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Performance of the SWAT model in an inter-comparison of nutrient loss quantification tools throughout Europe: EUROHARP project

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EUROHARP: Towards European Harmonised Procedures for Quantification of Nutrient Losses from Diffuse Sources

EC Framework V project (EVK-2001-00062)
January 2002 – December 2005

Objective:

provide a scientific evaluation of different methodologies for quantifying diffuse nitrogen and phosphorus losses
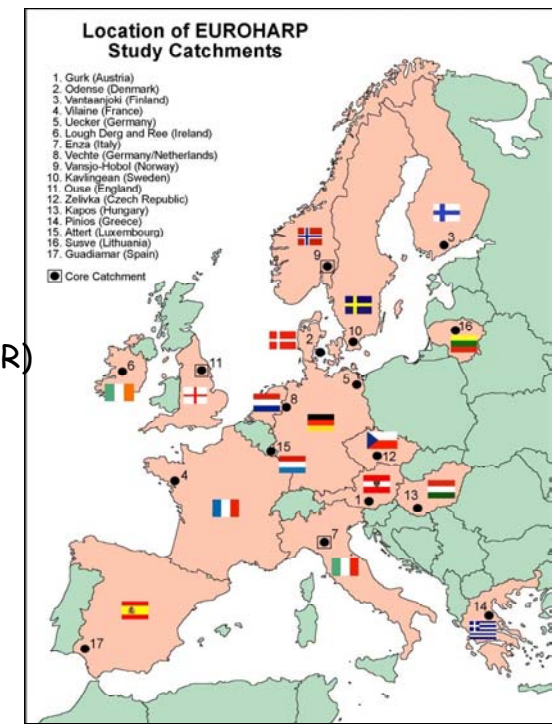
Euroharp project

Inter-comparison:

9 different methodologies

17 study catchments across Europe

Method name	Phosphorus	Nitrogen	Institute	
NL-CAT (ANIMO)	*	*	ALTERRA	(NL)
EVENFLOW		*	ADAS	(UK)
REALTA	*		KMM	(IR)
MONERIS	*	*	IGB	(DE)
N-LES CAT		*	NERI	(DK)
NOPOLU	*	*	IFEN/BETURE-CEREC	(FR)
SOURCE APPORTIONMENT	*	*	NERI	(DK)
SWAT	*	*	EC-JRC/NTUA/IRSA-CNR	(IT, GR)
TRK (SOILNDB/HBV)	(*)	*	SLU/SMHI	(SE)

SWAT 2000

Location of EUROHARP Study Catchments

1. Gurk (Austria)
2. Odense (Denmark)
3. Vantaanjoki (Finland)
4. Vilaine (France)
5. Uecker (Germany)
6. Lough Derg and Ree (Ireland)
7. Enza (Italy)
8. Vechte (Germany/Netherlands)
9. Vansjo-Hobol (Norway)
10. Kavlingean (Sweden)
11. Ouse (England)
12. Zelivka (Czech Republic)
13. Kapos (Hungary)
14. Pinios (Greece)
15. Attert (Luxembourg)
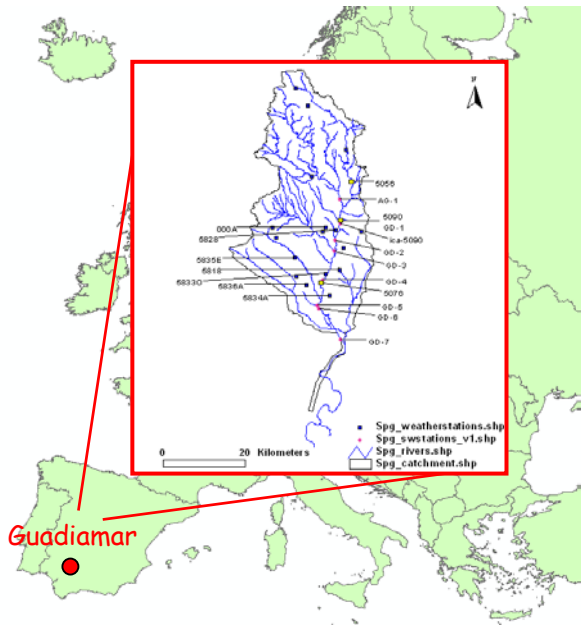16. Susve (Lithuania)
17. Guadiamar (Spain)

