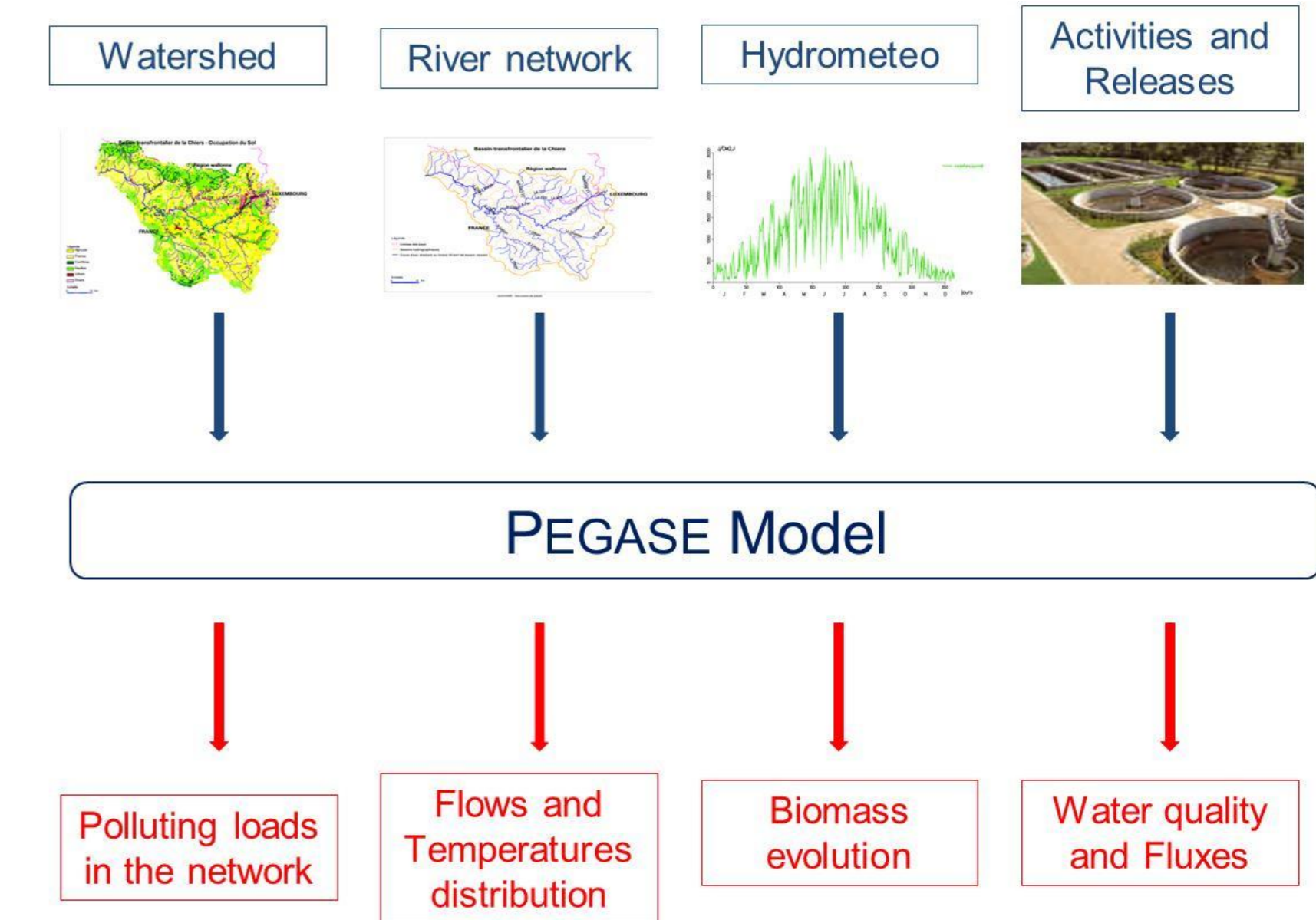# PEGASE MODELLING STUDIES APPLIED TO MICROPOLLUTANTS: USE CASES

Introduction

- PEGASE is a physically based integrated model for watershed and river ecosystems aiming at the deterministic calculation of the water quality, taking into account releases and pollutant discharges (pressure/impact relations), under stationary or non-stationary hydrological situations
- The software PEGASE OPERA is interoperable with GIS and provides user-friendly interface

