Modelling the nitrate dynamics and the role of riparian zone in a major European catchment, the Garonne River, in southwest France

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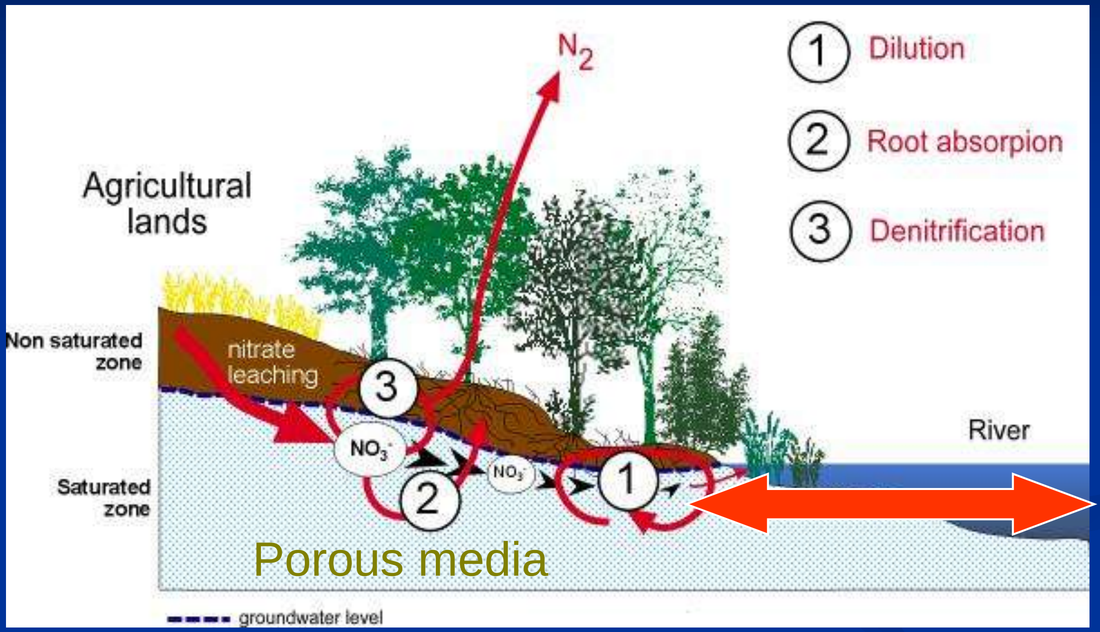
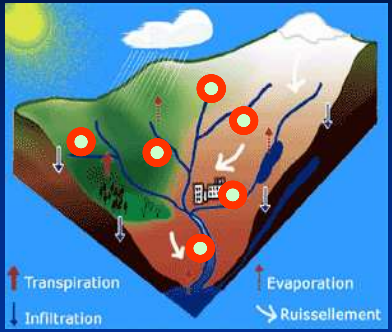
riparian zone



HYP1 : Riparian zones are active zones for dissolved and particulate elements.

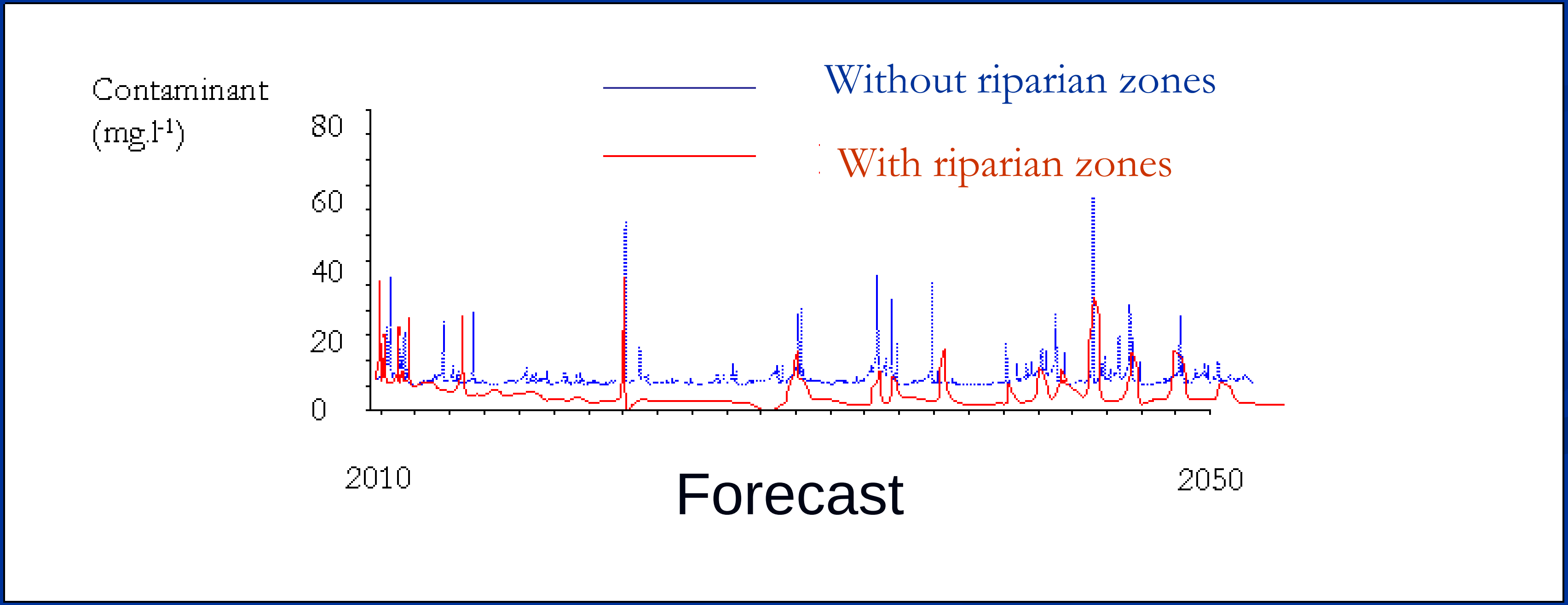
HYP2 : Their function depends on hydrological and morphological characteristics.

