Julia Gorbunova

Nutrient loads to the Vistula Lagoon of the Baltic Sea

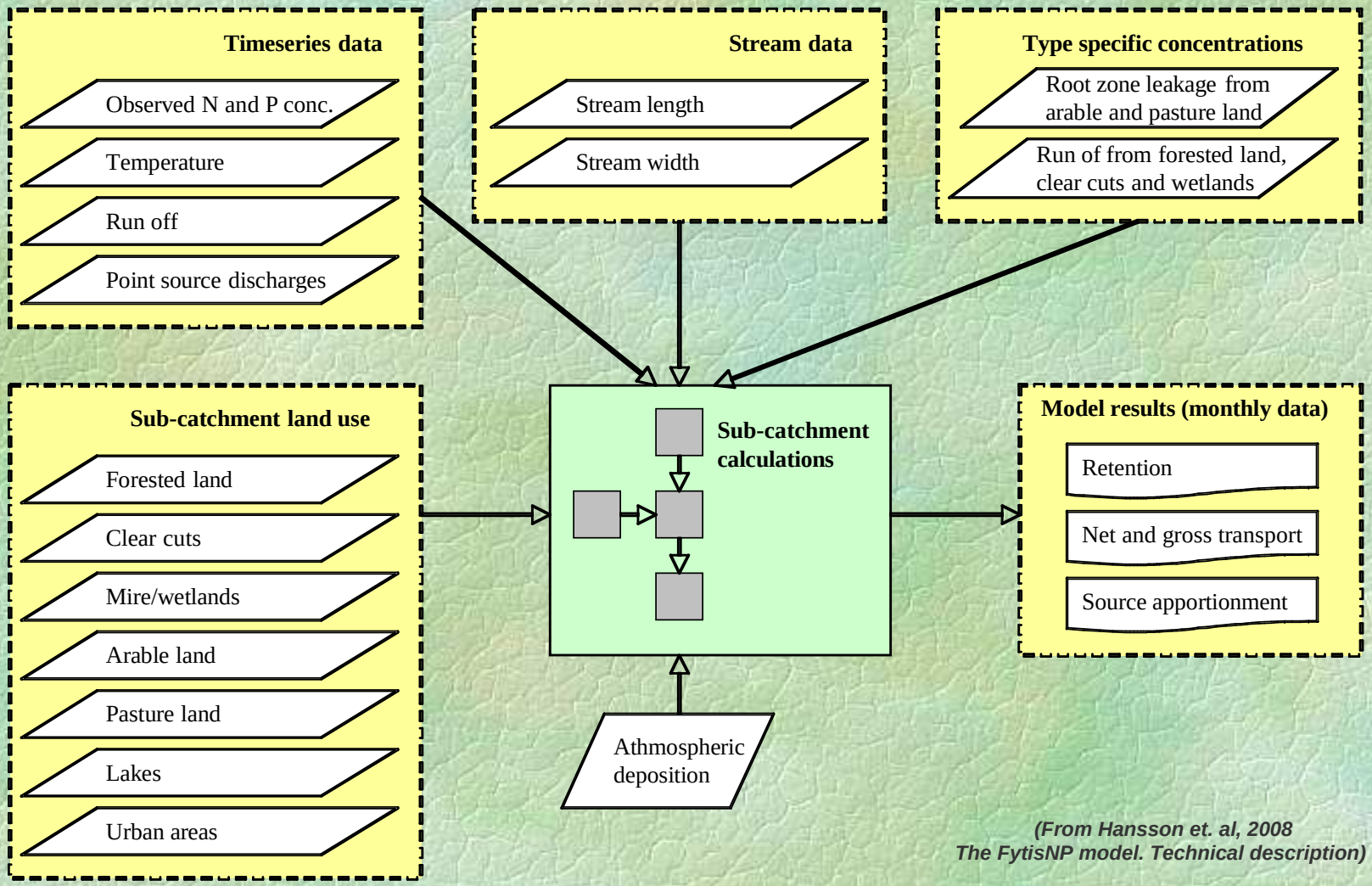
Atlantic Branch of P.P.Shirshov Institute of Oceanology Russian Academy of Sciences

