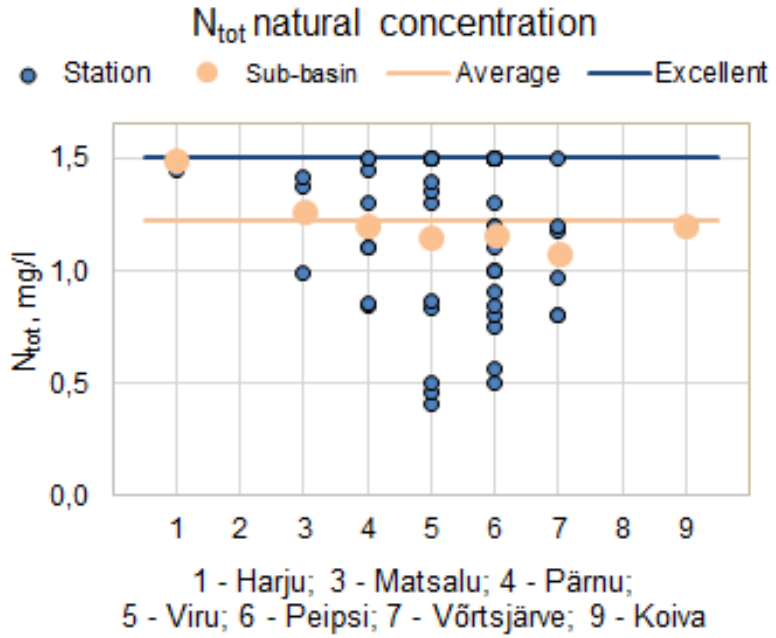


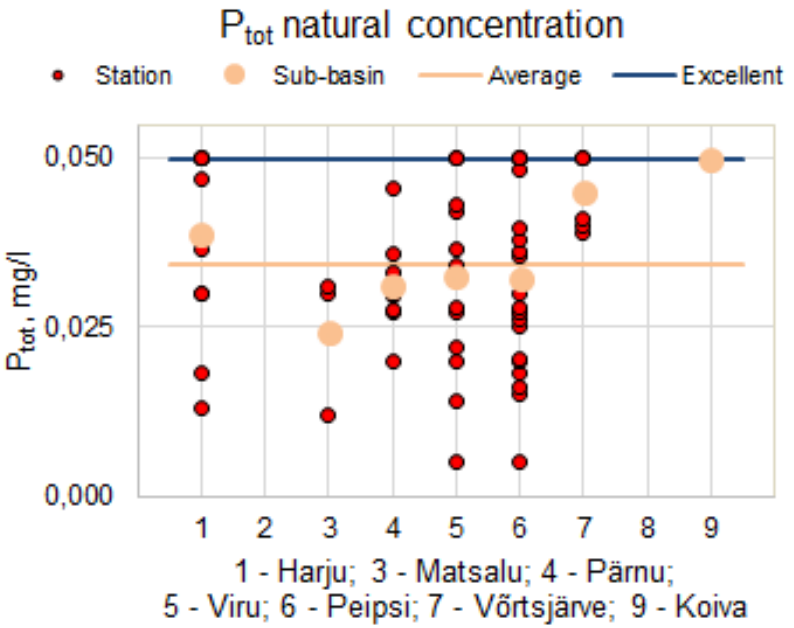
EstModel – N, P natural concentrations

A reference stream (natural stream) is a least impacted waterbody that can be monitored to establish a baseline to which other waters can be compared.