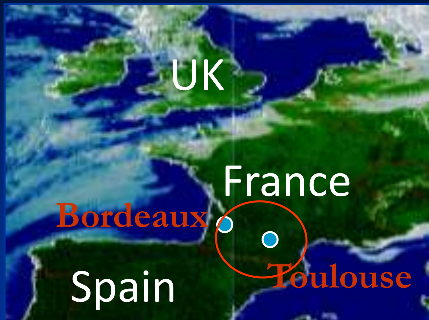
In a context of environmental changing



- Riparian zones → Nitrates transfers

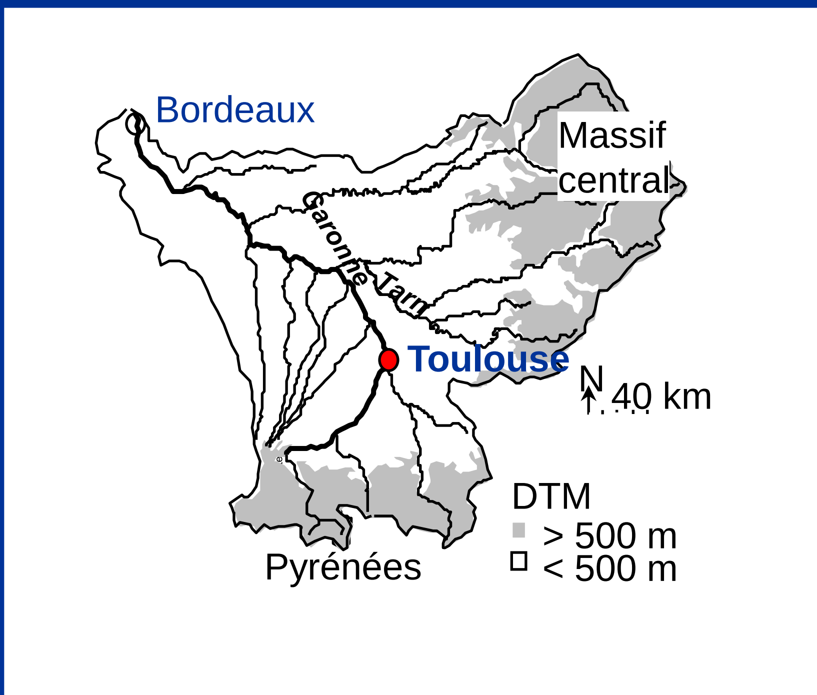
Climate changes
Land use changes

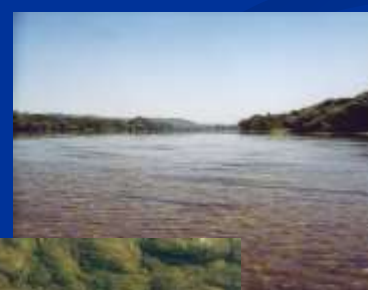




3rd river in France (600 $m^3.s^{-1}$, 12 l/s/km²)

650 km long

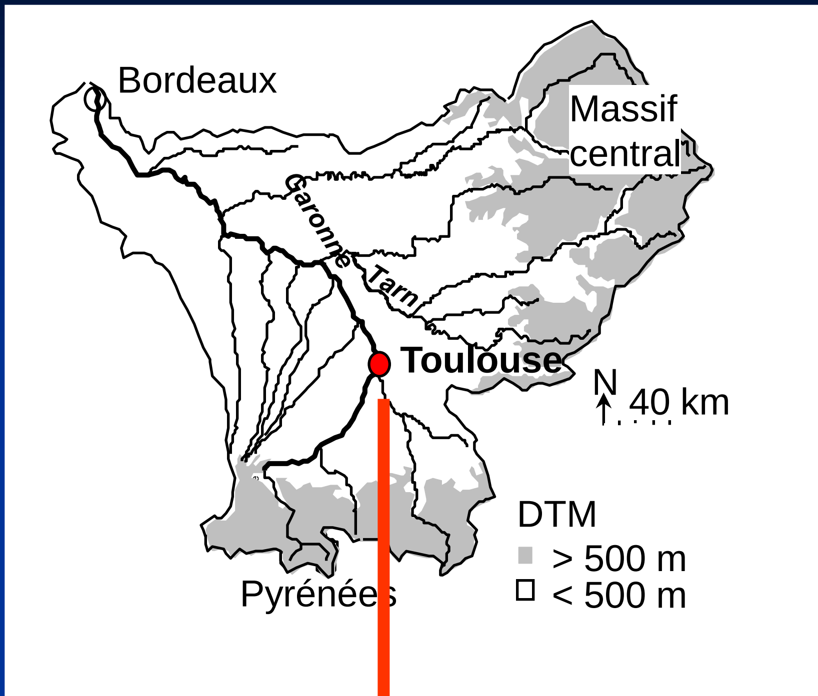




Epilitic biofilm

Storm events :