RFBR grant 09-05-92421 (ECOSUPPORT Bonus+)

The catchment area of the Vistula Lagoon

(From Domnin D. & Chubarenko B., 2007 Atlas of transboundary river basins of the Kaliningrad Oblast)

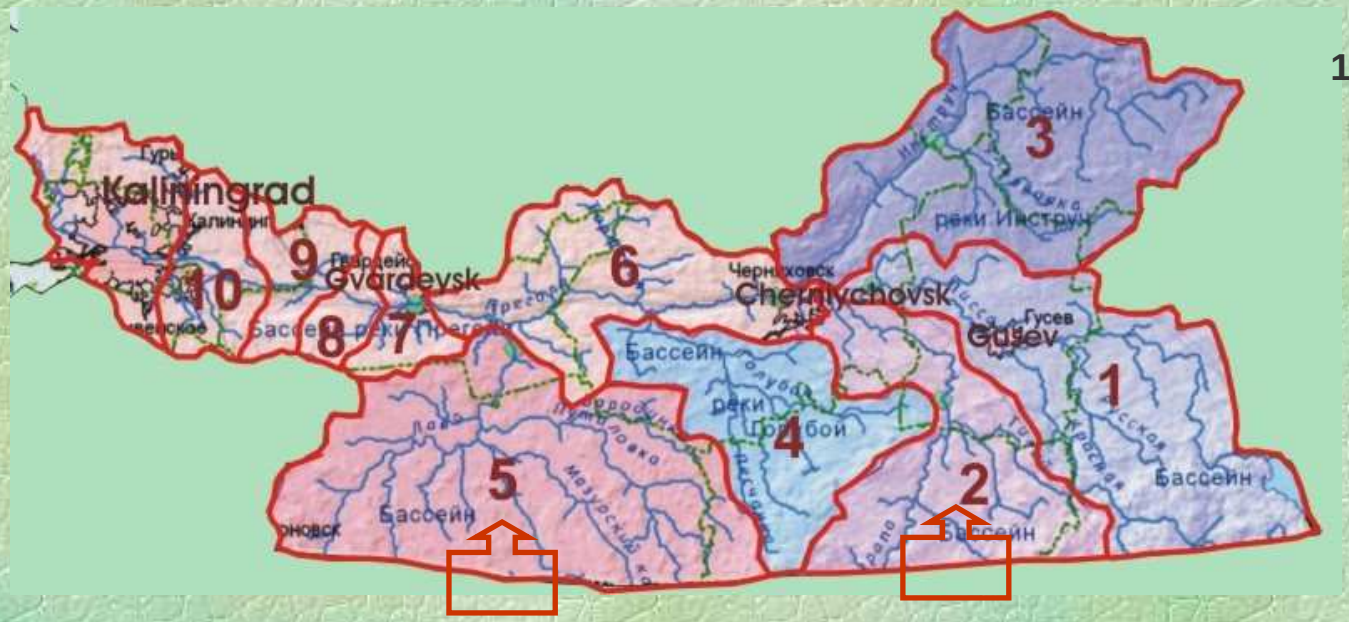
The FyrisNP model (*Swedish University of Agricultural Sciences*)



(From Hansson et. al, 2008
The FytisNP model. Technical description)

Pregolia River Basin (Kaliningrad Oblast, Russia)

delineation of sub-catchments for FyrisNP model installation



1) Pissa River Sub-basin; 2) Angrapa River Sub-basin; 3) Instruch River Sub-basin; 4) Golubaya River Sub-basin; 5) Lava River Sub-basin; Pregolia River Sub-basins: 6) 16,5 - 33 km from the mouth; 7) 33-44 km from the mouth; 8) 44-56 km from the mouth; 9) 56-60 km from the mouth; 10) 60-123 km from the mouth.

