

**TRANSNATIONAL MODELLING
for the Coordination of the
European Water Framework Directive
in International River Basins Districts**

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3rd International Yellow River Forum, Dongying, China, 2007

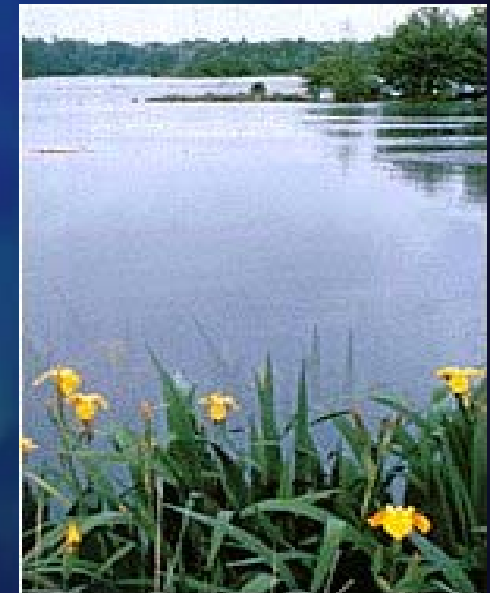
Implementation of the European Water Framework Directive

Among the most important technical tasks :

- What are the impacts of the various pressures on the water system ?
- What are the most efficient actions ?

Generally, the pressure-impact relations can be determined :

- by expert judgment
- by MODELLING



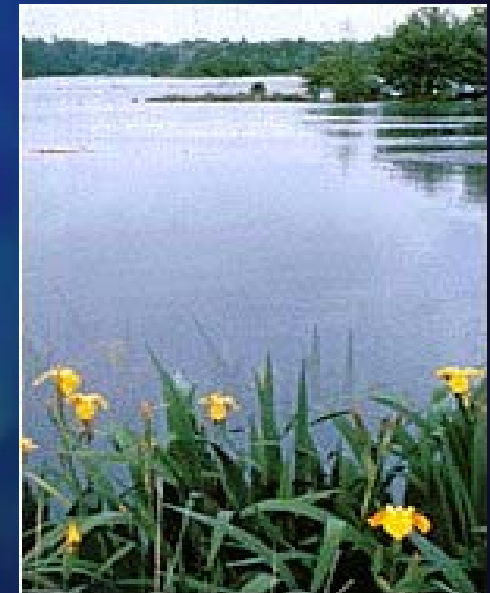
Implementation of the European Water Framework Directive

Pressure – Impact relations :

- MODELLING is used for what can be easily modelled
- Expert judgment is used for the other variables

Advantages of using a MODEL :

- better understanding of the system
- more precise assessments
- possibility to test various scenario's



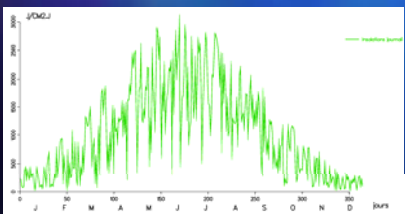
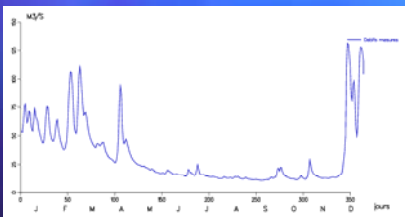
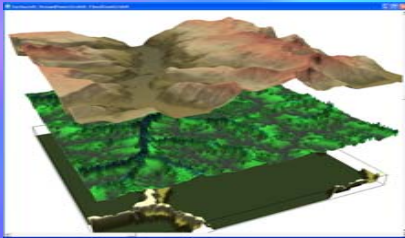
The PEGASE model is extensively used to help implementing the Water Framework Directive

The Pegase model is an integrated basin – river model

- INPUT data :
 - land use
 - river flows,
 - pressures (pollution discharges, ...)
- OUTPUT results :
 - biomasses and water quality variables
 - in the river system network