Up to 6000 m^3.s-1



TOULOUSE

1 200 000 inhabitants

4th city in France

56 000 km²

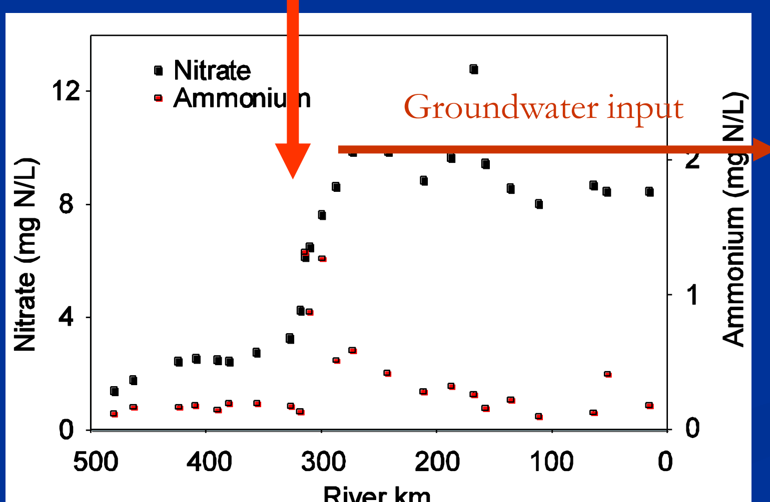
Rainfall : 950 mm

62 000 km of rivers

4 000 000 inhabitants

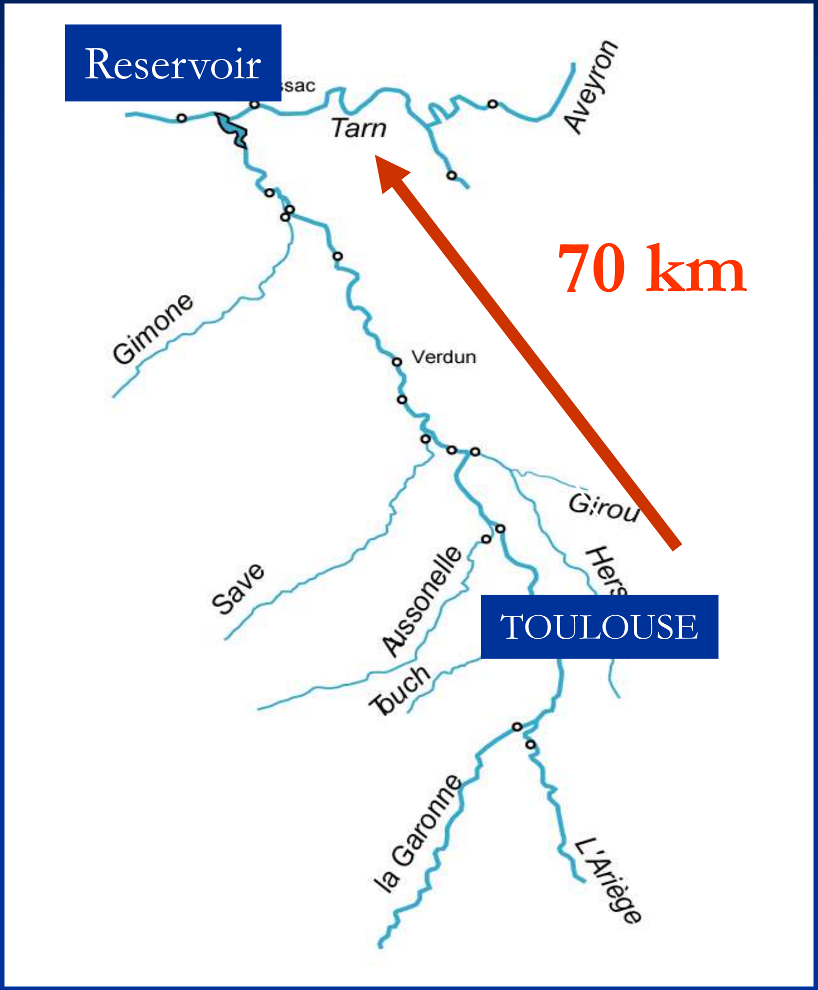
Alluvials, calcareous soils

45% of the surface : agriculture



40% of the french production

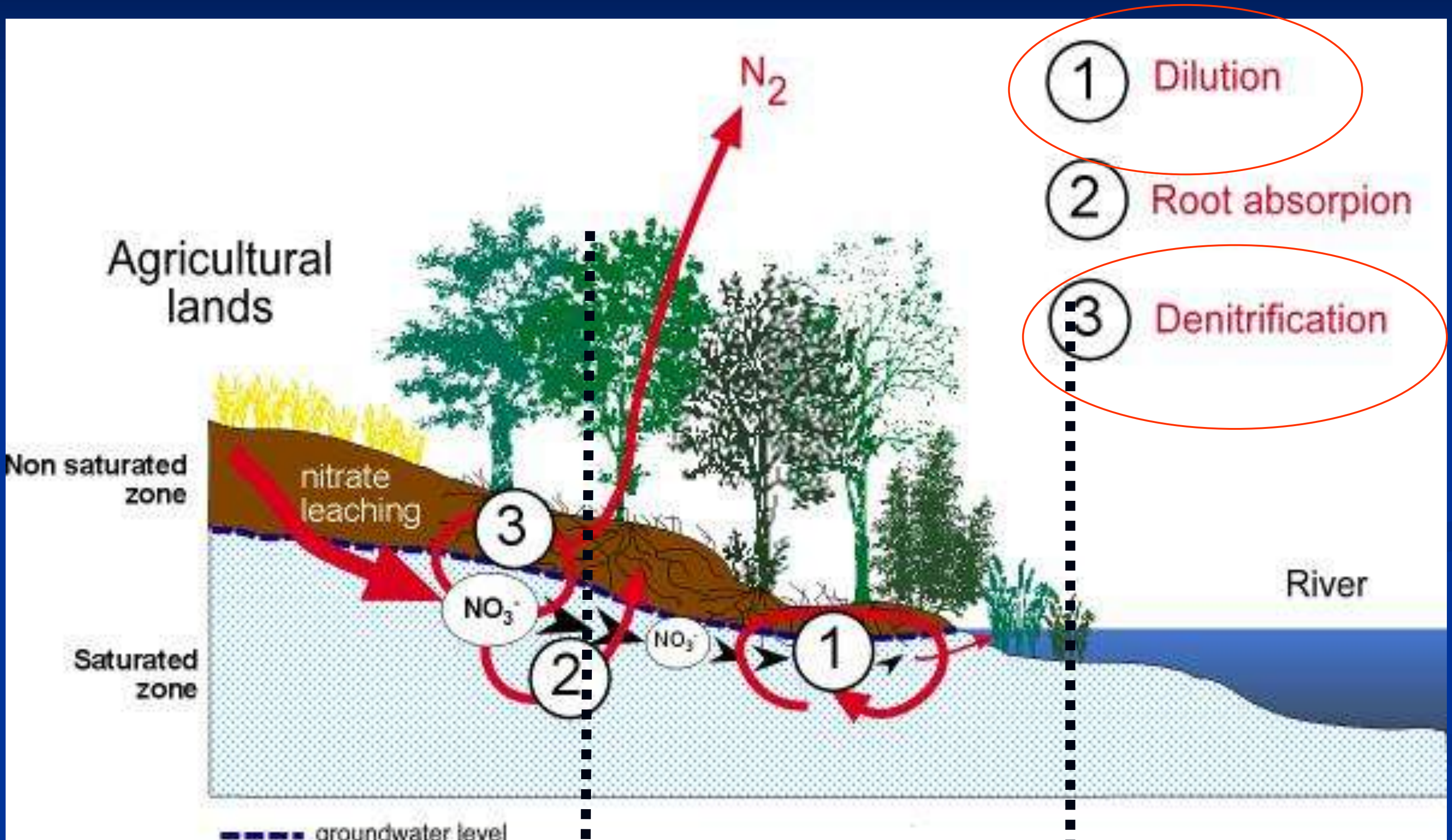
By modelling approaches (1 year)



NO_3^- uptake

6000 **$T.y^{-1}$**

up to 20%
of the Surface Water



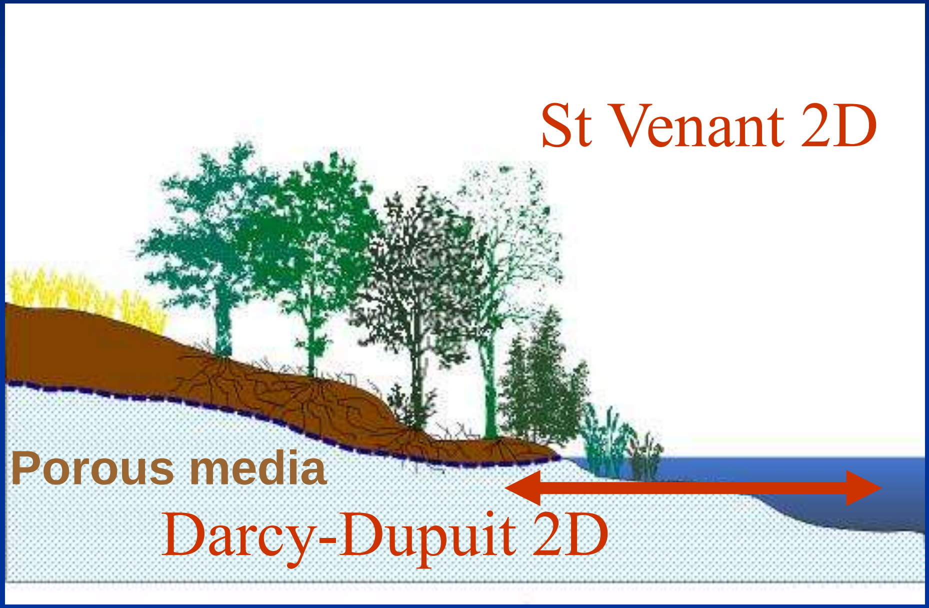
Agricultural plain | riparian zone | River