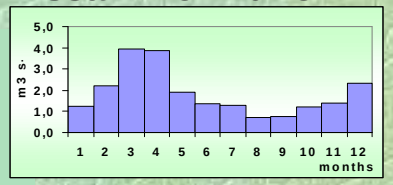
External load – nutrients (N, P) input from upstream parts (Poland)

Input data:

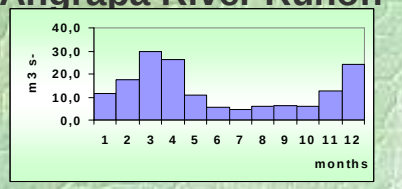
Sub-catchments:	
Map material and analysis	Domnin D., Chubarenko B., 2007 Atlas of transboundary river basins of the Kaliningrad Oblast
Arable and Pasture lands areas	Data of agricultural census, 2006 (*Federal State Statistics Service*)
Mire area	Map of swamp complexes, 1:500000 (Kucheriaviy P., 2002 // Geographic atlas of Kaliningrad oblast)
Forested land and clearcuts areas	Vegetation map, 1:500000 (Suchova A., 2002 // Geographic atlas of Kaliningrad oblast)
Temperature (surface air)	http://meteo.infospace.ru/
Point and Diffuse Sources of Nitrogen and Phosphorus	
Wastewaters	Analytic review, 2008 (*Federal State Statistics Service*)
Housholds emission (number of habitats and gross emission)	Statistical bulletin, 2006 (*Federal State Statistics Service*); Swedish Environmental Protection Agency, 1995
External load of nutrients (N, P) from upstream parts (Poland)	ECE/MP.WAT/WG.2/2007/8 (Estimation of the transboundary water resources in the ECE UN region
Type-specific nutrients concentrations in runoff from different land use	
Soil types	Soil map, 1:500000 (Lazareva N., 2002 // Geographic atlas of Kaliningrad oblast)
Crops	Data of agricultural census, 2006 (*Federal State Statistics Service*)
Relationship between type-specific nutrients concentrations and soil types and crops	Data of Swedish Agricultural University