The PEGASE model

Input



Basins
Land use

Hydrographic
network

Hydro-meteo

Driving forces /
Pressures

**PEGASE
model**

Output / results

Pollutant loads to
the river network

River flow & veloc.
Water temperature

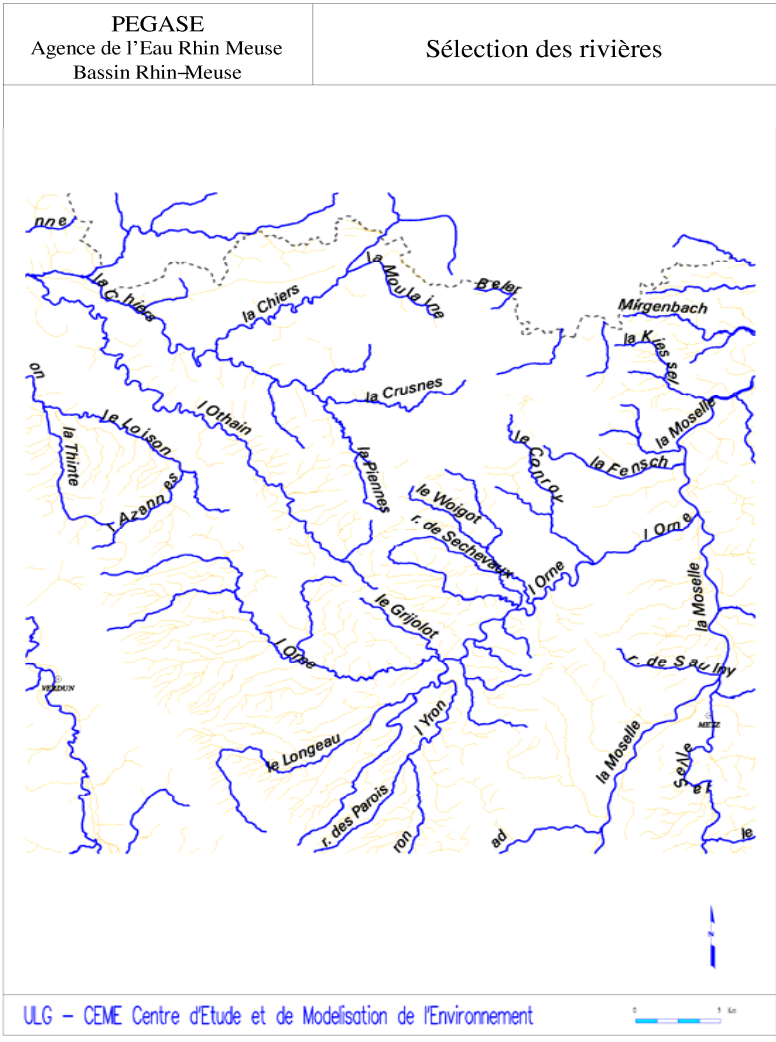
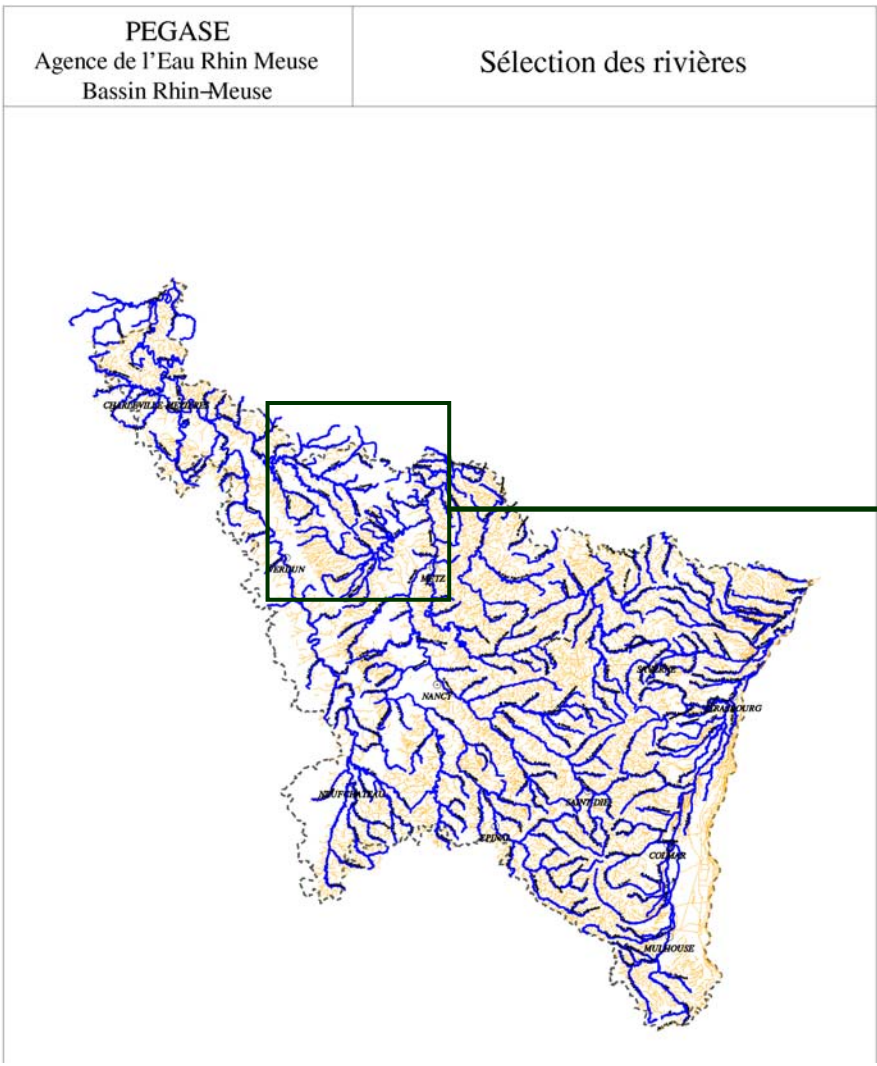
Biomasses
Ecosystem activity

Water quality
Fluxes

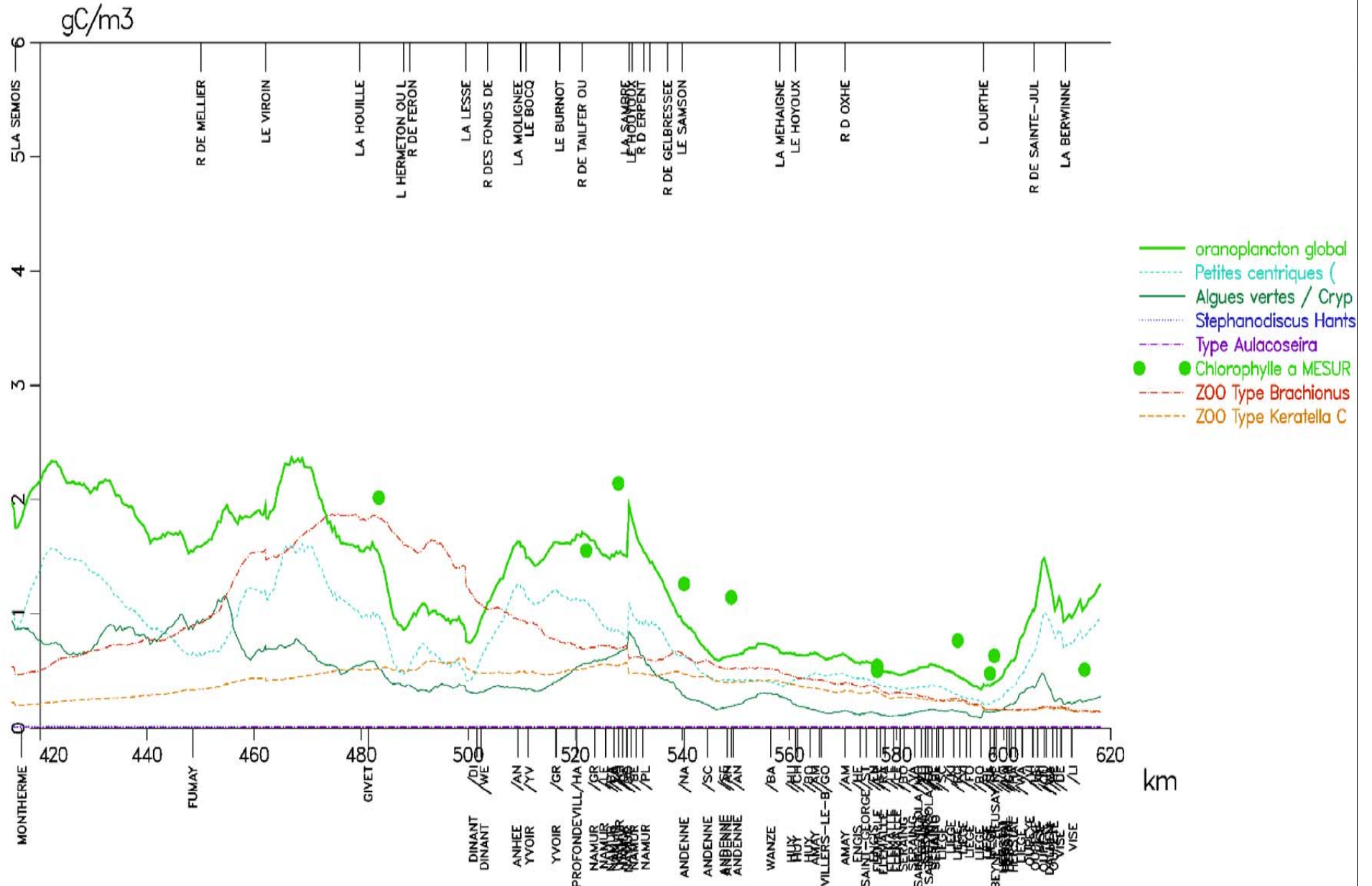
The PEGASE model : main characteristics

- Integrated basin – river network model
- Deterministic / Non-stationnary
- Utilization of ' common ' input data
- Local AND basin scale visions
- very few calibration
- Explicit calculation of biological activities :
 - . Phytoplankton (5 groups of species)
 - . Bacterial biomasses (degradation of organic matter)
- Calculation of biological quality indexes
(benthic diatoms, benthic macroinvertebrates)
- Calculation of micro-pollutant concentrations
- Cost – effectiveness calculations