Objective

Assessment of Emissions Limits Values (ELV) in compliancy with the Environmental Quality Standards (EQS) using a pollutants transport model

Watershed | River network | Hydrometeo | Activities and Releases

→ PEGASE Model →

Polluting loads in the network | Flows and Temperatures distribution | Biomass evolution | Water quality and Fluxes

PEGASE OPERA interface

Methodology

Application of PEGASE MICROPOL sub-model to heavy metals within two French basins

Mechanisms in relation to MICROPOL sub-model

- transport in the liquid phase
- adsorption & desorption mechanisms (on suspended matters and bottom sediments)
- transport in the solid phase (with suspended matters)
- sedimentation mechanisms for the absorbed micropollutants
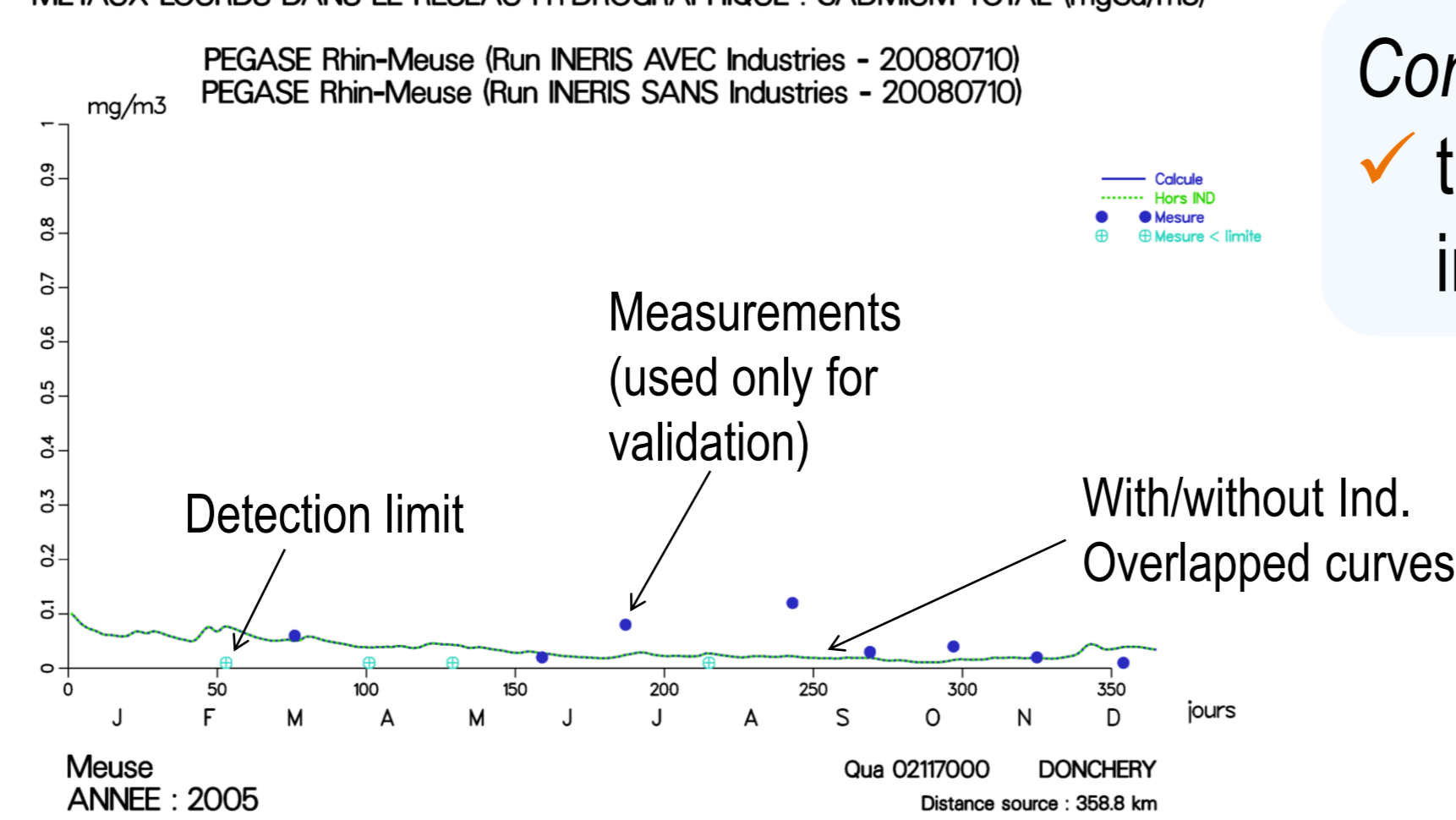- linear degradation