Time series data

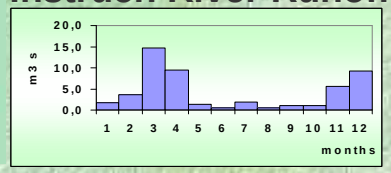
Pissa River Runoff



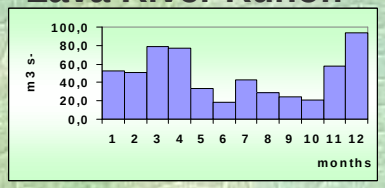
Angrapa River Runoff



Instruch River Runoff



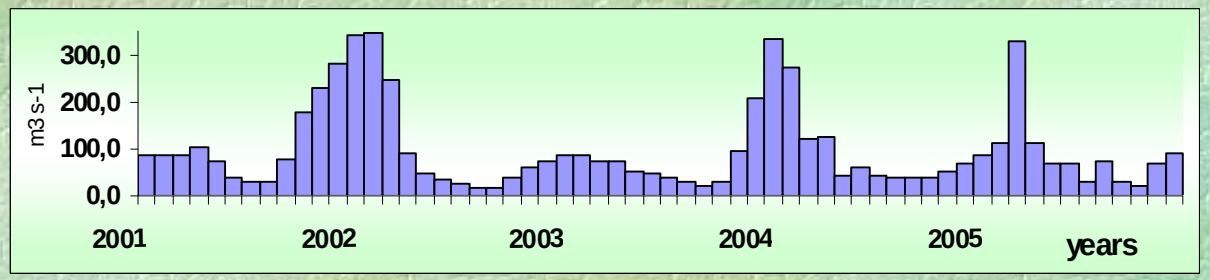
Lava River Runoff



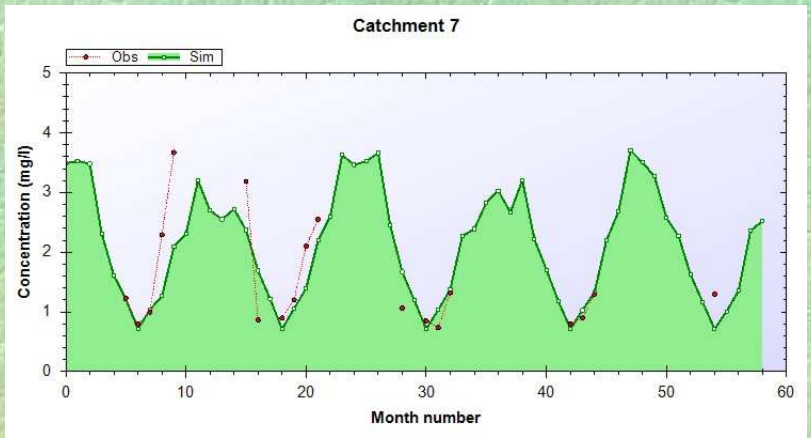
- **sampling stations (N total, P total) summer-autumn 2001-2005**

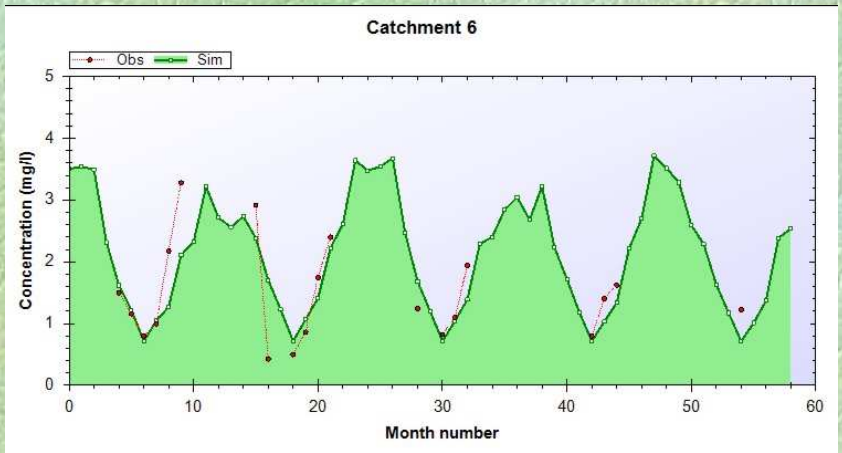
  (Atlantic Research Institute of Marine Fisheries and Oceanography)