The PEGASE model : local AND basin scale visions

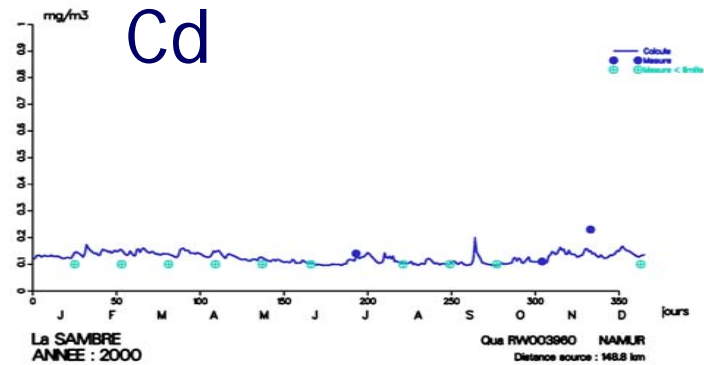


The PEGASE model : phytoplankton biomass

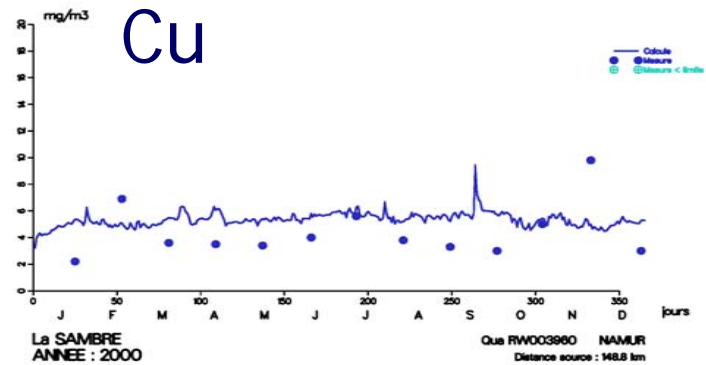


The PEGASE model : micropollutants

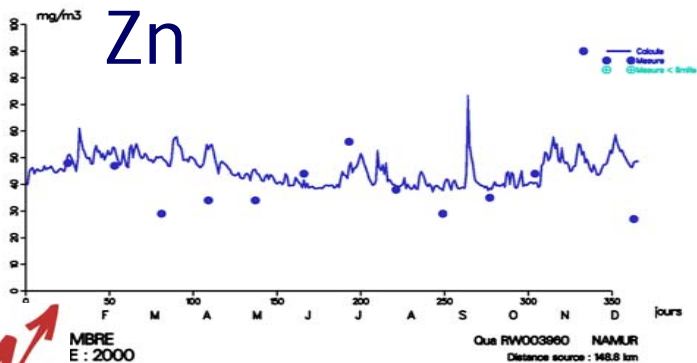
REGION WALLONNE - PROGRAMME PIRENE - BASSIN DE LA MEUSE
 METAUX LOURDS DANS LE RESEAU HYDROGRAPHIQUE : CADMIUM TOTAL (mgCd/m³)
 RWM Test PIRENE INTEGRE (Version D)



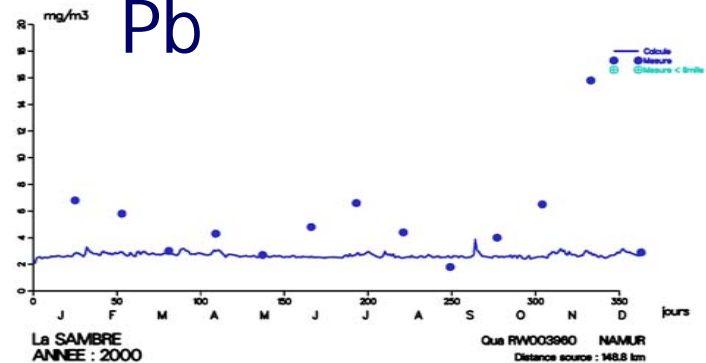
REGION WALLONNE - PROGRAMME PIRENE - BASSIN DE LA MEUSE
 METAUX LOURDS DANS LE RESEAU HYDROGRAPHIQUE : CUIVRE TOTAL (mgCu/m³)
 RWM Test PIRENE INTEGRE (Version D)




REGION WALLONNE - PROGRAMME PIRENE - BASSIN DE LA MEUSE
 METAUX LOURDS DANS LE RESEAU HYDROGRAPHIQUE : ZINC TOTAL (mgZn/m³)
 RWM Test PIRENE INTEGRE (Version D)



REGION WALLONNE - PROGRAMME PIRENE - BASSIN DE LA MEUSE
 METAUX LOURDS DANS LE RESEAU HYDROGRAPHIQUE : PLOMB TOTAL (mgPb/m³)
 RWM Test PIRENE INTEGRE (Version D)