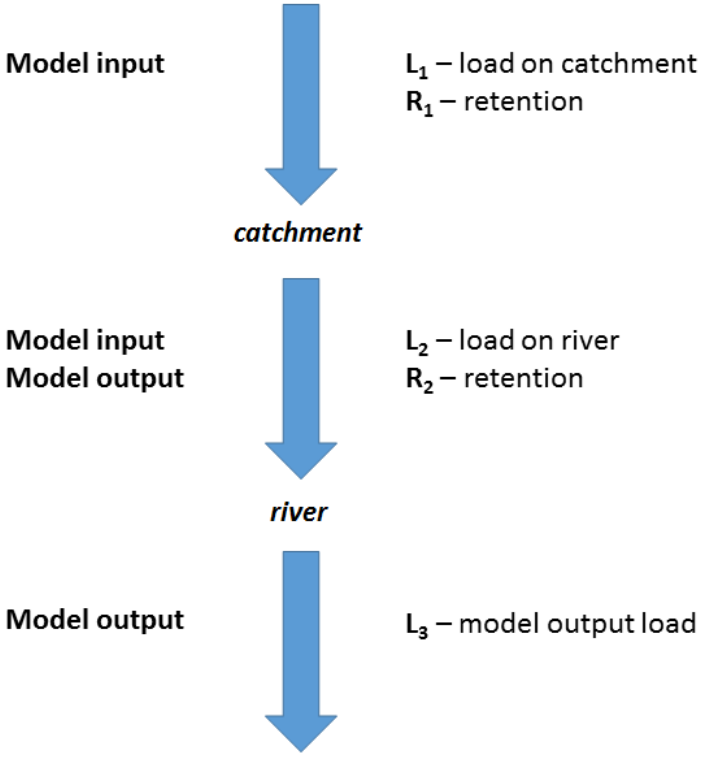


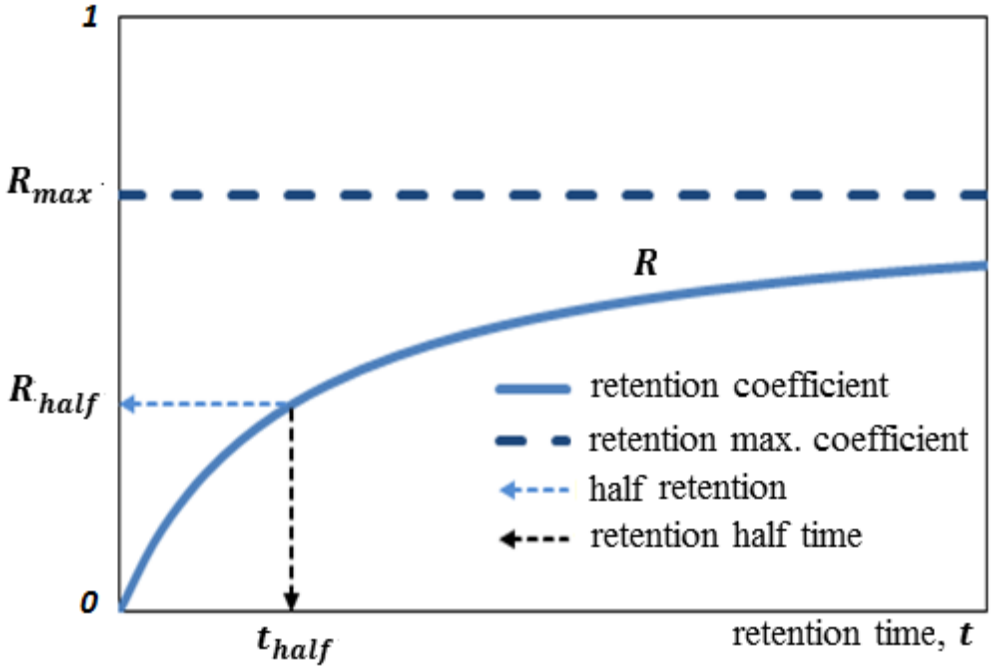
U.S. EPA. 2000. Nutrient Criteria.Technical Guidance Manual: Rivers and Streams. U.S. Environmental Protection Agency, Washington, DC. EPA-822-B00-002.
https://nepis.epa.gov/Exe/ZyPDF.cgi/20003CVP.PDF?Dockey=20003CVP.PDF