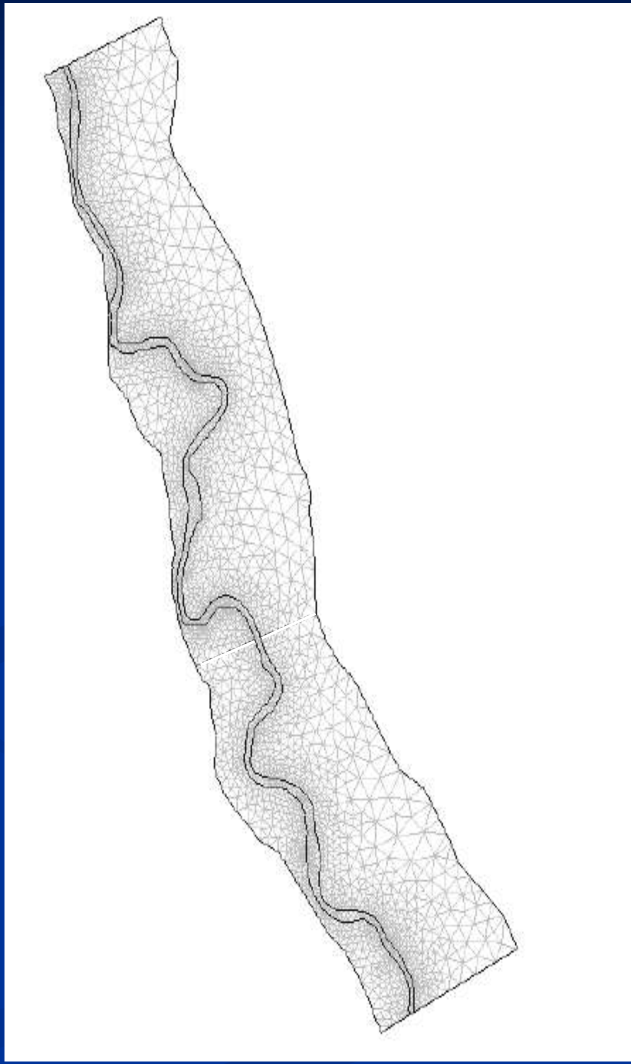
1.Weng P., Sánchez-Pérez J.M., **Sauvage, S.,** Vervier P. and Giraud F. (2003) *Hydrological Processes*

1.Sánchez-Pérez J.M, Lucot E., Bariac T.., Tremolieres T.R. (2008).. *STOTEN,*

1.Sánchez-Pérez J.M, Vervier P, Garabétian F., **Sauvage S.,** Loubet M., Rols J.L., Bariac T. and Weng P. (2003).. *Hydrology and the Earth Sciences System,*