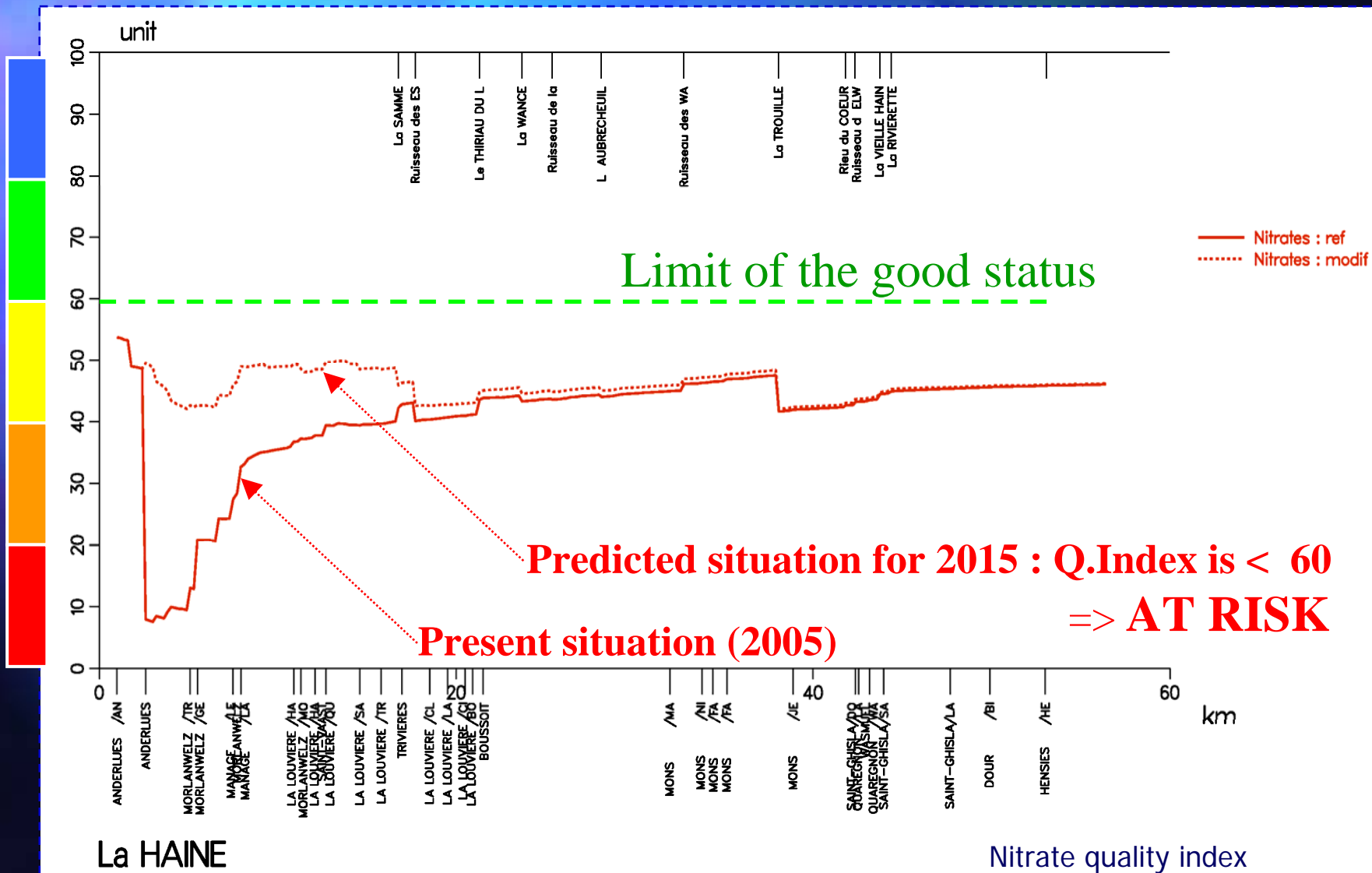


PEGASE : utilisation in the scope of the European Water Framework Directive

- 
- 1) IMPLEMENTATION of the model in a river basin
 - 2) VALIDATION of the model : simulation of past/present situations
*Very few or NO calibration needed (all processes are already calibrated)
calibration needed only for emission coefficients of diffuse loads*
 - 3) PRESSURE / IMPACT ANALYSIS
Assessment of the impacts of domestic, industrial, diffuse loads
 - 4) SIMULATION OF SCENARIO'S (2015 scenario's)
Assessment of the **RISK** of failing to meet the GOOD STATUS
 - 5) SIMULATION OF BASIC / ADDITIONAL MEASURES
+ COST – EFFECTIVENESS ANALYSIS
 - ➔ preparation of the River Basin Management Plans (2009)
 - ➔ support for the public participation / consultation
 - 6) SUPPORT for the DESIGN of the MONITORING NETWORKS

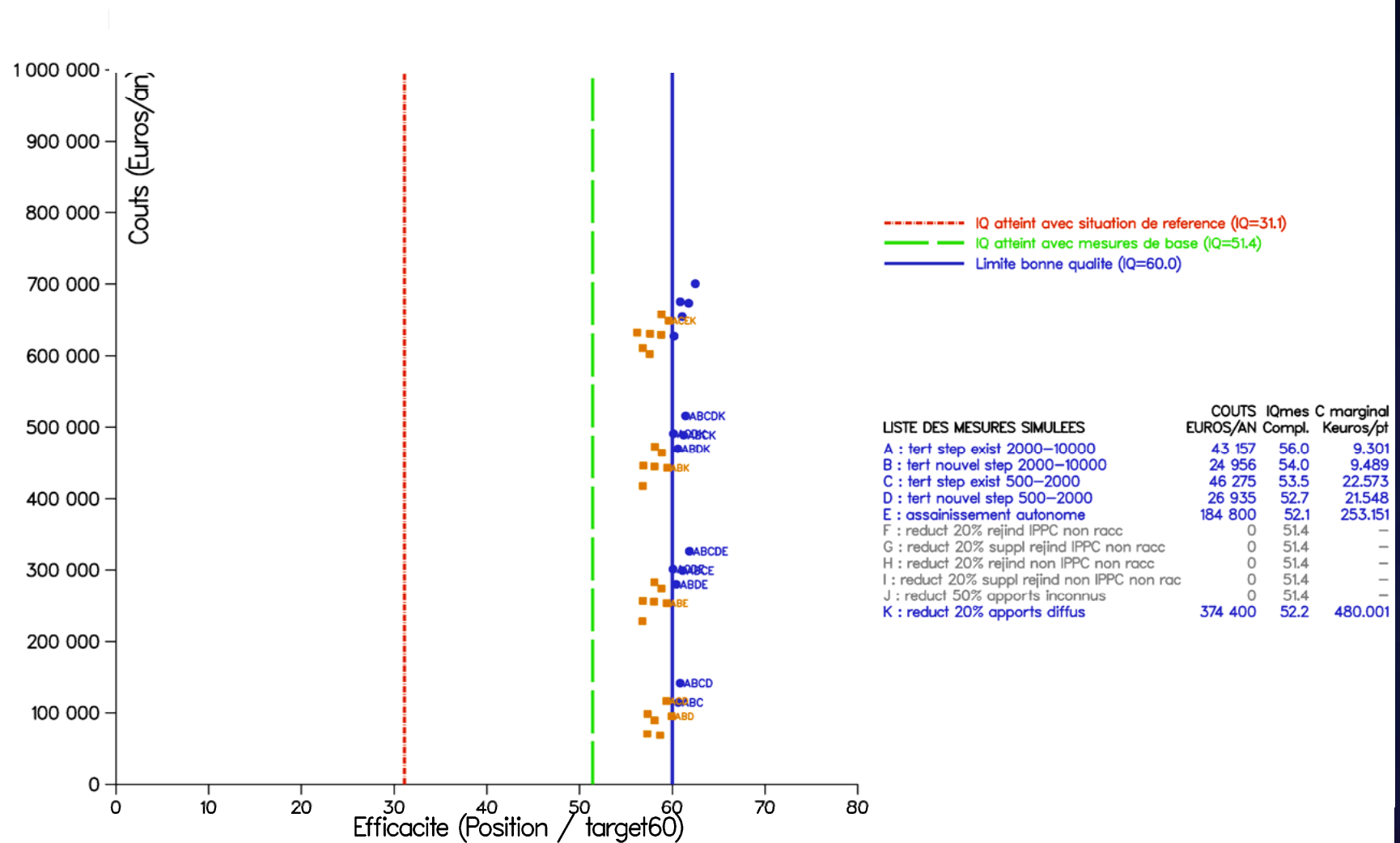
PEGASE :