Core Catchment

Euroharp project

Euroharp phases:

1) Development of a catchment information system

2) Application of the 9 tools to 3 core catchments
   → Inter-comparison

3) Application to the 17 catchments
   → CASE I: Scarce data availability

4) Toolbox: evaluation/synthesis of model performance
   → CASE II: Scenarios analysis
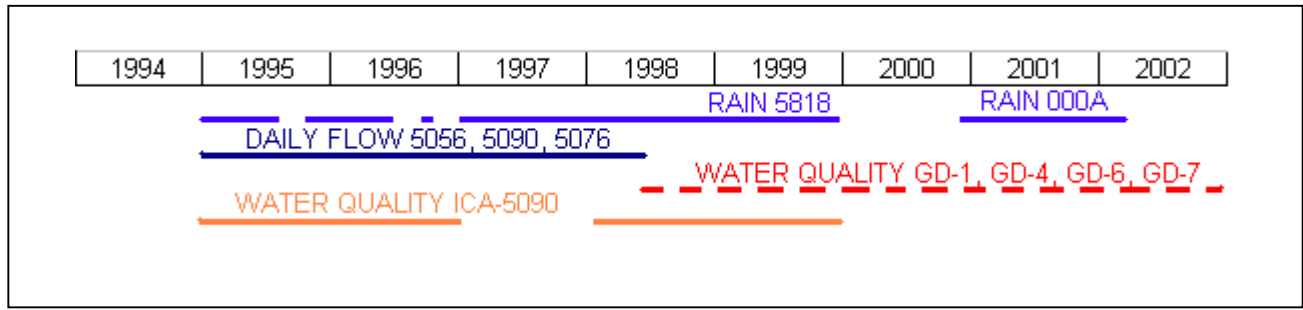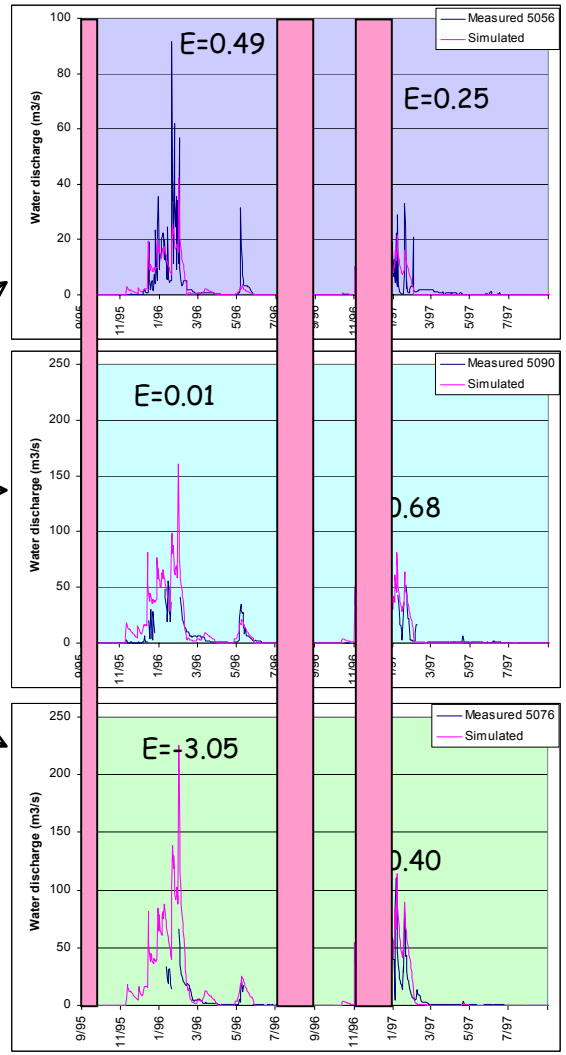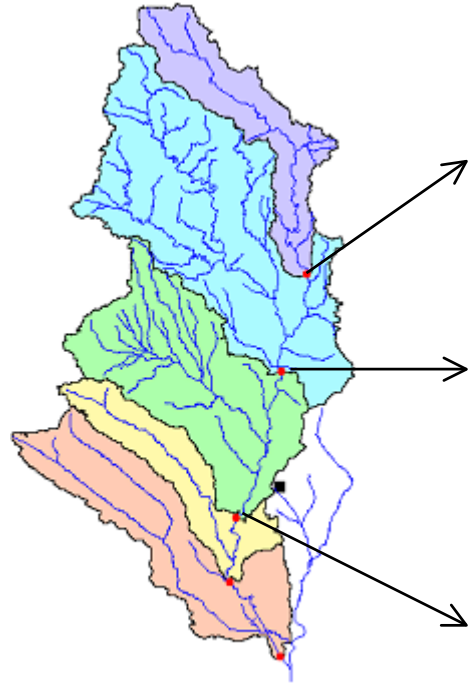
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Vansjo-Hobol
Ouse
Zelivka
Enza
Guadiamar