EstModel – retention





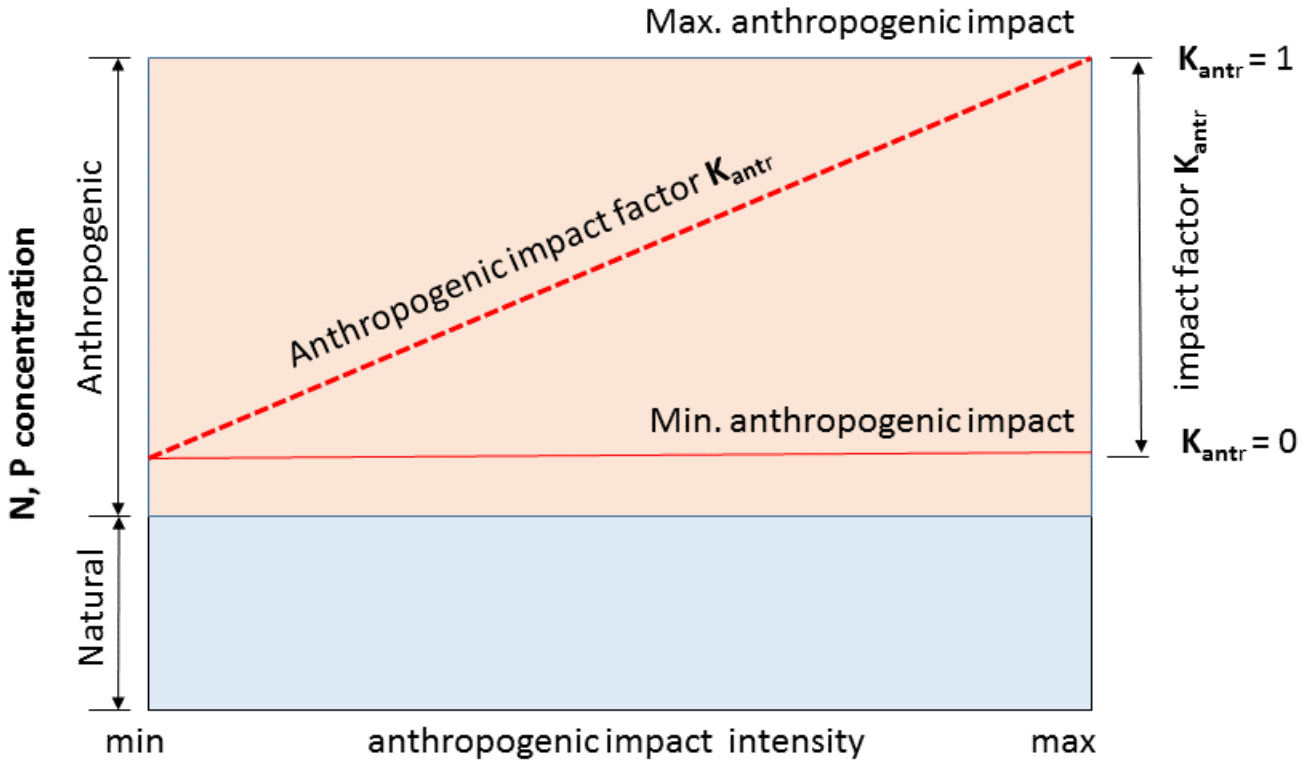
$$R^{N,P} = R^{N,P}_{max} \frac{t}{t^{N,P}_{half} + t}$$

$R^{N,P}$ – N, P retention coefficient (0 - 1);
$R^{N,P}_{max}$ – N, P retention max. coefficient (0 - 1);
t – retention time; $t^{N,P}_{half}$ – retention half time;

$$L\_ret^{N,P} = L^{N,P} * R^{N,P}$$

$L\_ret^{N,P}$ – N, P load retention;
L – input load;
$R^{N,P}$ – N, P retention coefficient;