SIMULATION OF 2015 SCENARIO'S / ASSESSMENT OF THE RISK



PEGASE : COST – EFFECTIVENESS ANALYSIS

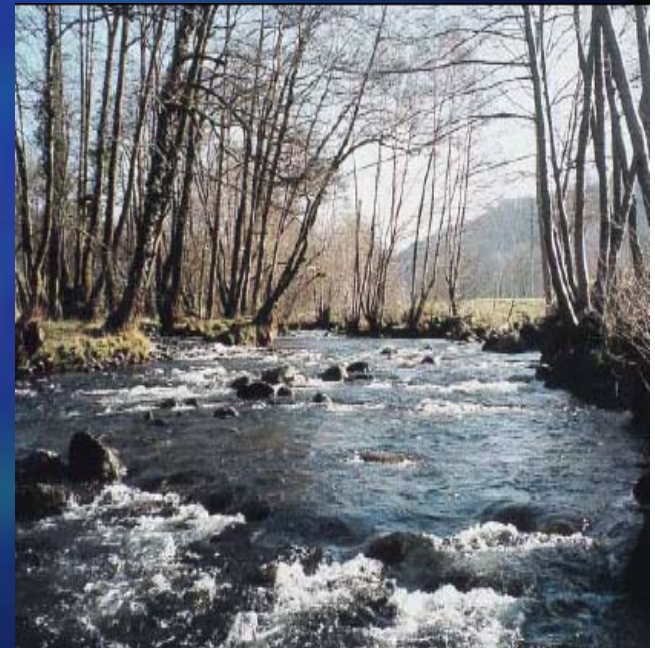
SAMBRE sub-basin - Water Body SA17R



The PEGASE model

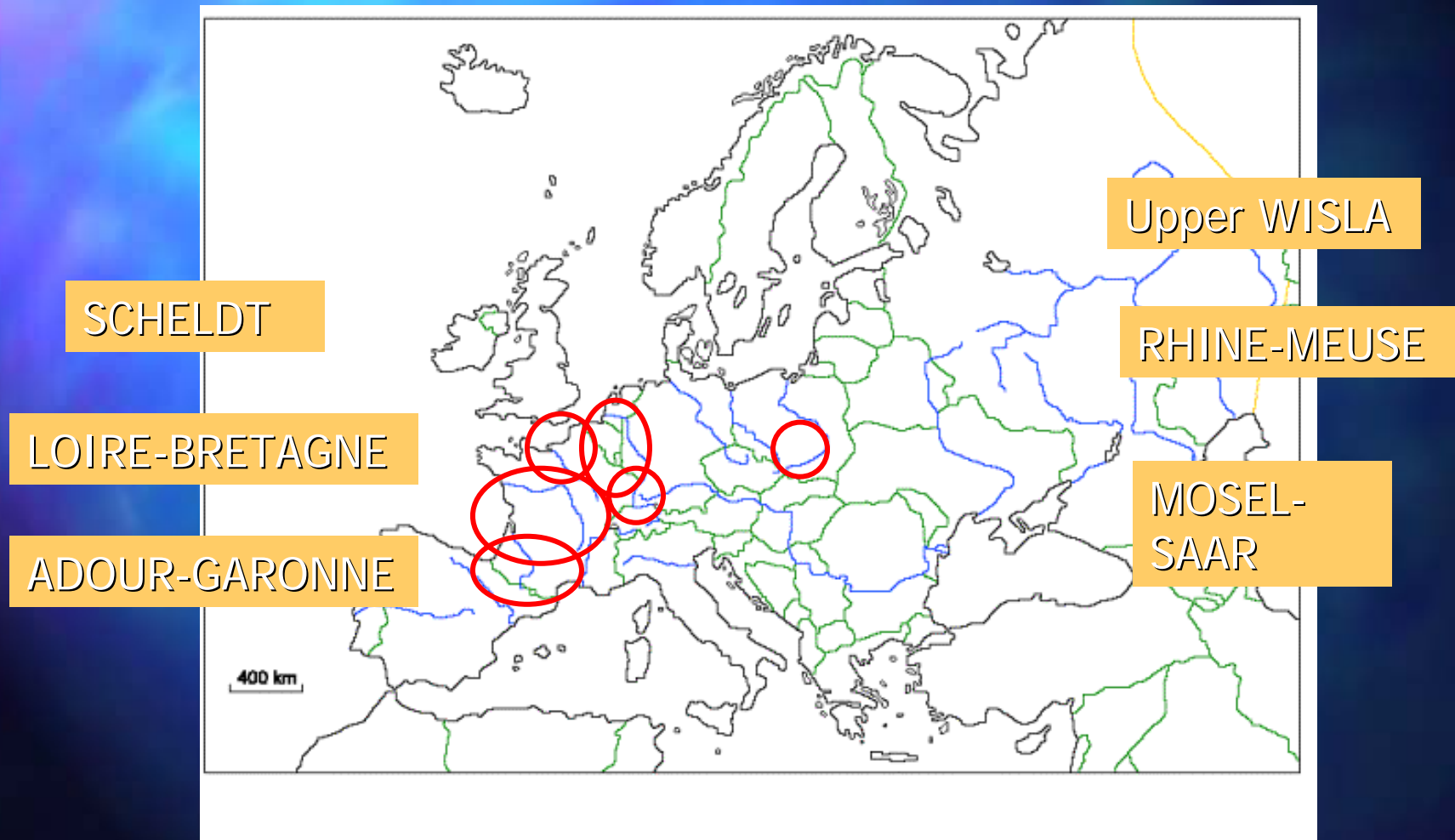
is used presently on a regular basis by / for :

- Ministry of Environment, Région wallonne, Belgium
- Flanders Environment Agency, Flanders, Belgium
- Rhine-Meuse Water Agency, France
- Artois-Picardie Water Agency, France
- Loire-Bretagne Water Agency, France
- Adour-Garonne Water Agency, France
- Water Administration, Luxemburg
- Saarland & Rhine-Palatine
Environment Agencies, Germany
- Gliwice and Krakow Water Agencies,
Poland
- several local Water Authorities



