Application of a conceptual water quality model of the river Dender (Belgium)

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Trabajo Final de Máster
TITULACIÓN: Máster en Ingeniería de Caminos, Canales y Puertos
Curso: 2016/17
Septiembre de 2017

AIM: To make a diagnosis of the water quality in the River Dender and improve its quality with the help of a conceptual water quality model

1- Location of the river

Belgium (Flemish part)

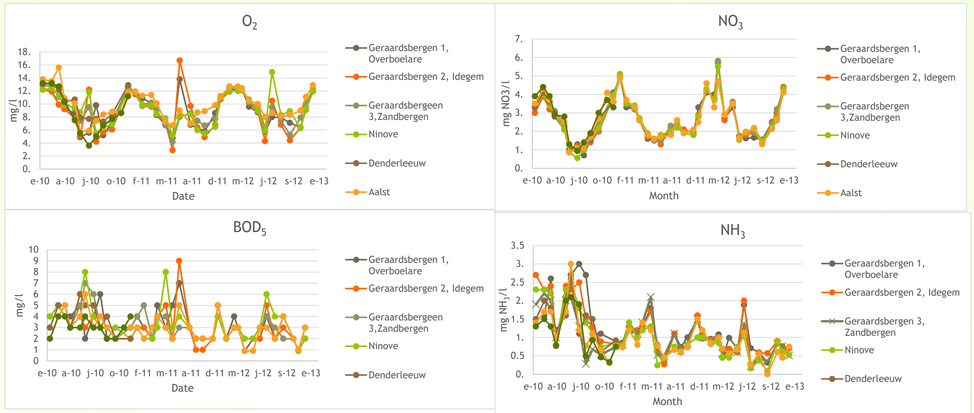
Between Brussels and Ghent

Main river: Dender
Tributaries (from upstream to downstream):
- Mark
- Molenbeek-G
- Wolfputbeek
- Bellebeek
- Molenbeek 2

2- Diagnosis of the water quality

The flow is highly irregular; It depends basically on rainfalls

It is studied from the observed data along the stations



Geraardsbergen and Ninove are the most important towns along the main river. Their households affect the most to the evolution of DO and BOD.

NO_3 values follow the same tendency but are higher for the years after 2010. The trend for NH_3 is lower for the years after 2010.

3- Development of the model

Conceptual water quantity model ↓ Flow, velocity and depth data	MIKE 11 ↓ concentration of NH_3, NO_3, DO and BOD which needs to be calibrated

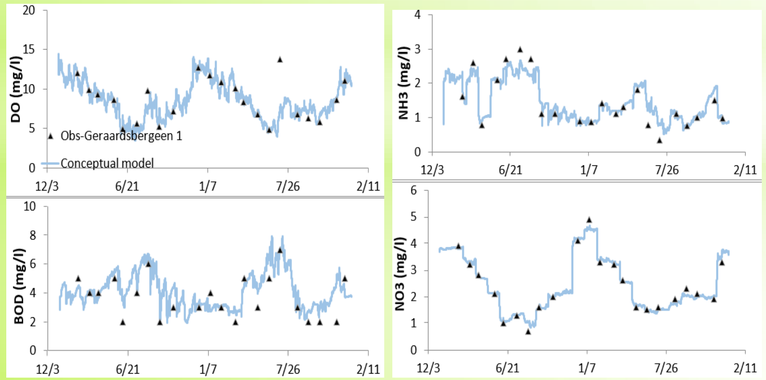
The conceptual water quality simulator:
- Is based on a dynamic method, analogous to static linear reservoir approach
- Integrates the mass-balance equation with the transformation/decay processes
- Uses a quasi-analytical solution, which gives unconditionally stable solutions

Discharges represented by point source boundaries which indicate the pollutant load (in kg/hr) entering the system

4- Model calibration

Method: manual iterative trial-error

Calibration period: 2010-2011 Validation period: 2010-2012



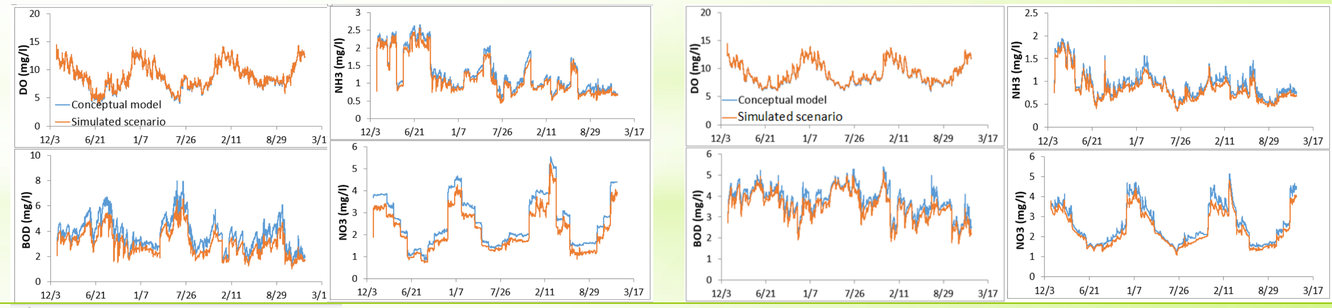
Results match comparatively better at the upstream than the downstream sections

Best calibrated variables: NO_3 and DO
Worst calibrated variables: NH_3 and BOD

5- Scenarios

5 scenarios are proposed. The measures taken into account will combine the reduction of pollutant load in the different boundaries, affecting agricultural, domestic and WWTP discharges.

It is intended to reduce the pollutant load by half as an order of the VMM. Based on the results, the two most beneficial scenarios are chosen.



6- Conclusions

In general, the measures implemented lead to improvement and solve most of the water quality problems.
- The reduction of pollutant load in effluents from the WWTP does not generate a relevant change.
- In contrast, the reduction of contaminant concentration in agricultural and domestic effluents generate a great change.
- As for the variables, the most difficult change to achieve is the increase of DO. The easiest way to get this is by decreasing the pollutant load of the domestic effluent.