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CASE I: <u>Scarce data availability</u>

Guadiamar

Precipitation: 6 gauging stations from 1995 to 1999. Station 5818, was selected for the modelling.

Water flow: 3 gauging stations (5056, 5090 and 5076) from 1980 to 1998.

Water quality: 8 gauging stations, two of which located near the available water flow stations

1994	1995	1996	1997	1998	1999	2000	2001	2002

RAIN 5818

RAIN 000A

DAILY FLOW 5056, 5090, 5076

WATER QUALITY GD-1, GD-4, GD-6, GD-7

WATER QUALITY ICA-5090

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CASE I: <u>Scarce data availability</u>

Water flow calibration

Precipitation are generated by the model

Efficiency
(Nash-Sutcliffe et al.1970)

Sep.95 –Aug.96 ; Sep.96 –Aug.97

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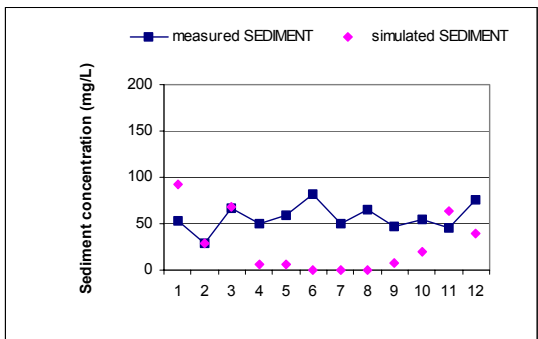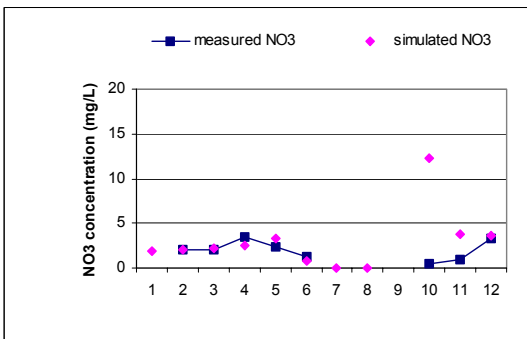CASE I: Scarce data availability