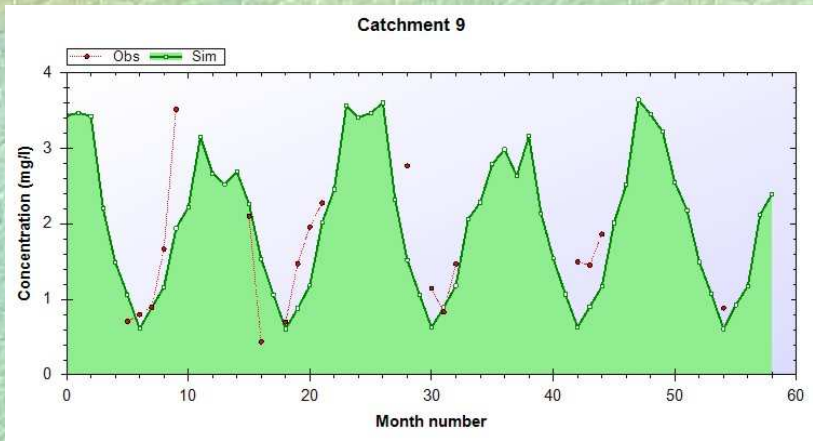
Pregolia River Runoff

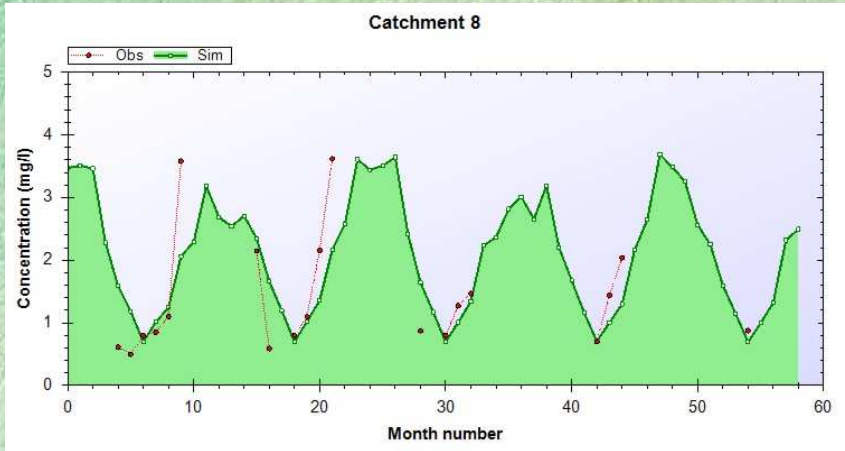


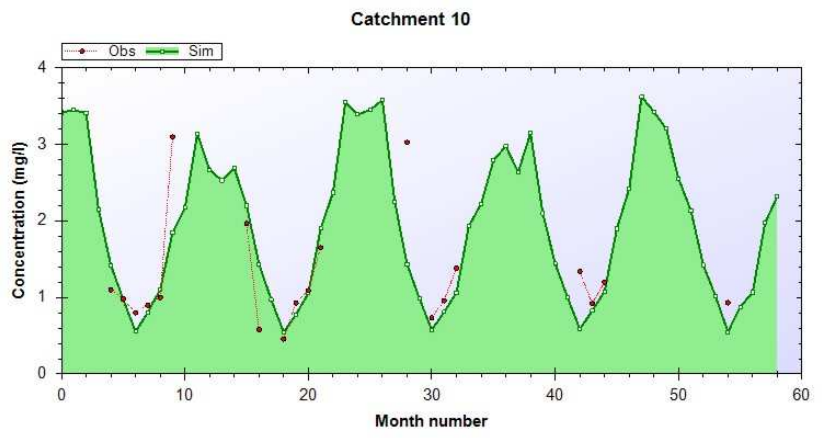
Calibration
(nitrogen concentrations)