EstModel – anthropogenic impact



$$C^{N,P} = C^{N,P}_{natural} + C^{N,P}_{antr}$$

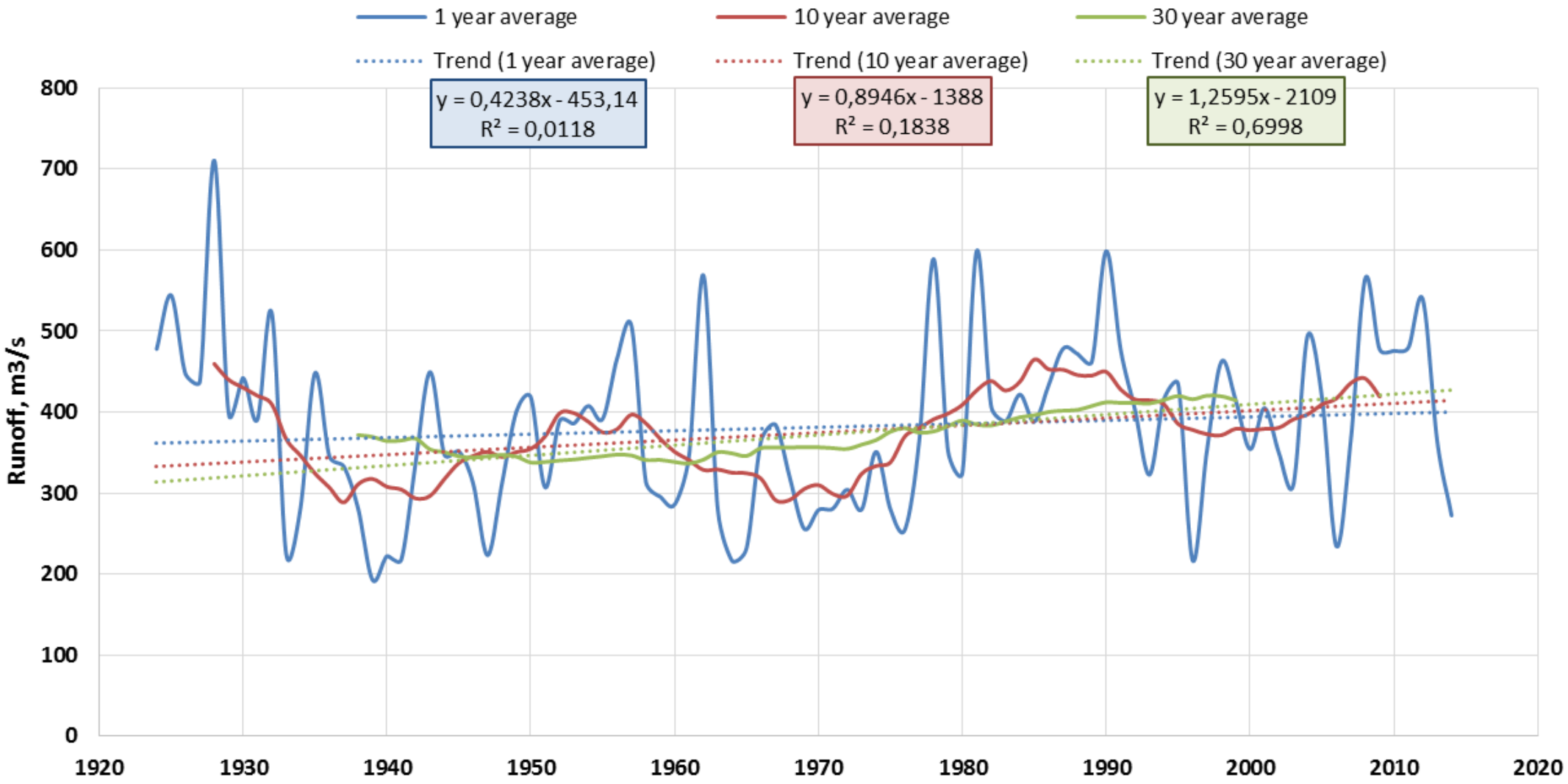
$C^{N,P}$ – N, P concentration, g/m^3;
$C^{N,P}_{natural}$ – N, P natural concentration, g/m^3;
$C^{N,P}_{antr}$ – N, P anthropogenic concentration, g/m^3;

$$C^{N,P} = C^{N,P}_{min} + K^{N,P}_{antr} * (C^{N,P}_{max} - C^{N,P}_{min,i,j})$$