Inputs

- pressure data (urban, industrial, waste water treatment plants and livestock discharges)
- diffuse loads of micropollutants from the watershed, as a result of the global erosion (use of statistical soil loads functions)

Results and conclusions

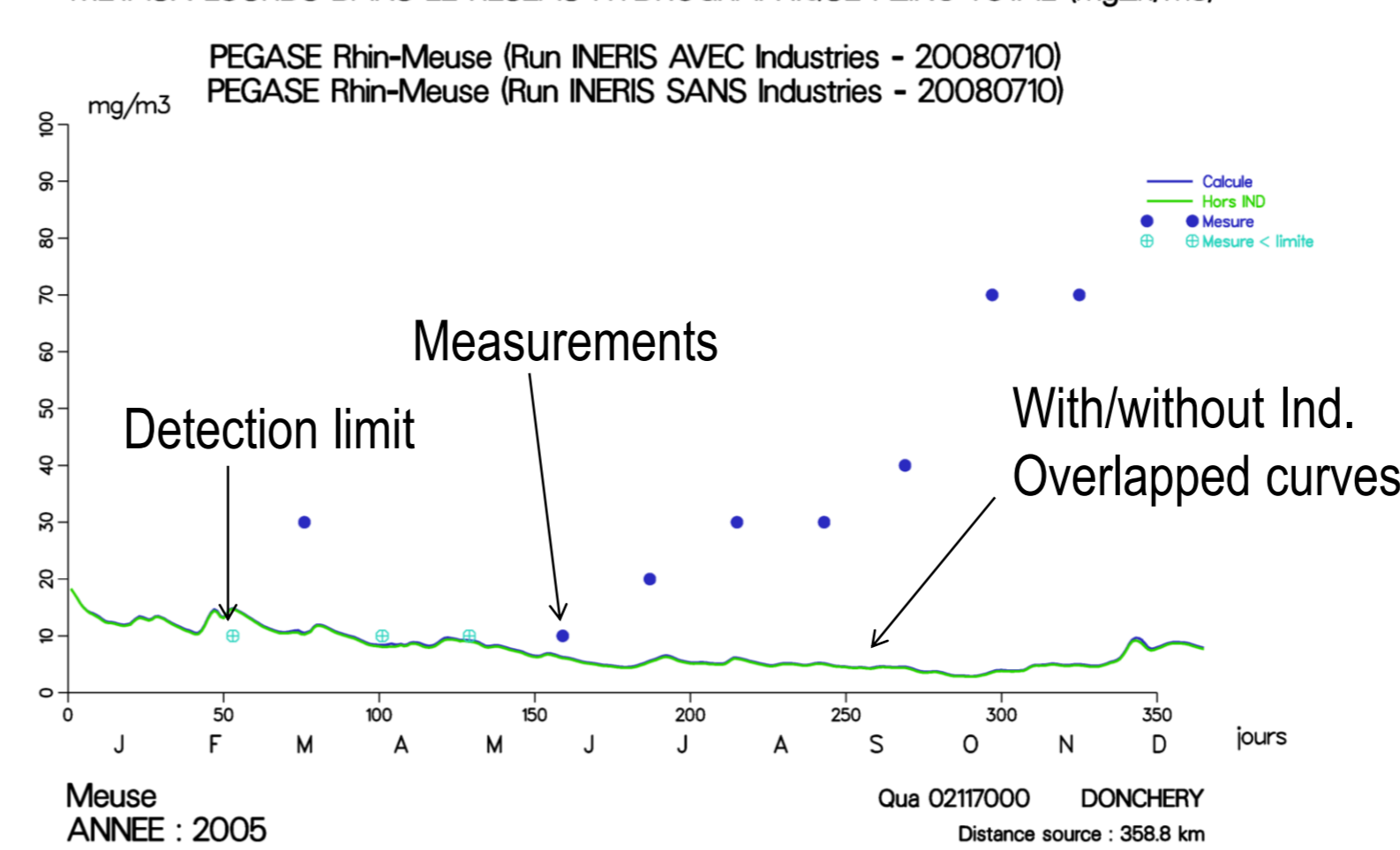### The Meuse sub-basin (French Water Agency Rhine-Meuse), Cd and Zn simulations