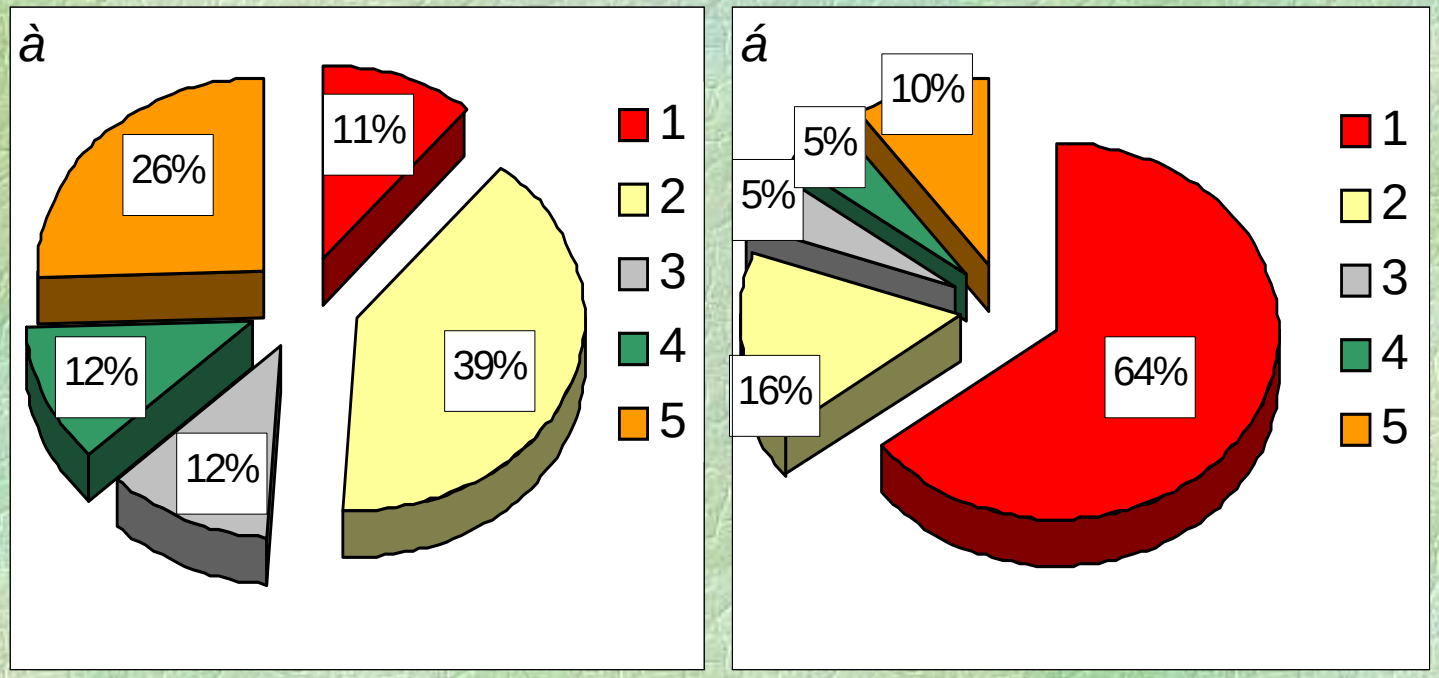


Estimation time period	Nutrients input to the Vistula lagoon	Total N Ton N/year	Total P Ton P/year	References
Estimation 1992	Pregolia river + Sewage collector, Kaliningrad	20680	1710	Krugen Consalt, 1995. Kaliningrad Urban and Indastrial Wastwater Project, Draft Interim Report
Estimation 1994-1995	Pregolia river upstream Kaliningrad	7300	875	Prioritizing hot spot Remediations in the Vistula Lagoon catchment. Environmental Assessment and Planning for the Polish and Kaliningrad Parts of the Lagoon – May 2007
	Pregolia river downstream Kaliningrad	8962	1228	
	Pregolia river + Sewage collector, Kaliningrad	10705	1850	
Estimation 1998-2000	Pregolia river upstream Kaliningrad	3950	310	Kalinigrad Oblast in Number, Kaliningrad, 2002
	Pregolia river + Sewage collector, Kaliningrad	6028	490	
Modelling of geosystem conditions (1980s-1990s)	Pregolia river	4250	540	Zotov S., 2001 Modelling of geosystem conditions
Modelling (FyrisNP) 2001 – 2005	Pregolia river upstream Kaliningrad	2300	440	Our data and estimations
	Pregolia river + Sewage collector, Kaliningrad	3700	740	

Total phosphorus load to the Vistula Lagoon
-contribution of different sources :