Water flow validation
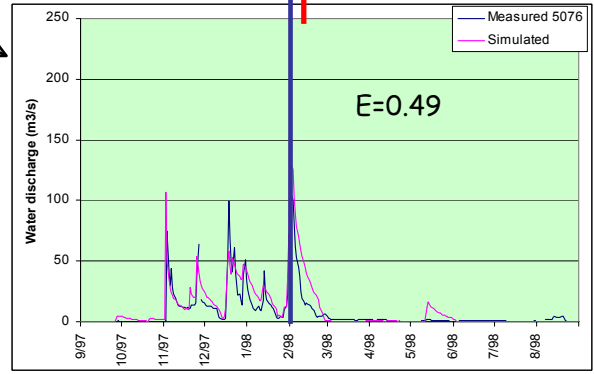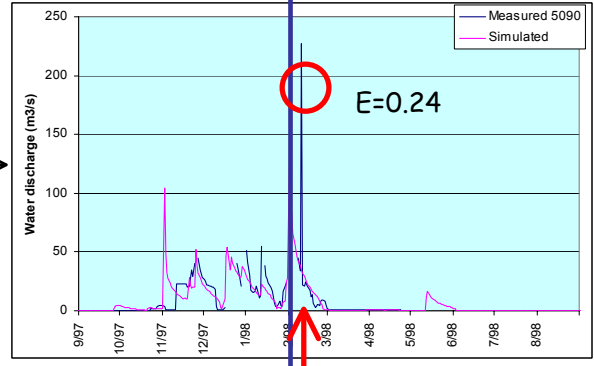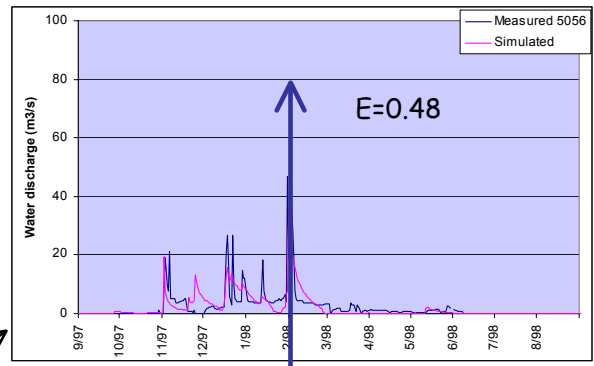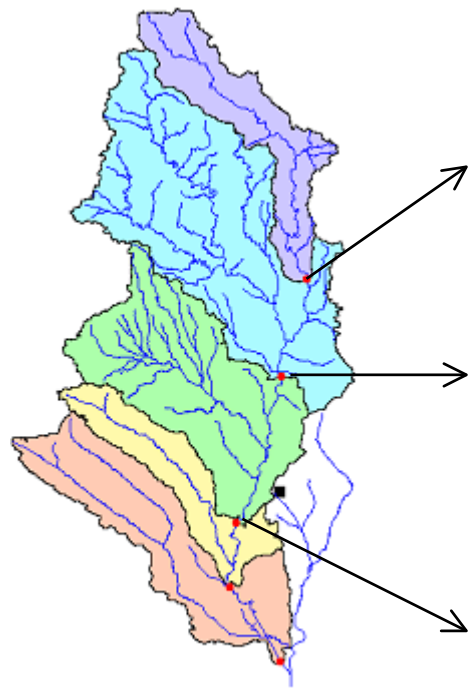
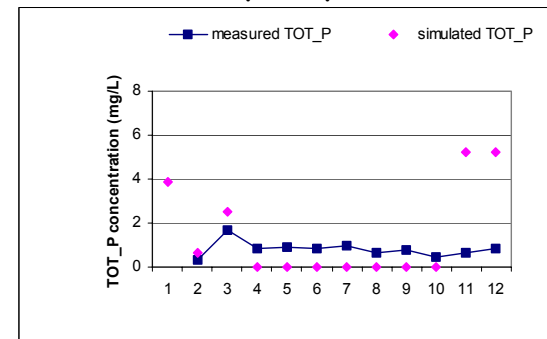# CASE I: <u>Scarce data availability</u>

Water quality calibration

Sediment

Nitrate

Total phosphorus

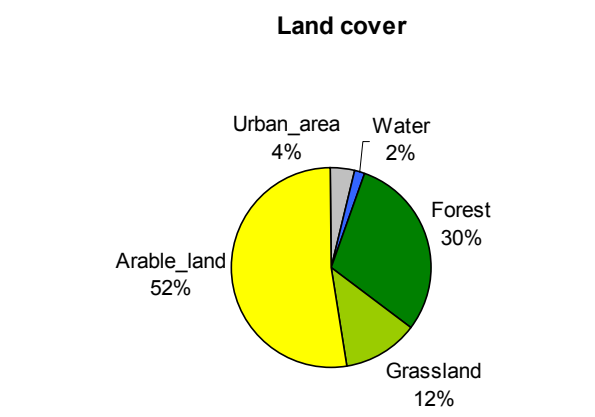Year 2001 (no water flow data)

CASE II: Scenario analysis

Precipitation: 4 gauging stations from 1996 to 2000.