Conclusions

✓ the influence of the industrial loads on Zn and Cd concentrations in surface water of the Meuse basin is weak and strictly local
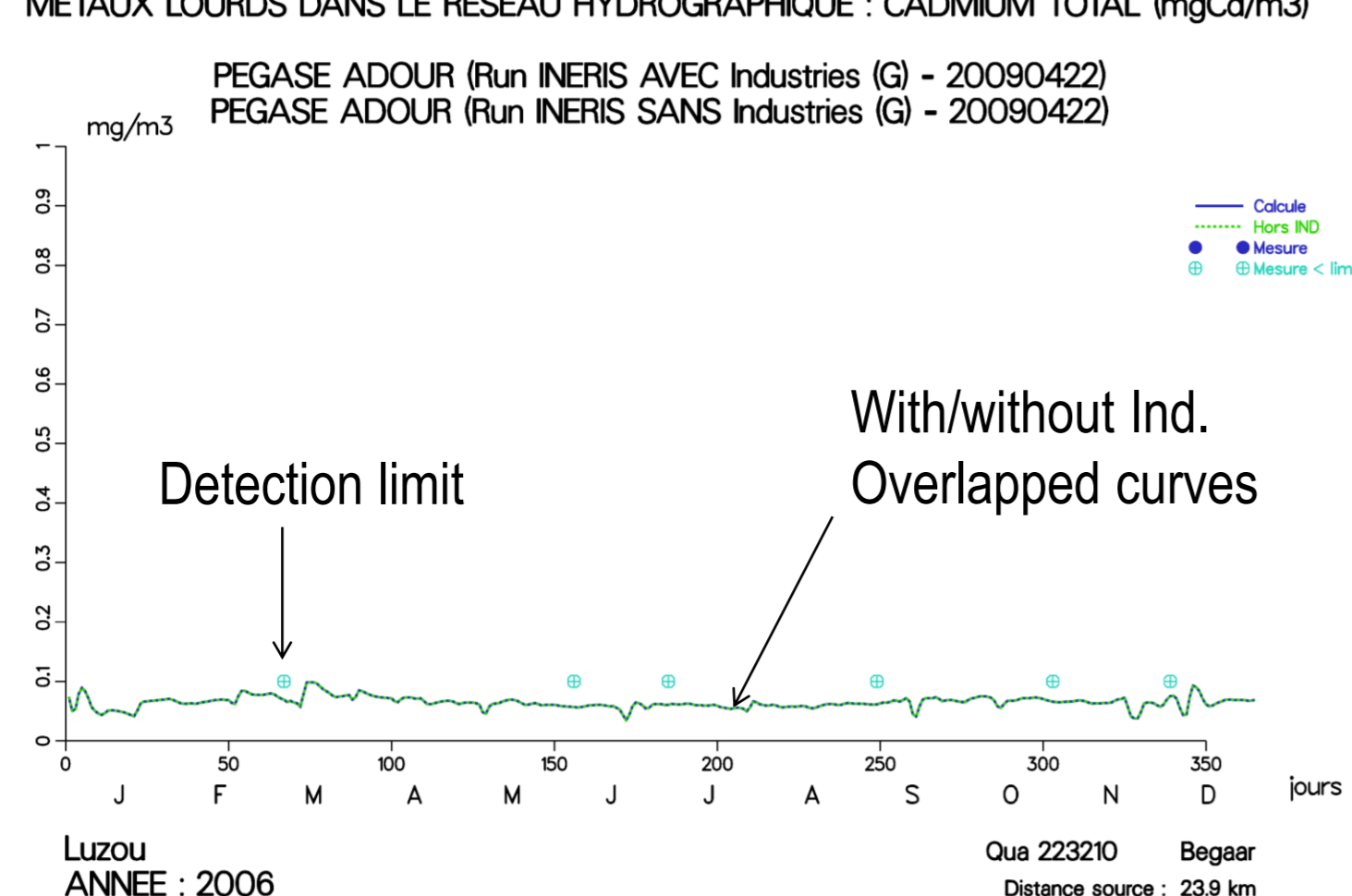
✓ it seems that important sources of Zn are not identified in the basin