a) from the Pregelia River catchment - upstream Kaliningrad,

b) from the Pregelia River catchment, including the Kaliningrad waste waters



1 – *waste waters*, 2 - *arable*, 3 – *pasture*, 4 - *forests*, 5 - *other.*

Total nitrogen load to the Vistula Lagoon
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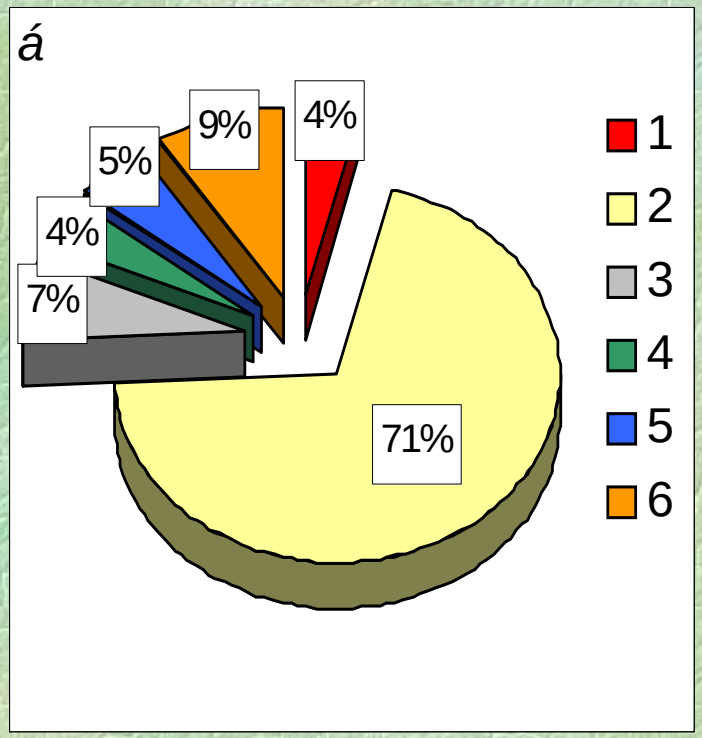
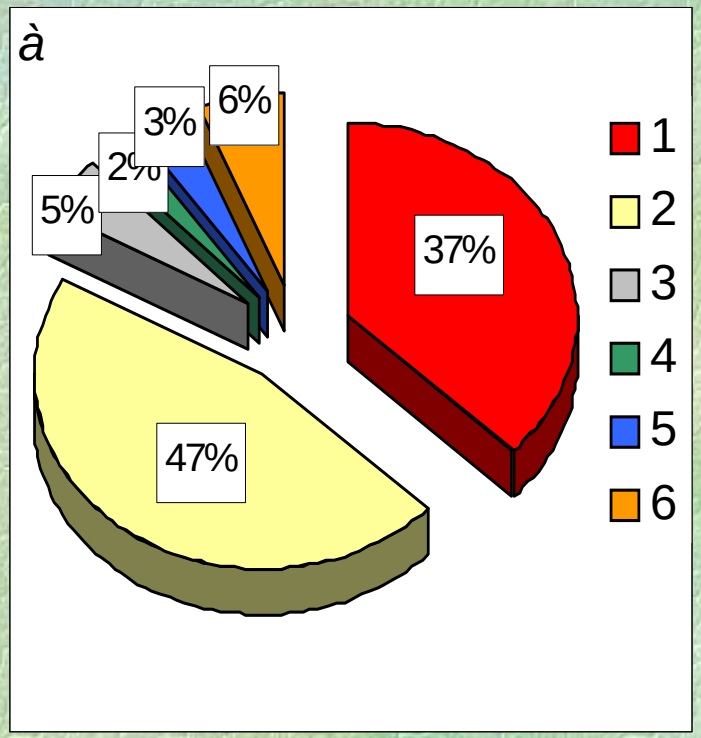




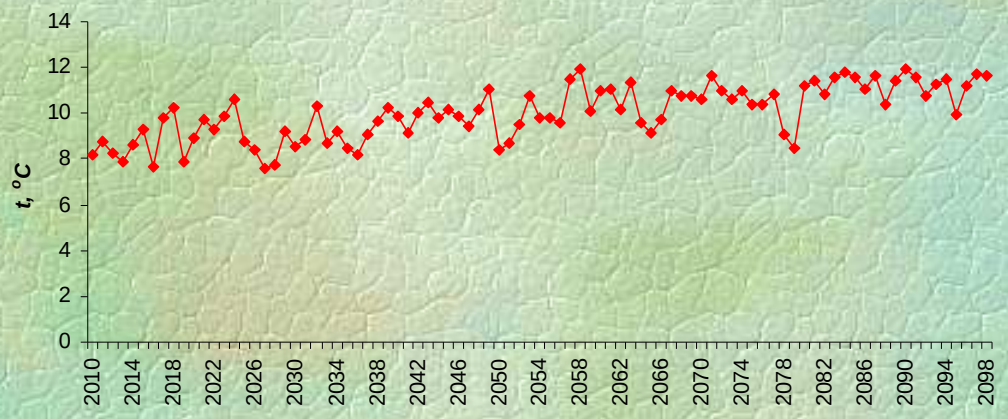
1 – *waste waters*, 2 - *arable*, 3 – *pasture*, 4 - *forests*, 5 - *atmospheric precipitation*, 6 – *other.*

The FyrisNP model evaluates the net nutrients load as gross load after *retention* i.e. losses of nutrients in river stream through sedimentation, up-take by plants and denitrification.