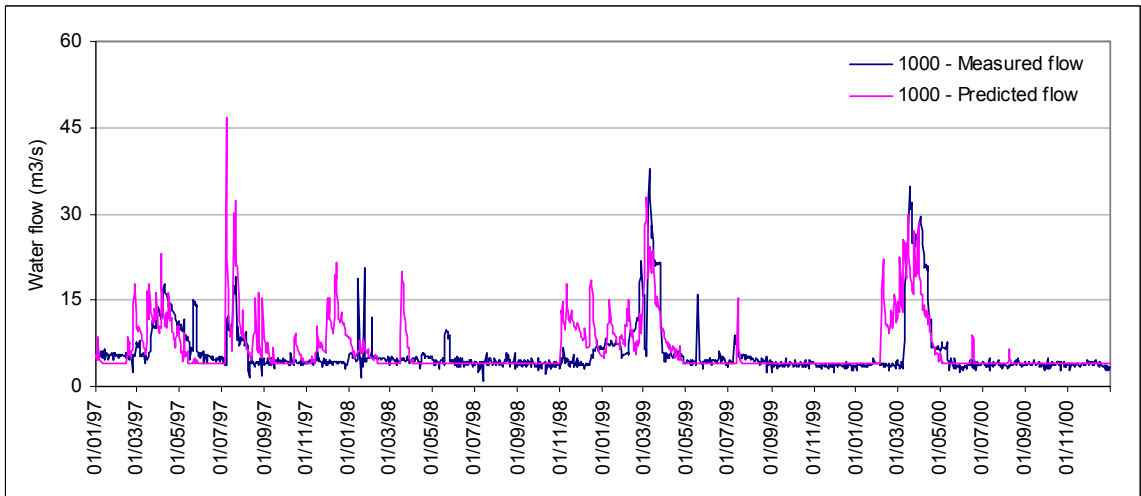**Water flow:** 13 gauging stations from 1996 to 2000.

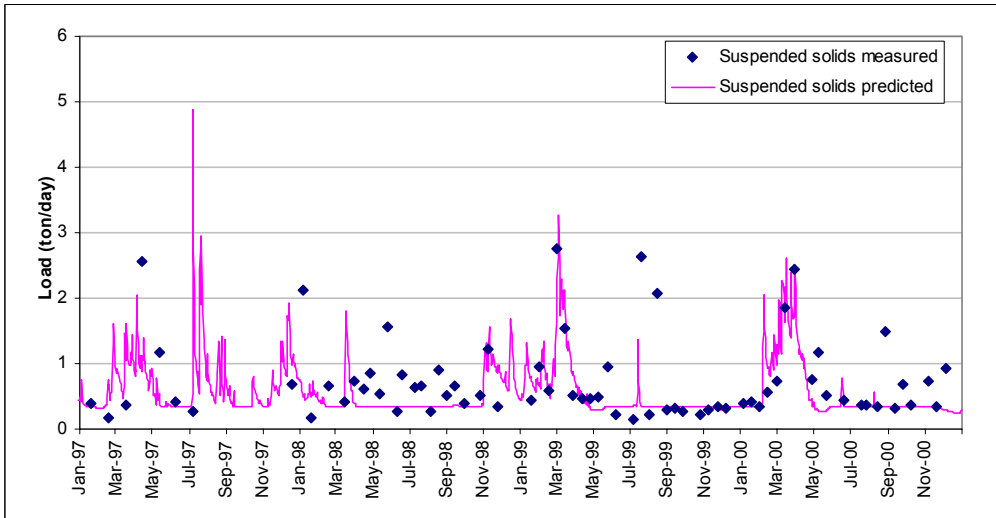**Water quality:** 13 gauging stations from 1996 to 2000

Land cover

- Urban_area 4%
- Water 2%
- Forest 30%
- Arable_land 52%
- Grassland 12%
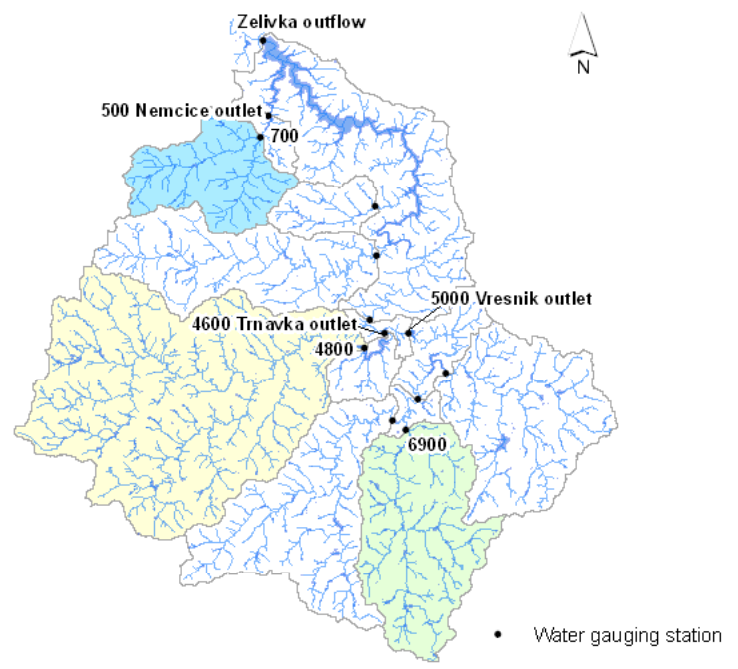
CASE II: <u>Scenario analysis</u>