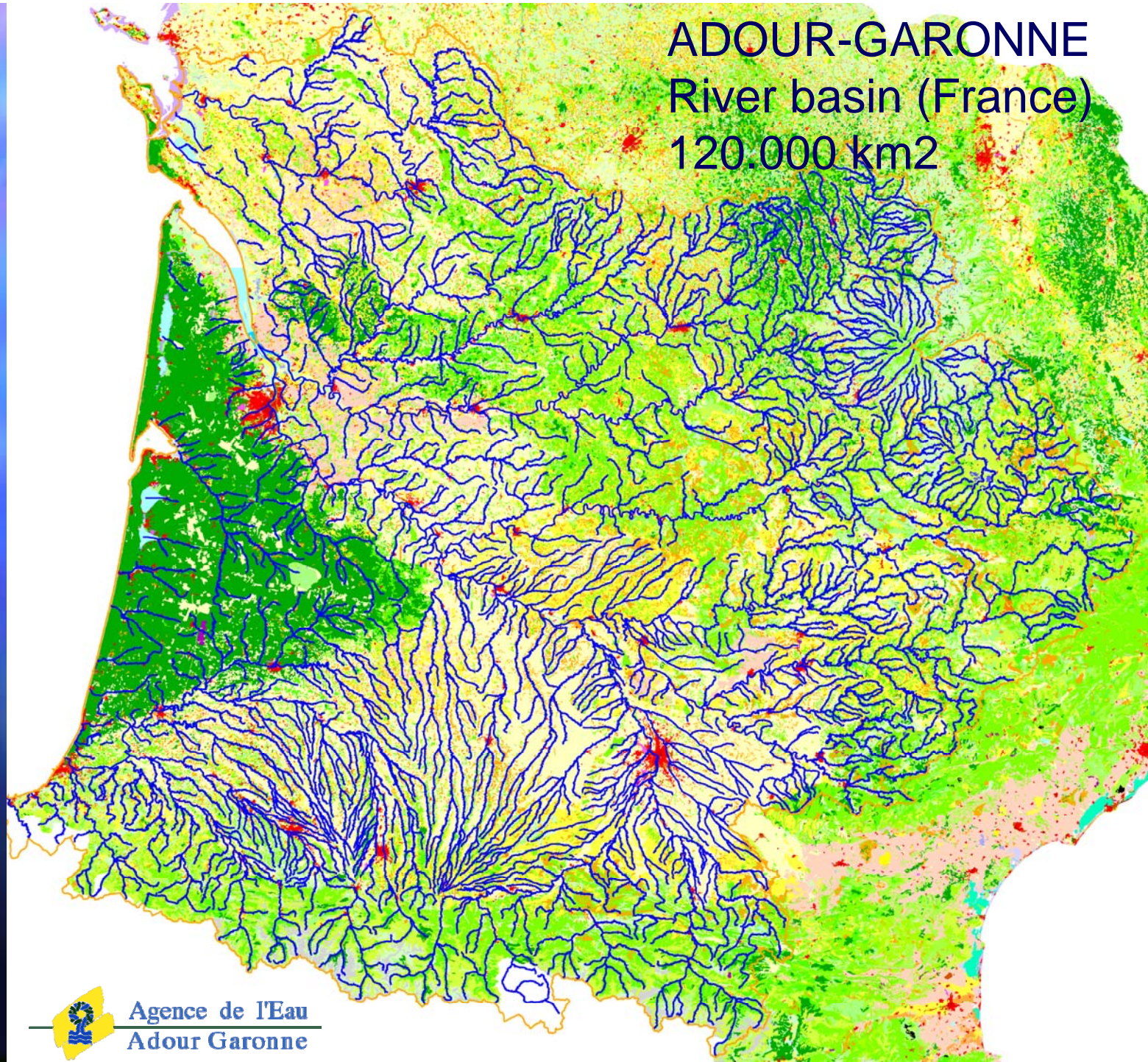
The PEGASE model

is used on a regular basis for several European basins :



3rd International Yellow River Forum, Dongying, China, 2007

ADOUR-GARONNE
River basin (France)
120.000 km²



Agence de l'Eau
Adour Garonne

COORDINATION of the European Water Framework Directive within international basins

In the international basins,
the European Water Framework Directive requires :

- an international coordination
- a single management plan

but it is still quite difficult to assess :

- the transboundary effects
 - the basin-scale effects
- ➔ It remains difficult to ensure the international coordination on sound basis

MODELLING water quality in international basins for the WFD

In order to support the coordination of the implementation of the Water Framework Directive, the model has been used (up to now) for 3 European international basins :

- the MOSEL-SAAR river basin
- the MEUSE river basin
- the SCHELDT river basin

The MOSEL-SAAR river Basin (29.000 km²)

5 Partners :

FRANCE :