✓ measurements are still to be improved (many points + detection limit) to be able to validate this kind of simulation

The Adour sub-basin (French Water Agency Adour-Garonne), Cd and Cu simulations

Acknowledgements

INERIS
maîtriser le risque pour un développement durable

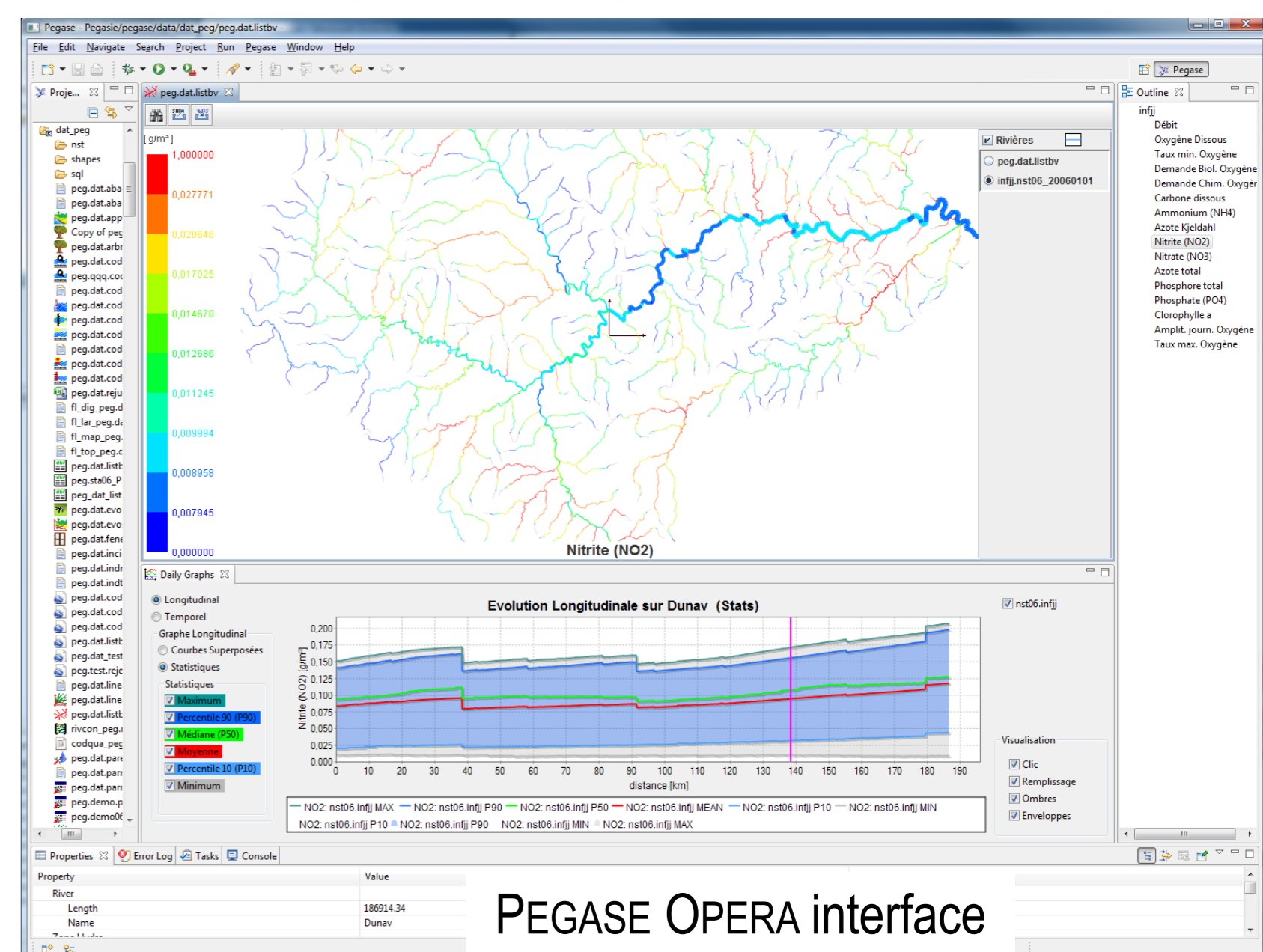AGENCE DE L'EAU RHIN·MEUSE

AGENCE DE L'EAU ADOUR-GARONNE

Conclusions