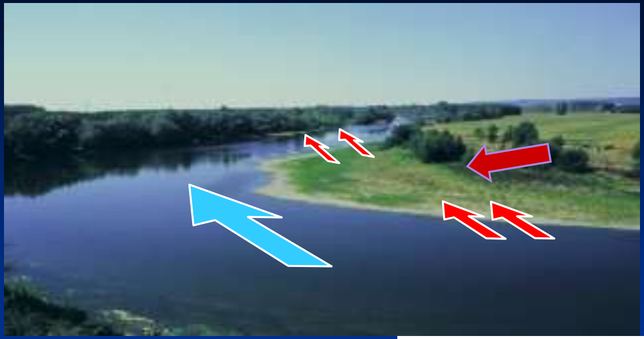
2SWEM



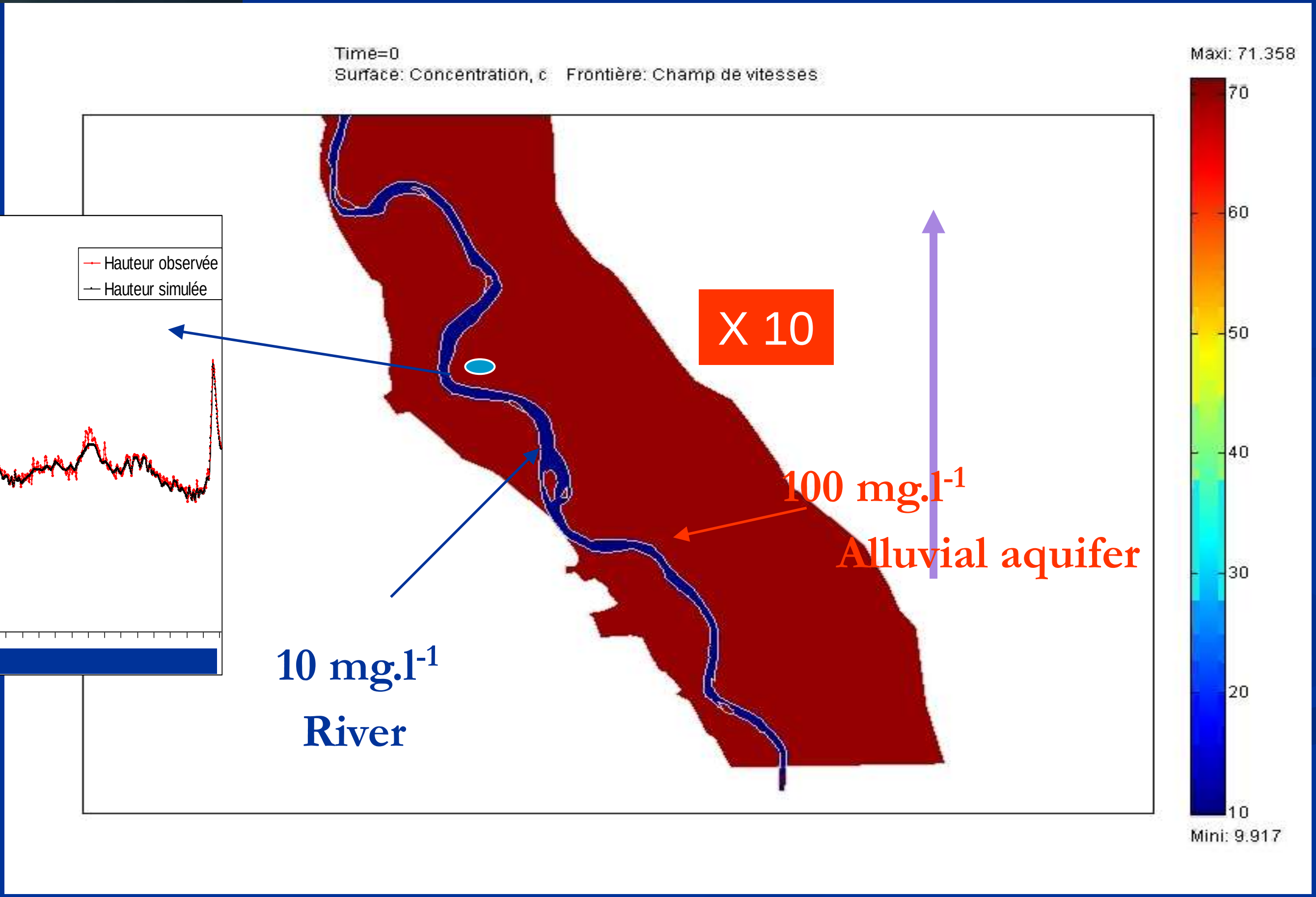


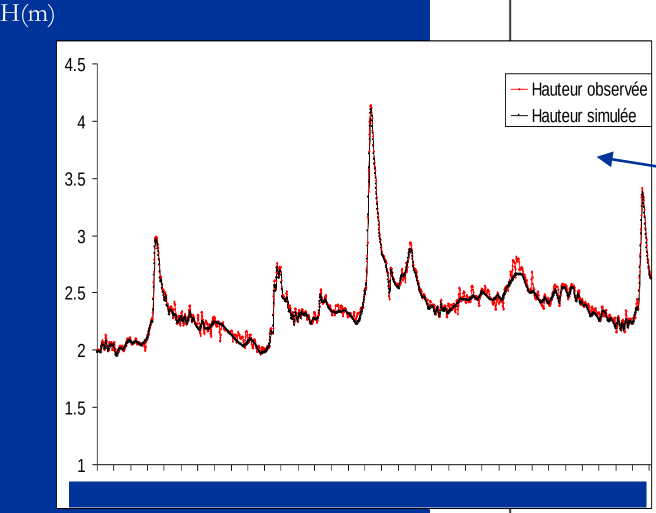
+ transport/reaction model

1.Peyrard D., **Sauvage S.,** Vervier P., **Sánchez-Pérez, J.M.** and Quintard M. (2008) *Hydrological Processes, 22, 4257-4273.*
Peyrard D., Delmotte S., **Sauvage S.,** Gerino M., Vervier P. and **Sánchez-Pérez J.M.** (accepted) *Physics and Chemistry of the Earth.*



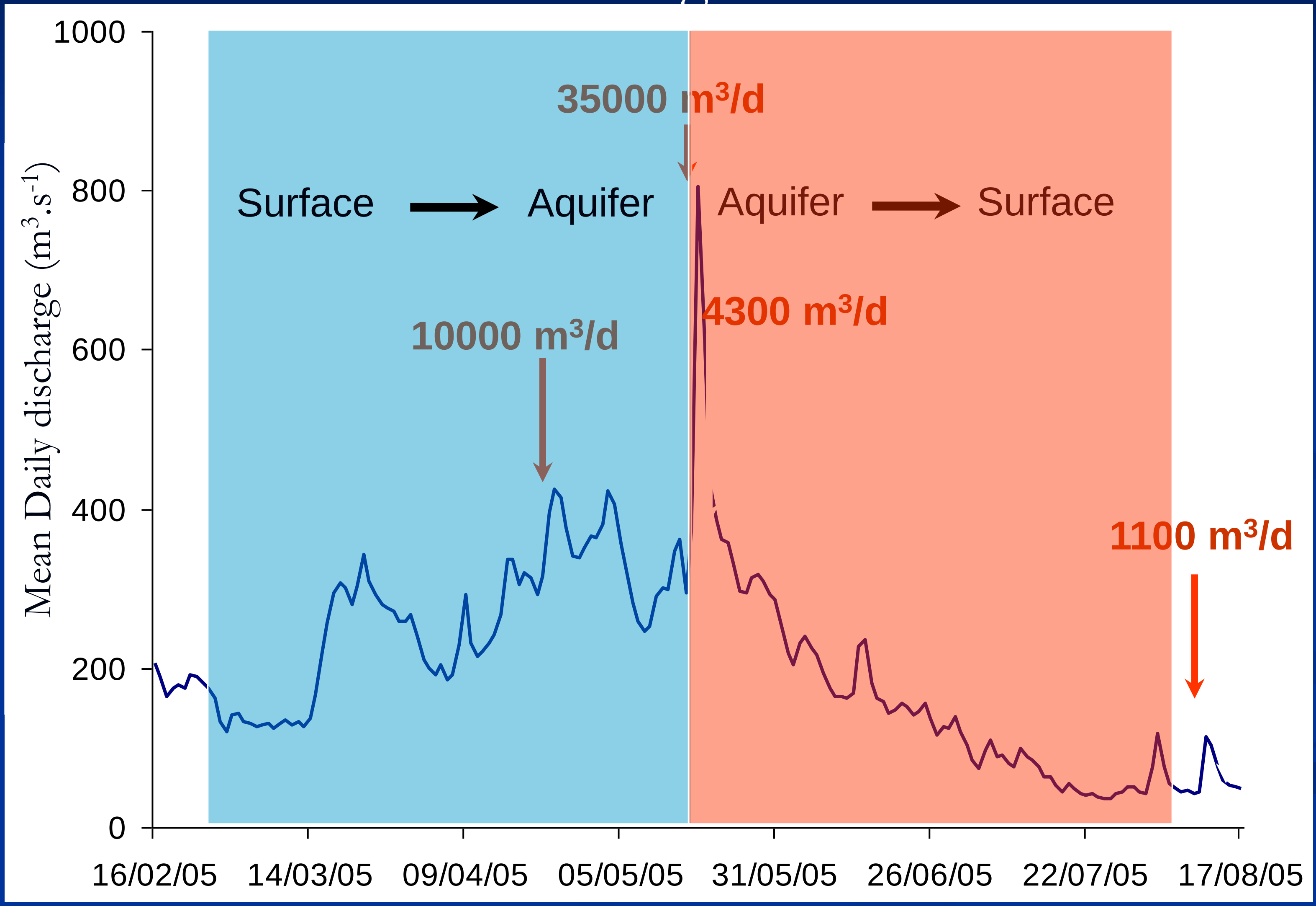
Dilution effect in riparian zone





1.Peyrard D., **Sauvage S.,** Vervier P., **Sánchez-Pérez, J.M.** and Quintard M. (2008) *Hydrological Processes, 22, 4257-4273.*