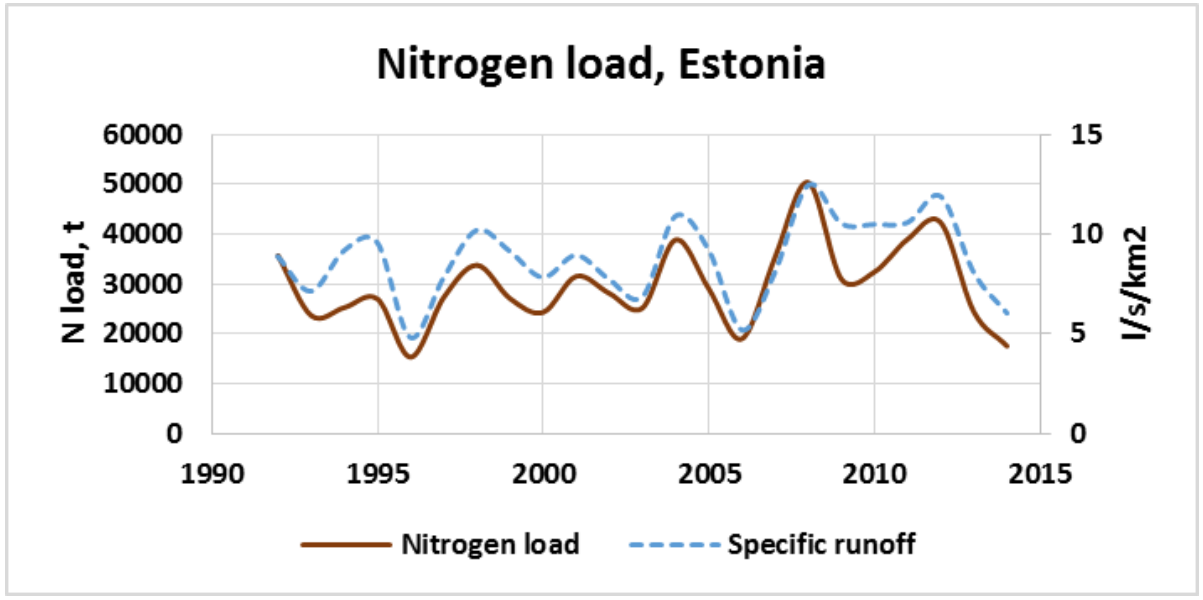
$C^{N,P}$ – N, P concentration, g/m^3;
$C^{N,P}_{min}$ – N, P min. concentration, g/m^3;
$C^{N,P}_{max}$ – N, P max. concentration, g/m^3;
$K^{N,P}_{antr}$ – N, P anthropogenic impact factor;