✓ the influence of the industrial loads on Cu and Cd concentrations in surface water of Adour basin is weak and strictly local
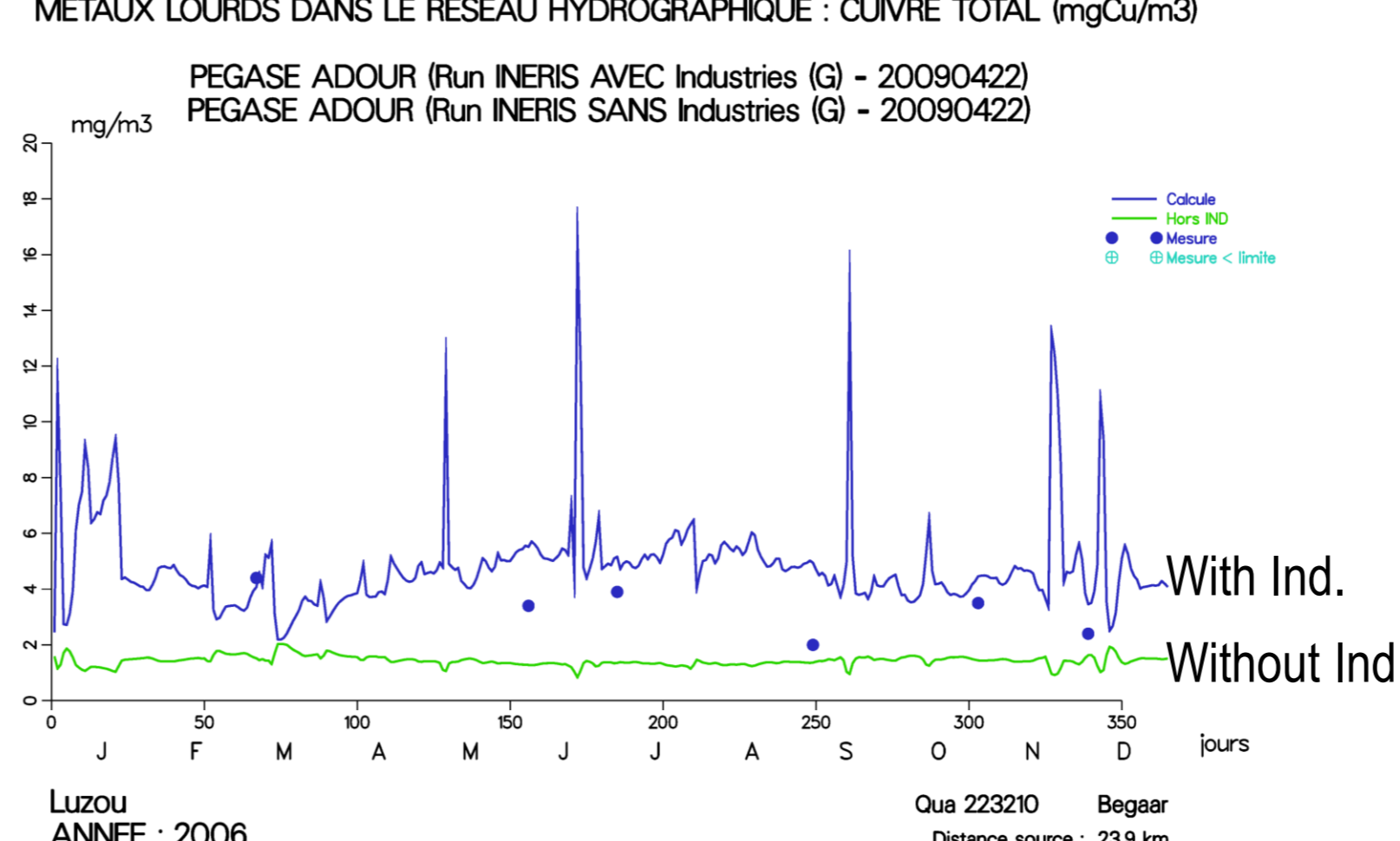
✓ it is necessary to improve input data and water quality measurements to carry on prospective scenarios

A test application to cocaine in Belgium

Adaptation of the methodology to the main stable metabolite of cocaine BZE (benzoylecgonine) based on results from COWAT study (Acknowledgements to Environmental Toxicology Laboratory, ULg)