- Rhine-Meuse Water Agency

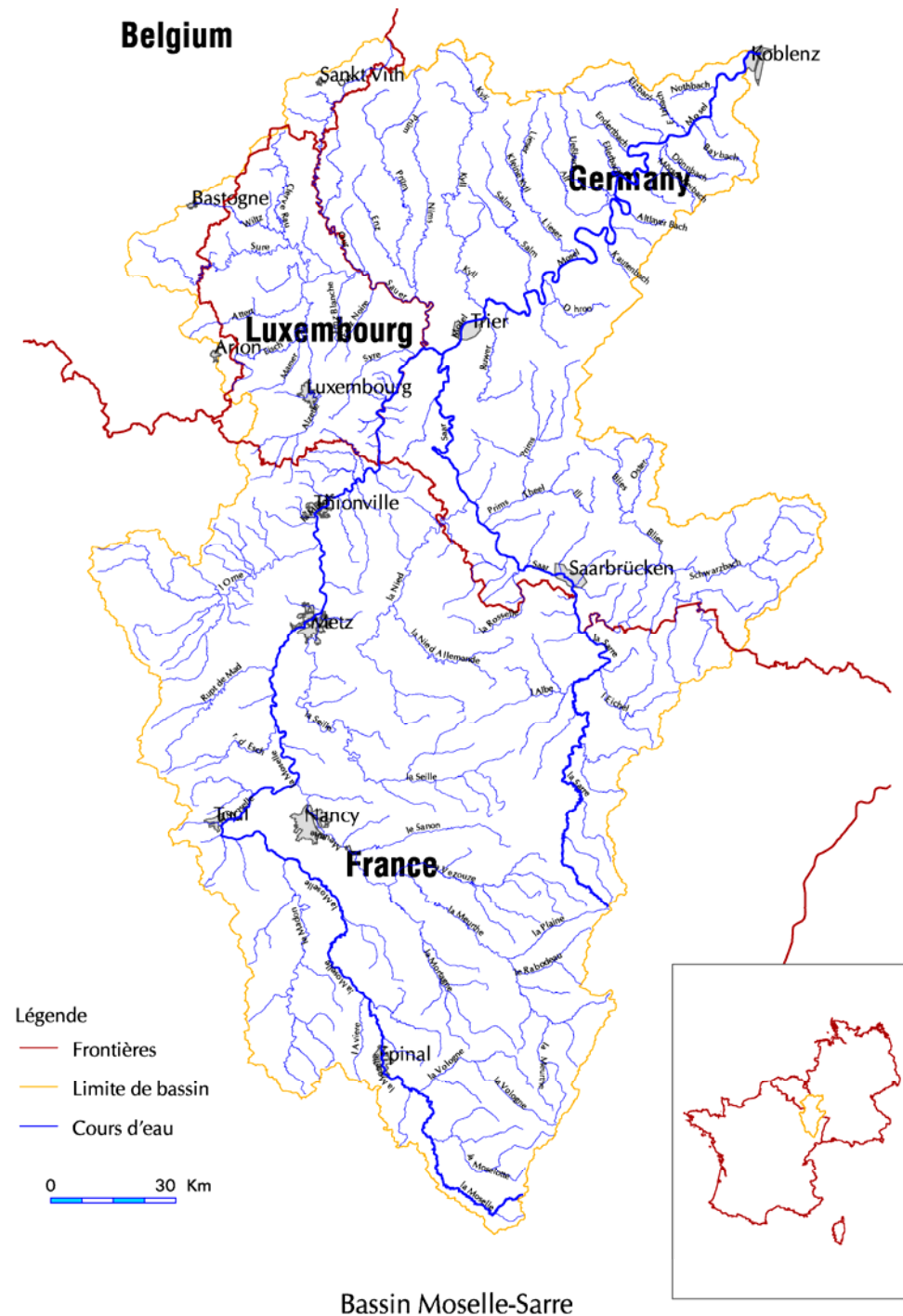
GERMANY

- Land Rhine-Palatine
- Land Saar

LUXEMBOURG

BELGIUM

- Region Wallonne



The SCHELDT river Basin (21.000 km²)

5 Partners :

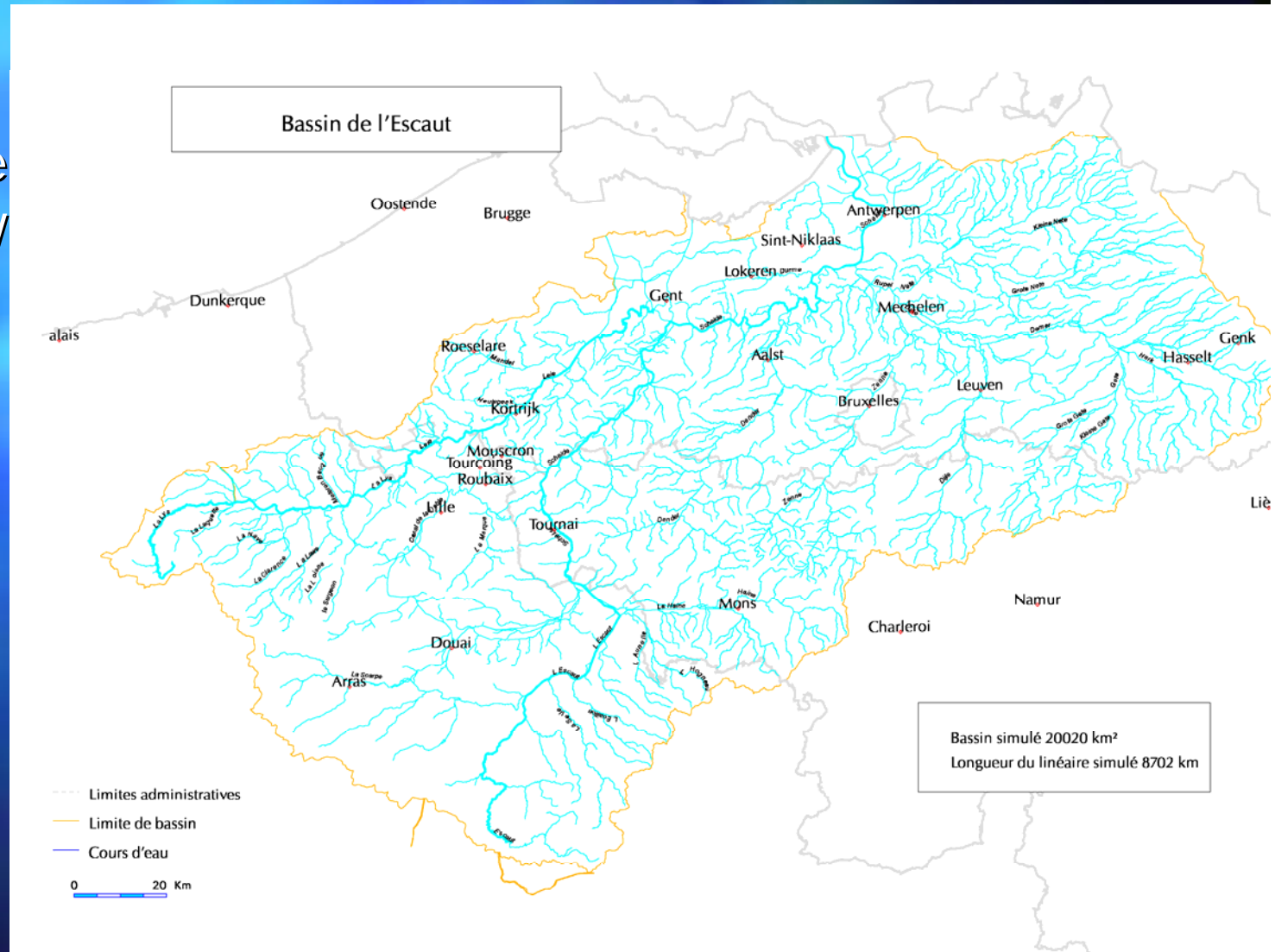
FRANCE :

- Artois-Picardie Water Agency

BELGIUM

- Flanders
- Region Wallonne
- Brussels

THE NETHERLANDS



The MEUSE river Basin (32.000 km²)

6 Partners :

FRANCE :

- Rhine-Meuse Water Agency

LUXEMBURG

BELGIUM

- Region Wallonne
- Flanders

GERMANY

- Land Nordrhein-Westfalen

THE NETHERLANDS



MODELLING the water quality in international basins for the WFD

Some generic difficulties have to be solved
in the scope of transnational modelling :

e.g. each country (each partner) utilizes its own :

- system of coordinates
- digital terrain model / grids
- list of parameters for pollution discharges
- ...