Balance : mean daily water fluxes exchanged
6 km along the river



1.Peyrard D., **Sauvage S.,** Vervier P., **Sánchez-Pérez, J.M.** and Quintard M. (2008) *Hydrological Processes, 22, 4257-4273.*

Denitrification process in riparian zone

Denitrification module adapted from NEMIS (*Henault and Germon, 2000*)

$$R = D_a(simulée) = D_p . f_N . f_T . f_C$$

D_a (mg N.L^{-1}.j^{-1}) : *in situ* denitrification

D_p (mg N .L^{-1}.j^{-1}) : potential denitrification

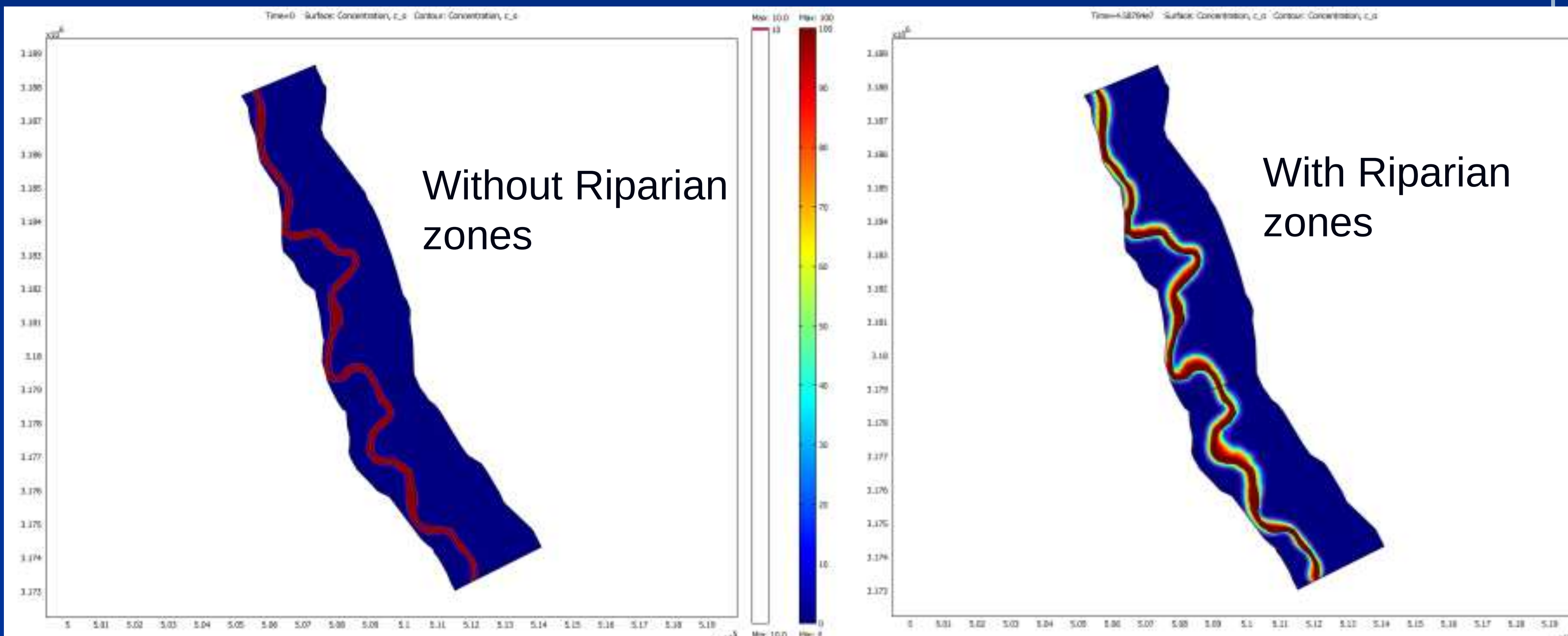
f_N function " nitrates " : $f_N = \frac{N}{K_N + N}$

f_T function " temperature " : $f_T = Q_{10}^{(T-Tr)/10}$

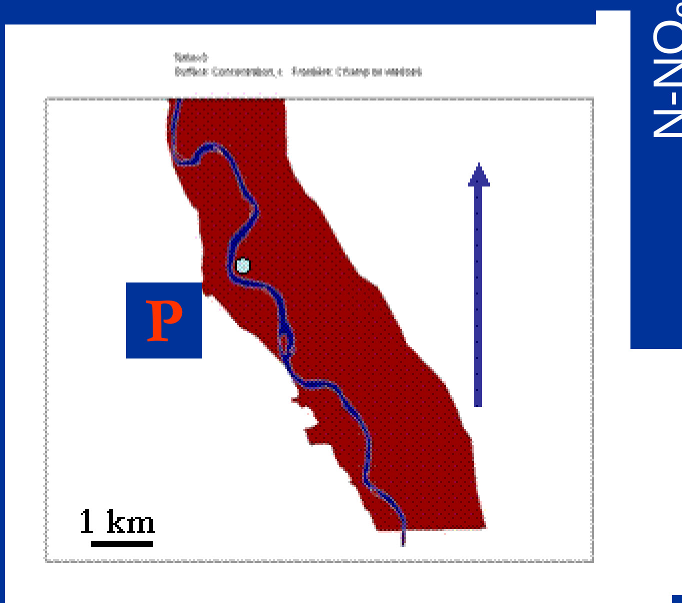
f_c function " connectivity " : $f_C = C^a$ takes into account (OM, O2, Bacteria …)