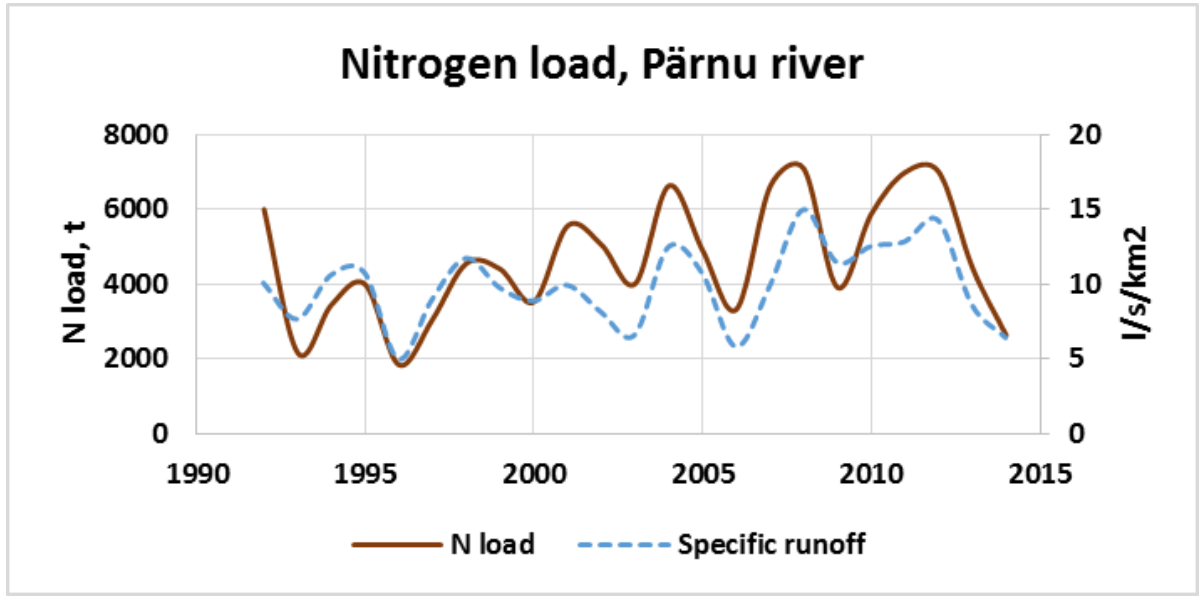
EstModel — hydrological module

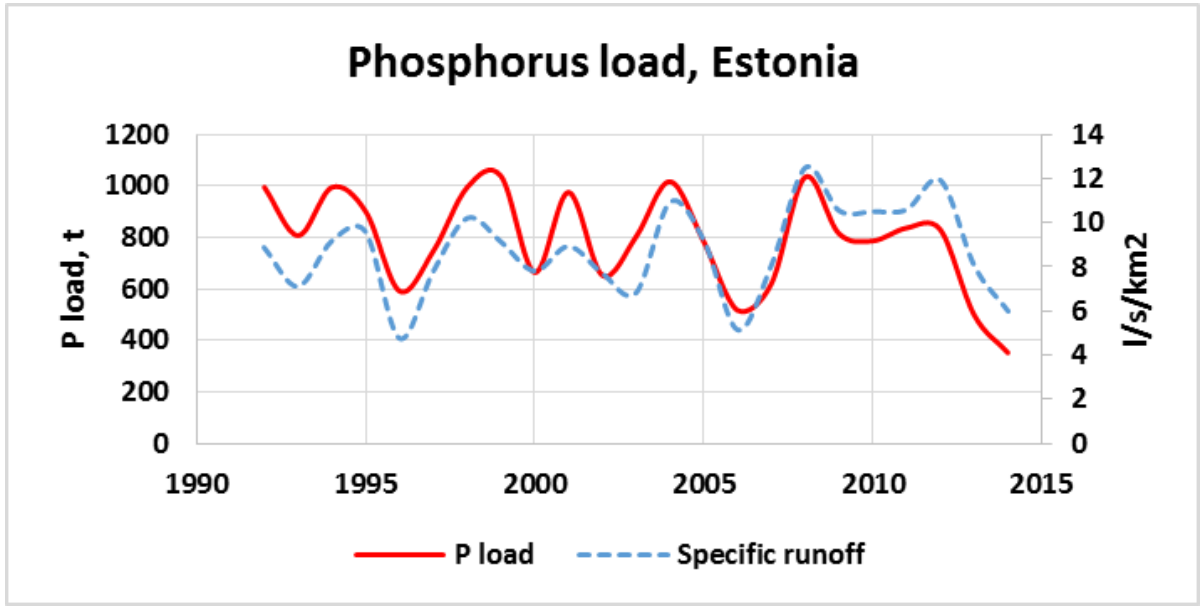
Estonian surface runoff, 1924 – 2014

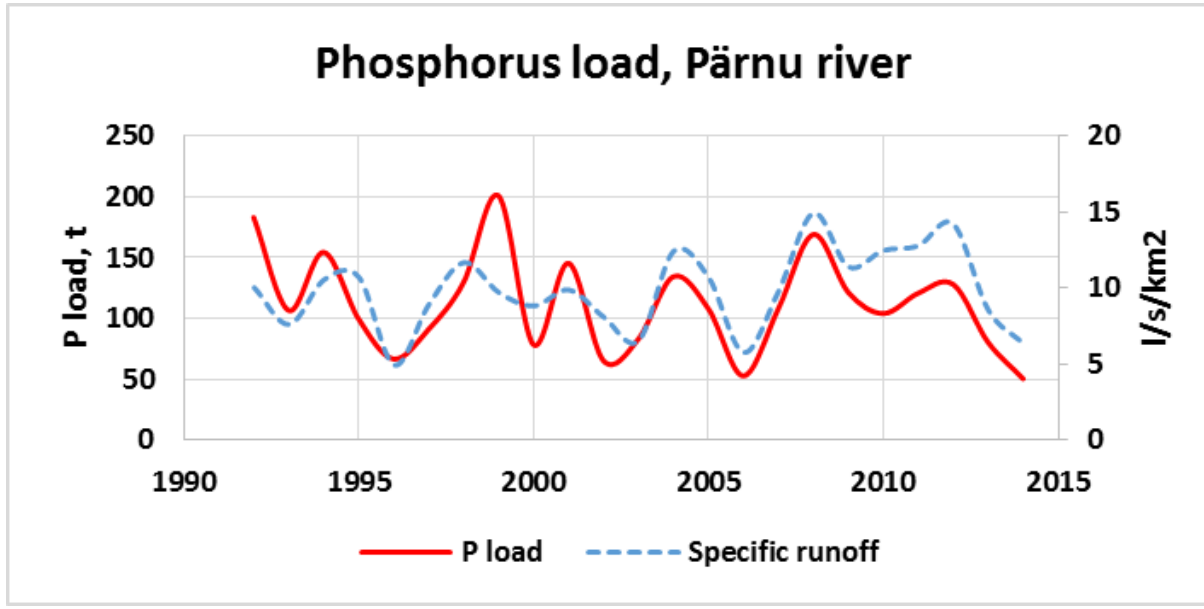


EstModel — load module









Paldies par uzmanību!
Tänan!