The relative removal is given by the retention coefficient, defined as production of the temperature adjustment factor and the flow rate adjustment factor (*Hansson* et al, 2008).

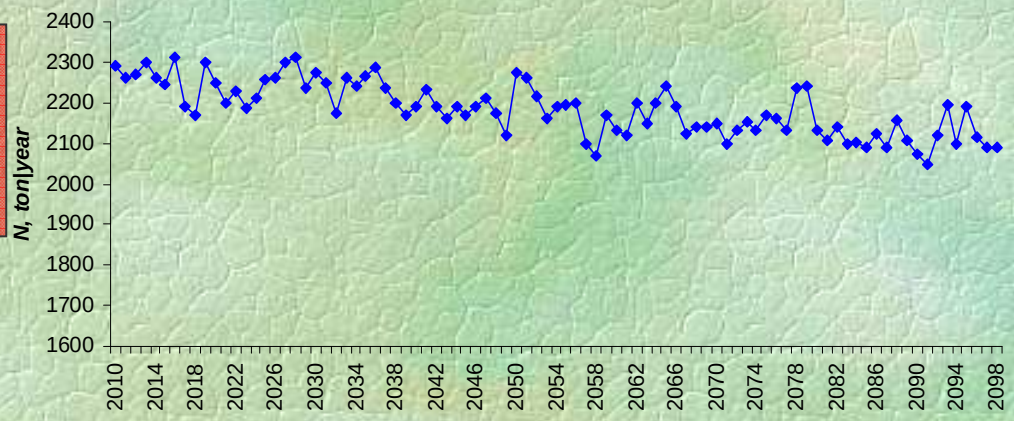
first-order estimation:

Temperature (℃) **RCAO-hadcm3 ref-a1b-25rm** **pos58**

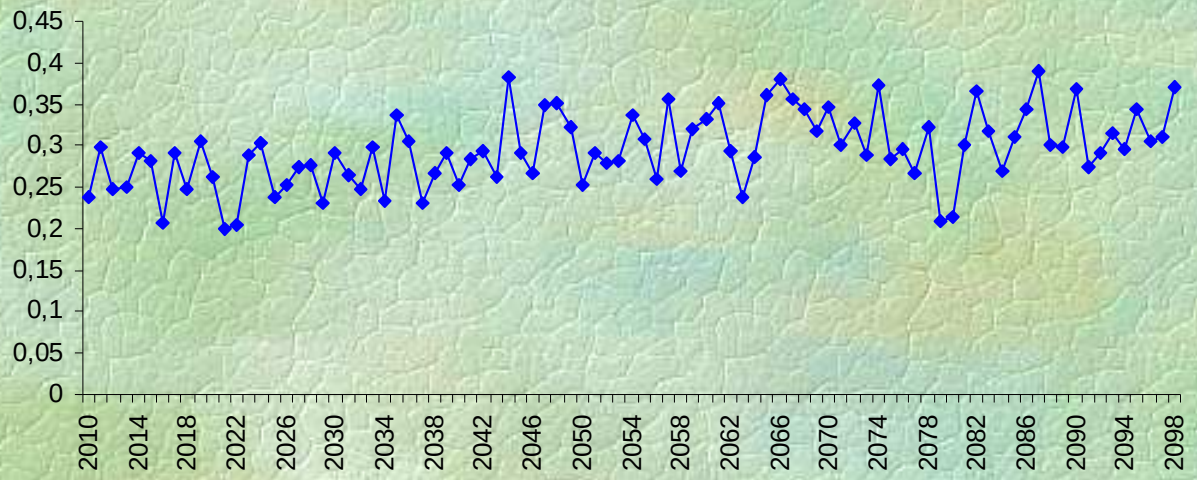


The retention as only temperature dependent function within the FyrisNP model was studied under temperature rise conditions

the temperature rise causes the nutrients decrease due to retention increase in river



Total precipitation RCAO-hadcm3 ref-a1b-25rm pos58



River runoff ?

Nutrients load?

Thank you for your attention