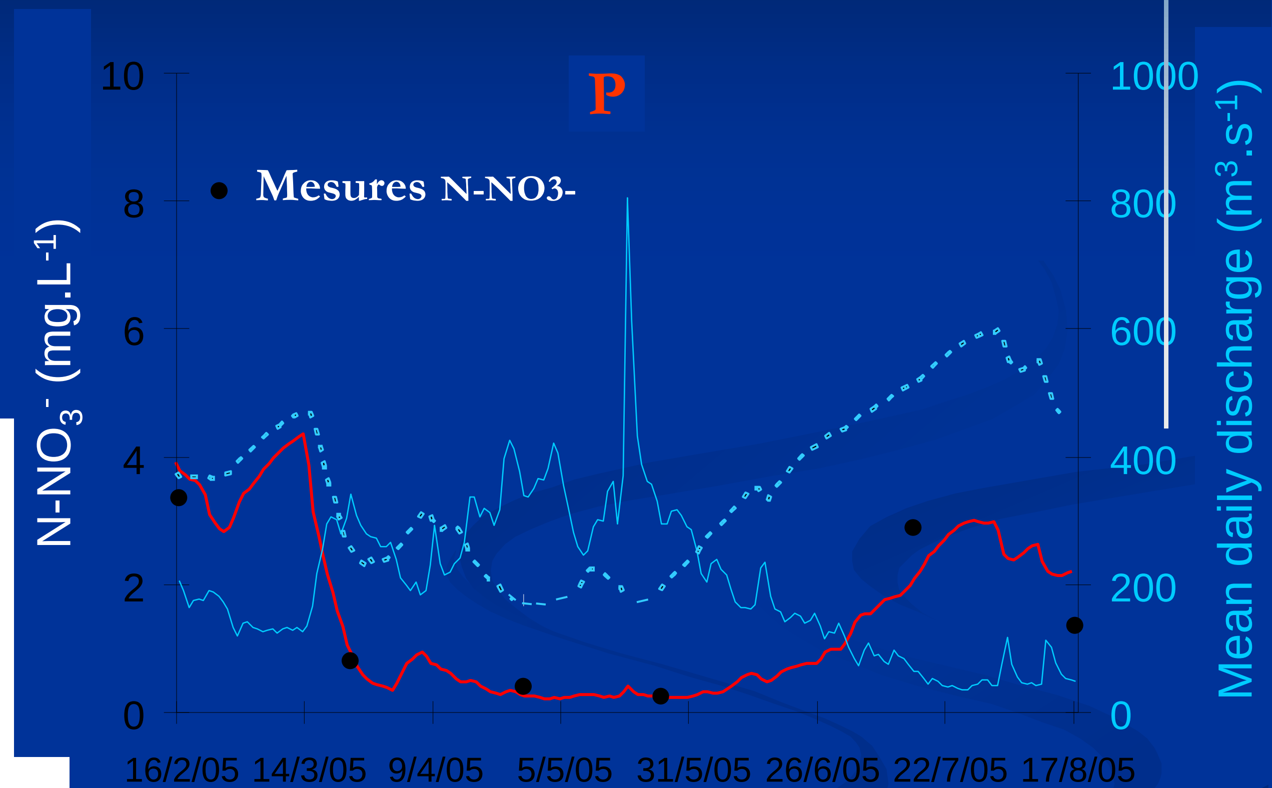
Peyrard D., Delmotte S., **Sauvage S.,** Gerino M., Vervier P. and **Sánchez-Pérez J.M.** (accepted) *Physics and Chemistry of the Earth.*

Connectivity function that activate denitrification



Dilution + denitrification processus

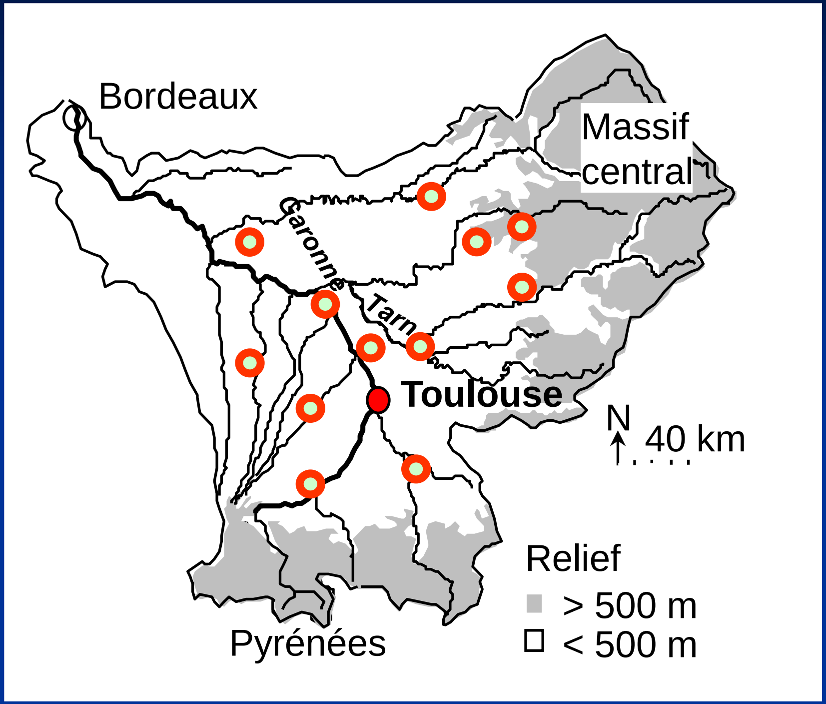


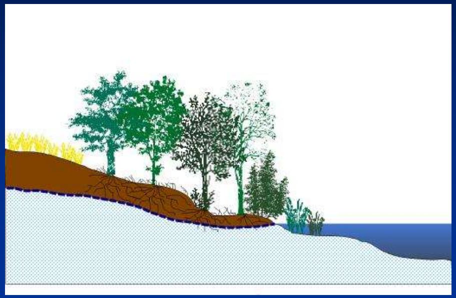


Effect of dilution

Effect of dilution + denitrification

How can we integrate these riparian zones in SWAT model ?





Alluvial Dominant System

daily time scale first approximation

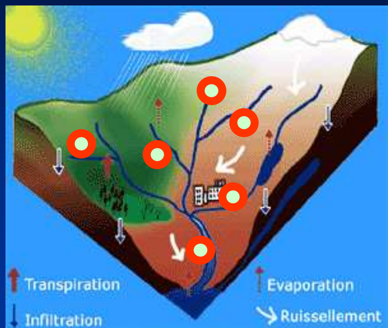
1 - activate/desactive function (based on flow, depth and meanders)

2 - integrate automatically the function with SWAT distributed

We need to quantify exchanges fluxes (flow and elements)