Water flow

Results at watershed outlet

Suspended sediment load

CASE II: Scenario analysis

NO3_N concentration

Results at watershed outlet

PO4_P concentration

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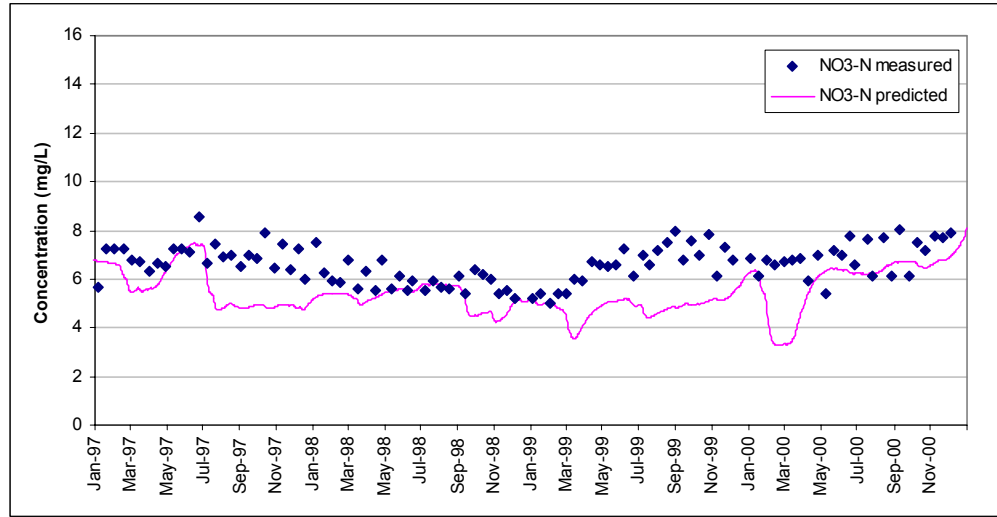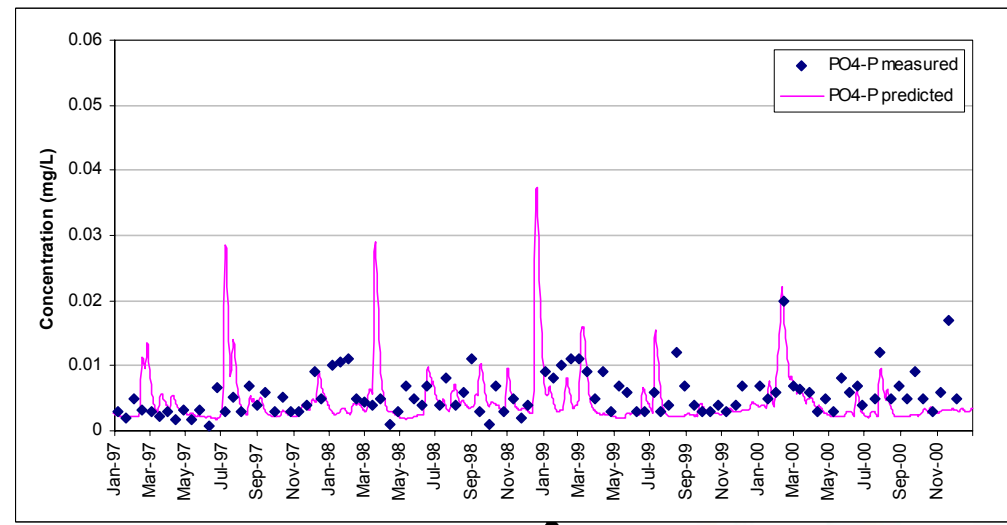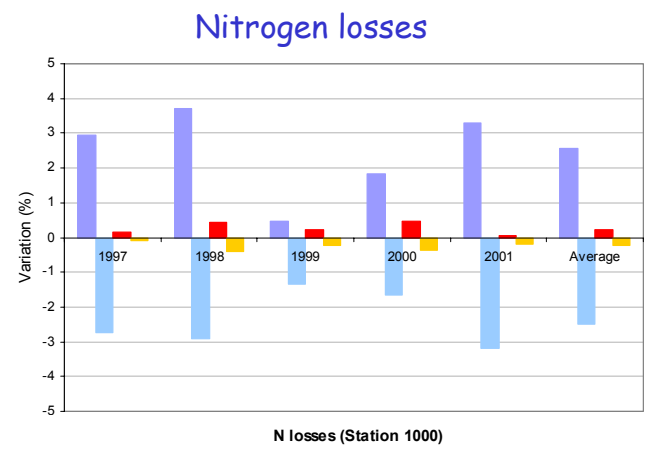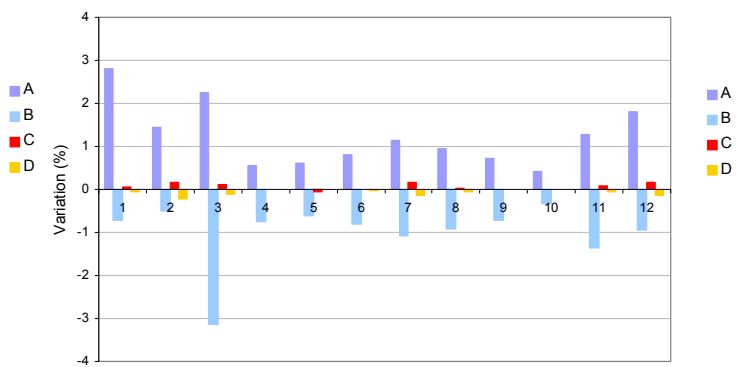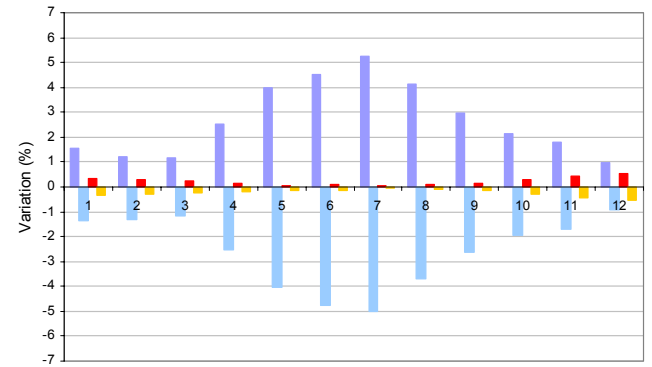
CASE II: Scenario analysis