and all these data have to be made compatible

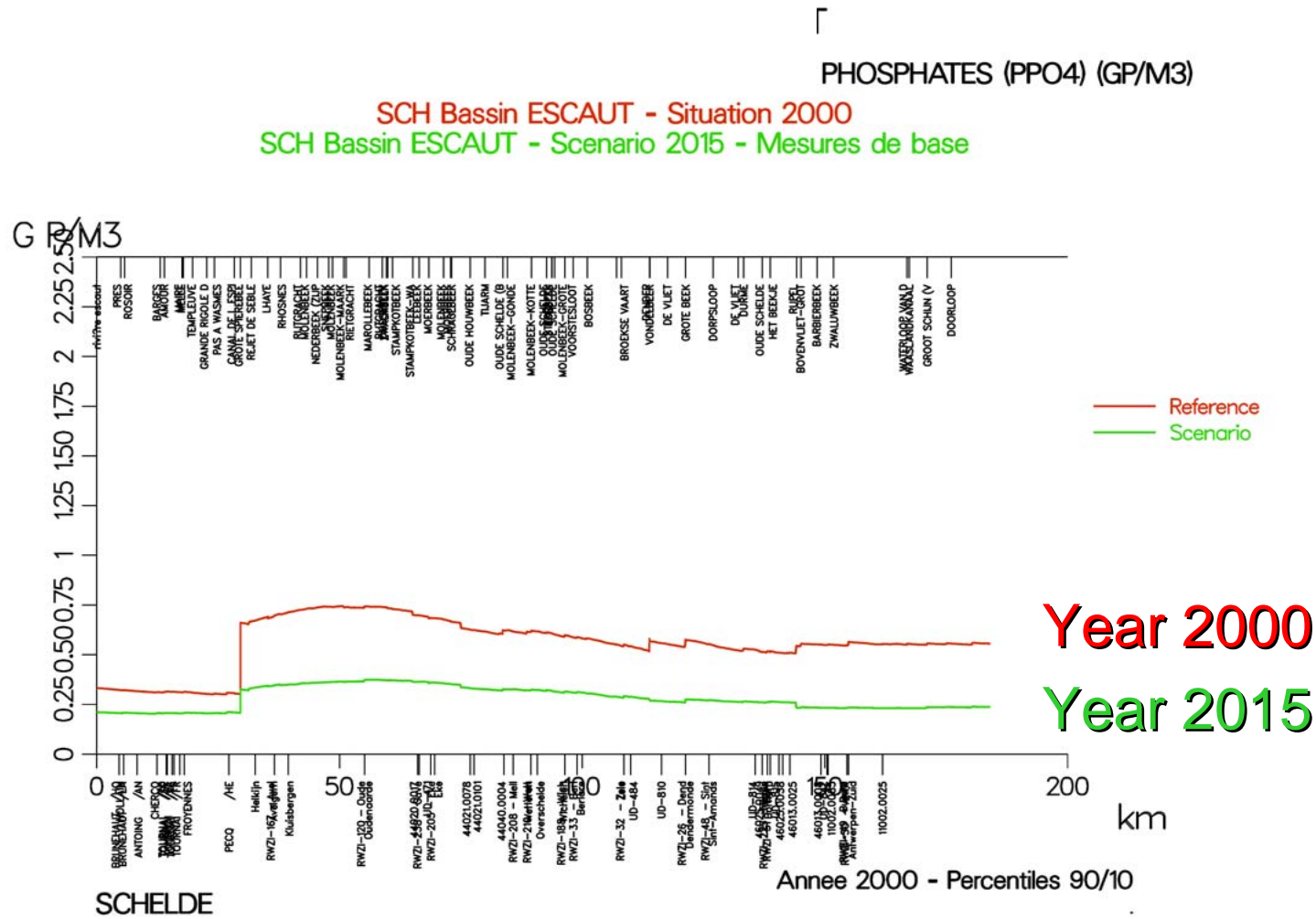
But some specific modelling-related difficulties
have also to be resolved

MODELLING the water quality in international basins for the WFD

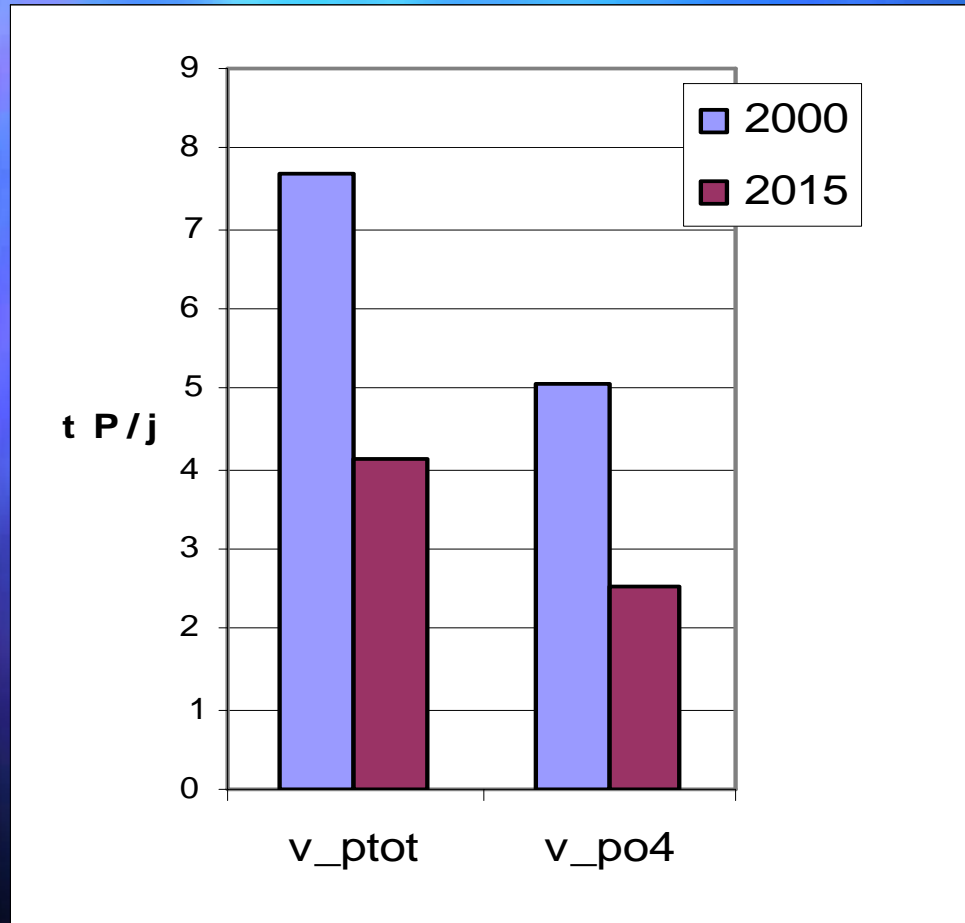
The general principles adopted for the approach are :

- 1) Each partner remains owner of his data
- 2) Each partner can do simulations alone but modifying his own data only
- 3) Each transnational co-ordinated simulation needs a preliminary agreement between the partners about the scenario(s) to be modelled
- 4) The results of the transnational modelling are made available to each partner for the whole basin

MODELLING the water quality in international basins : example of results



MODELLING the water quality in international basins : example of results



Averaged yearly fluxes
of phosphorus at the
outlet of the international
Scheldt river basin
Year 2015 scenario vs
reference Year 2000

(= cumulative effect of
the basic measures of
the partners)

MODELLING the water quality in international basins : CONCLUSIONS

Transnational modelling exercises in order to coordinate the European Water Framework Directive in international districts :

- are POSSIBLE
- are very USEFUL (necessary ?)

What is realized today :
transnational simulations
of BASIC and ADDITIONAL measures scenarios

What is **NOT** realized today :
transnational COST – EFFECTIVENESS analysis
(which are still done at national / regional level)

MODELLING the water quality in international basins : CONCLUSIONS

Key points for success :

- 1) Confidence between the partners
- 2) Availability of an 'independent' scientific team to implement / validate / run the model
- 3) Before the start of the process : a common agreement on the rules of the game

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