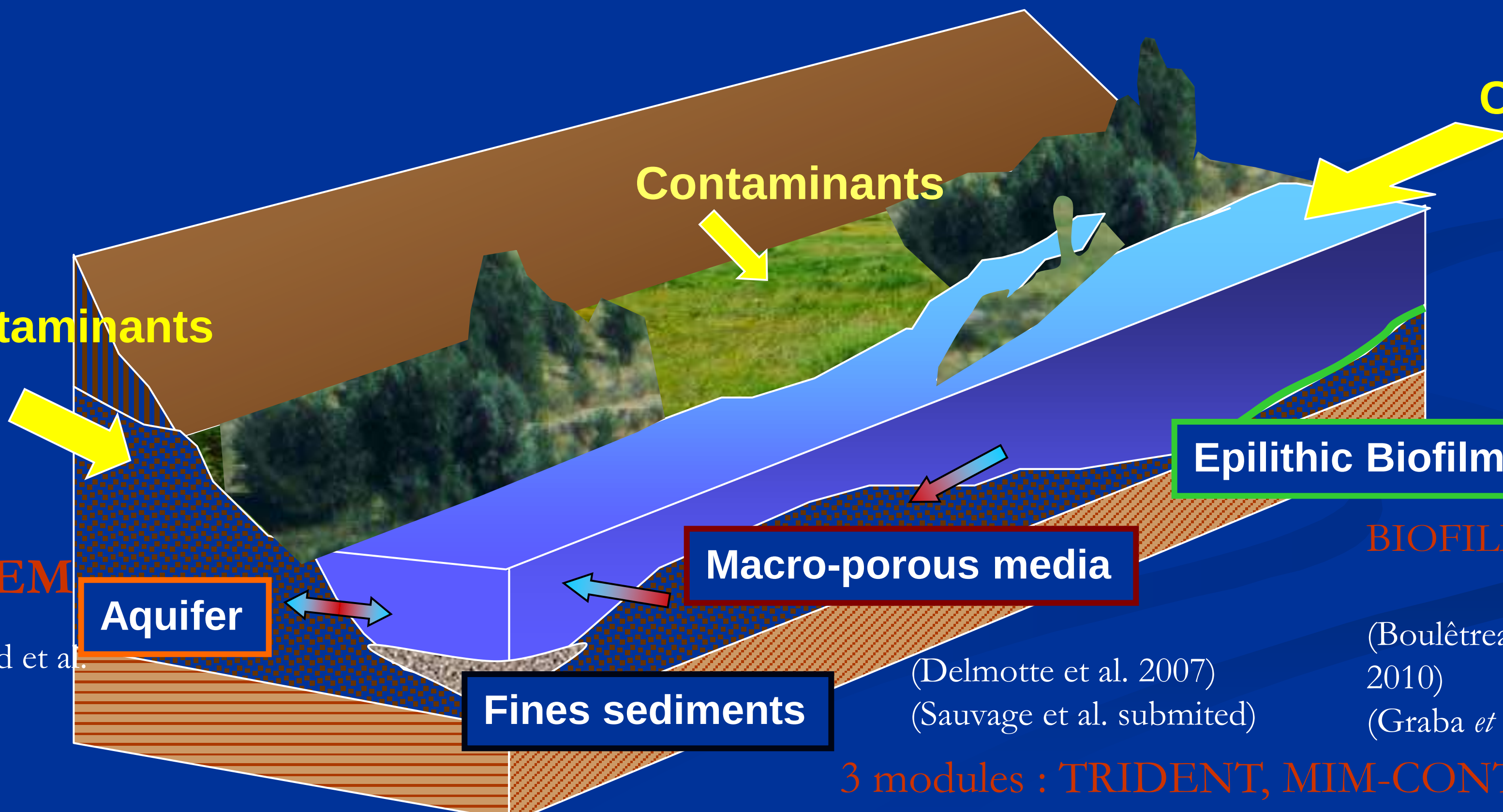
How can we integrate a hydraulic mechanistic model in some spatial zones ?
SWAT open-MI could be a solution !

In a context of environmental changing



- Interfaces of hydrosystems

C,N
+
Contaminants transfers
(pesticides, metals)



2SWEM

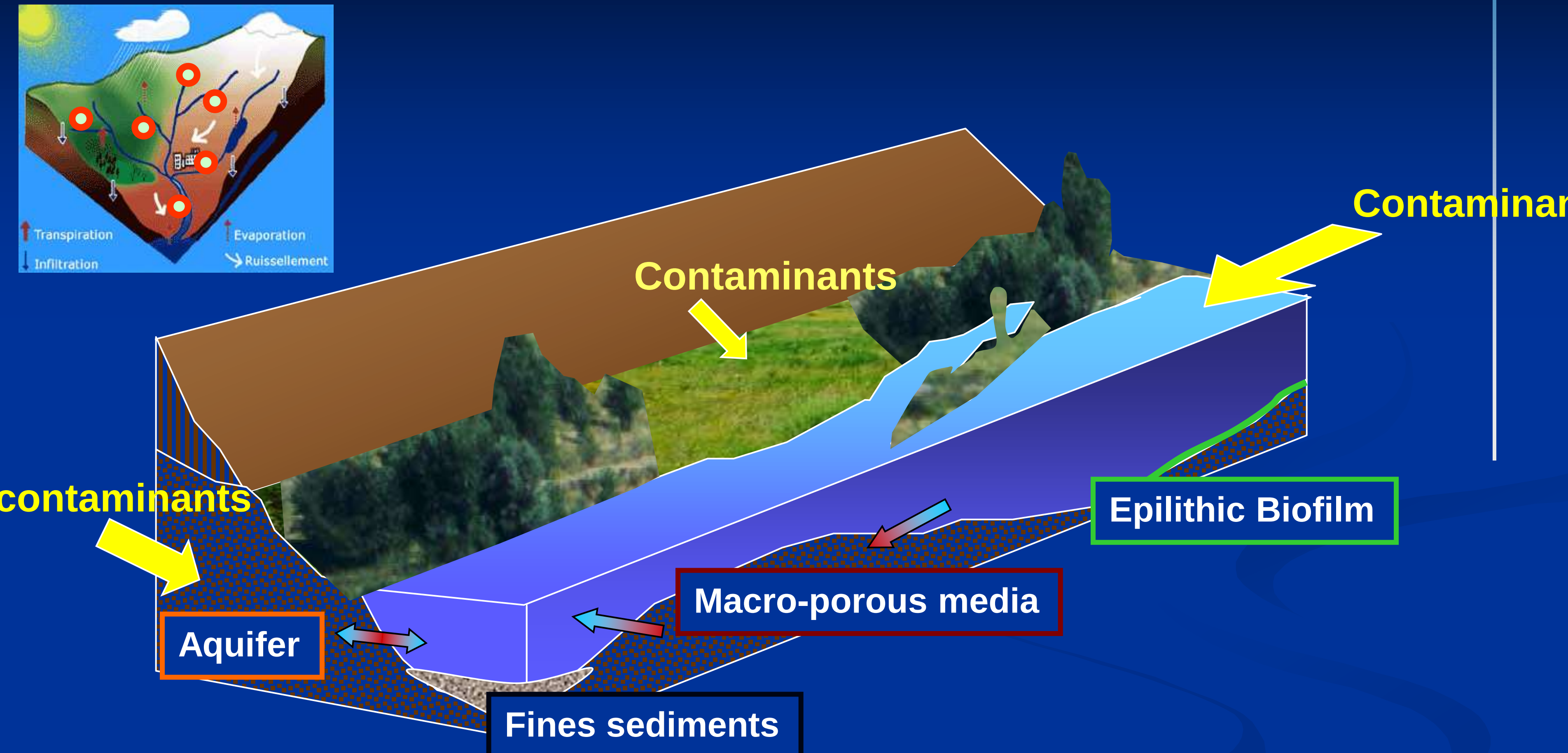
(Peyrard et al. 2008)

(Delmotte et al. 2007)
(Sauvage et al. submited)

BIOFILM model

(Boulêtreau *et al.* 2006, 2008, 2010)
(Graba *et al.*, 2010)

3 modules : TRIDENT, MIM-CONT, MIM-MO



Welcome anyone to join our team for developing and integrating these modules "Interfaces between rivers and land" into SWAT model


The Garonne at TOULOUSE
Thank you