- BZE is represented as a micropollutant (such as heavy metals) with specific parameterization
- Only urban releases are considered (industrial releases and soil loads are assumed to be negligible)
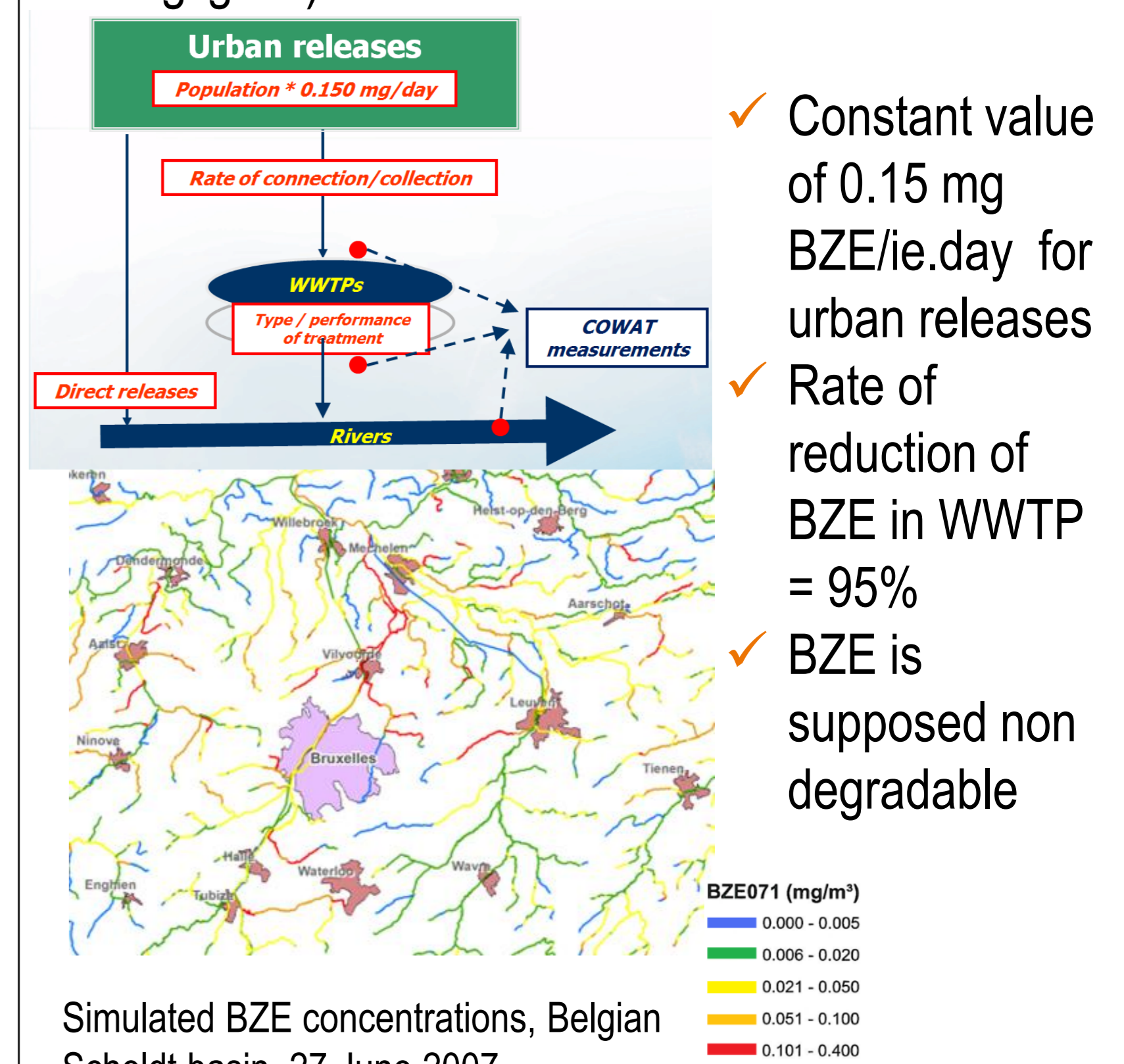
✓ Constant value of 0.15 mg BZE/ie.day for urban releases
✓ Rate of reduction of BZE in WWTP = 95%
✓ BZE is supposed non degradable

Simulated BZE concentrations, Belgian Scheldt basin, 27 June 2007

Perspectives

Future applications to other metabolites drug residues, pharmaceuticals and emerging substances as endocrine-disrupting contaminants will be considered

General conclusions

The model is relevant to

- quantify the "pressure-impact" relationships
- evaluate the effects of various prospective scenarios of measures
- support the elaboration of water management plans
- support the physicochemical surface water monitoring
- structure knowledge, including "input data" → detect inconsistencies between pressure data and water quality measurements
- identify the contribution of each pressure (urban, industrial …) to the total pollution loads in each compartment (waste water treatment plants inflow, river, watershed outlet …)
- accurate calculation from local scale up to the whole watershed (including international District)

The software PEGASE OPERA is dedicated as a tool for stakeholders in the scope of the implementation of WFD and other daughter directives (Nitrates, Dangerous Substances, EQS …)

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