- **Scenario A**: 20 % increase in N and P applications of inorganic fertilisers;
- **Scenario B**: 20 % decrease in N and P applications of inorganic fertilisers;
- **Scenario C**: 20 % increase in livestock numbers;
- **Scenario D**: 20 % decrease in livestock numbers;

Nitrogen losses

Phosphorus losses

Annual basis

N losses (Station 1000)

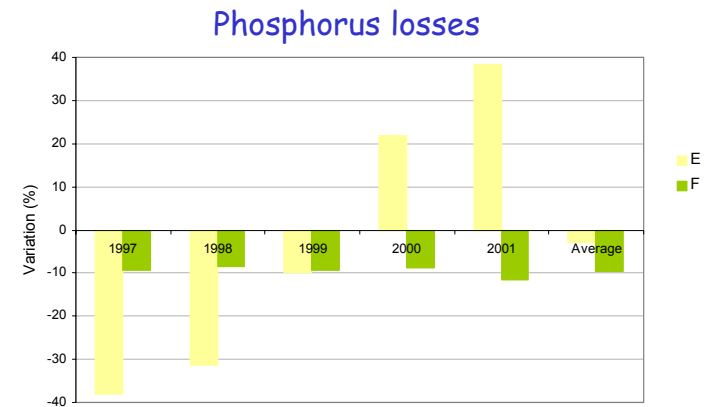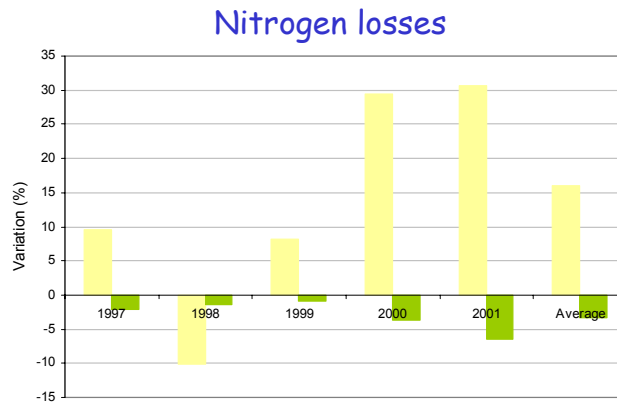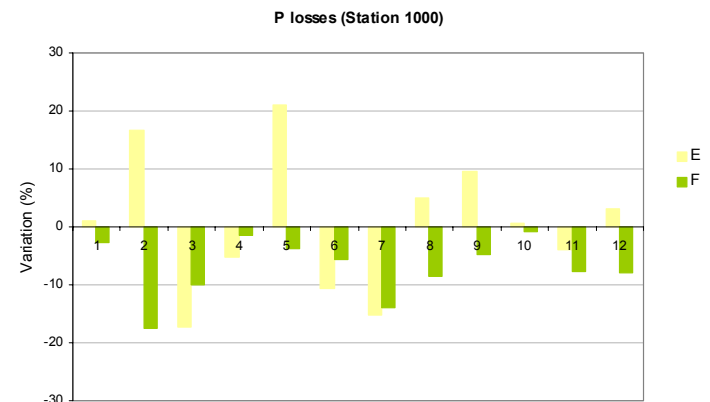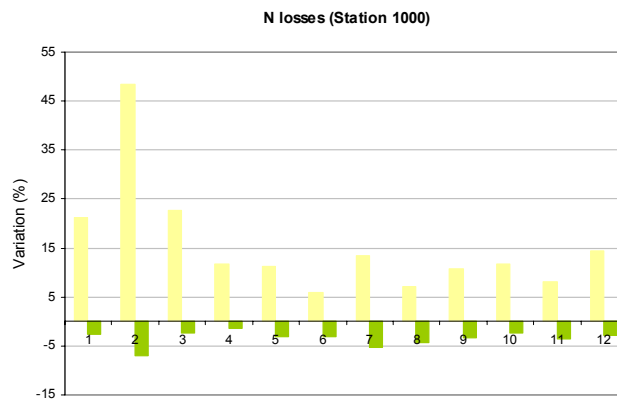P losses (Station 1000)
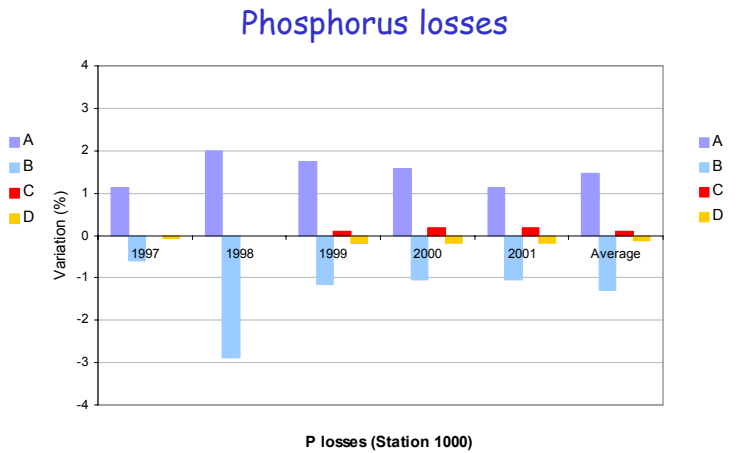
Monthly basis

CASE II: <u>Scenario analysis</u>

- **Scenario E**: the area of the predominant crop increases to cover the entire agricultural land;

- **Scenario F**: 20 % of the agricultural areas are abandoned and replaced by forest.

Annual basis

Nitrogen losses

Phosphorus losses

Monthly basis

N losses (Station 1000)

P losses (Station 1000)

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CONCLUSION

Performance of the SWAT model in the inter-comparison of nutrient loss quantification tools (results from EUROHARP project)

→ **Inter-comparison**
The performance of SWAT is in the average of the other nutrient quantification tools

→ CASE I: Scarce data availability

→ CASE II: Scenarios analysis

SWAT has high potential to be used throughout Europe by scientists and water managers

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