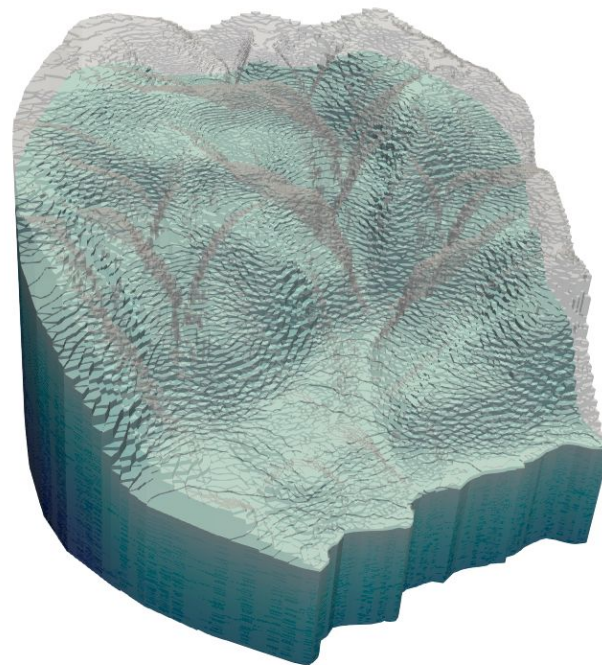


# Estimation of simulation parameters for steady and transient 3D flows modeling at watershed scale



Gillien Latour<sup>1</sup>, supervised by Pierre Horgue<sup>1</sup>,

Romain Guibert, François Renard<sup>2</sup> & Gérald Debenest<sup>1</sup>

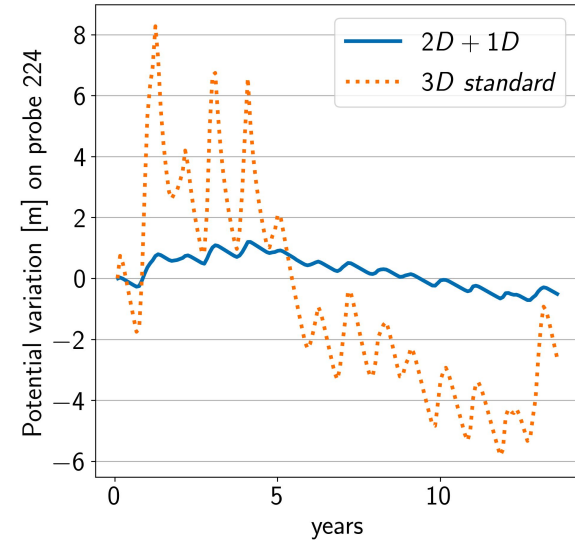
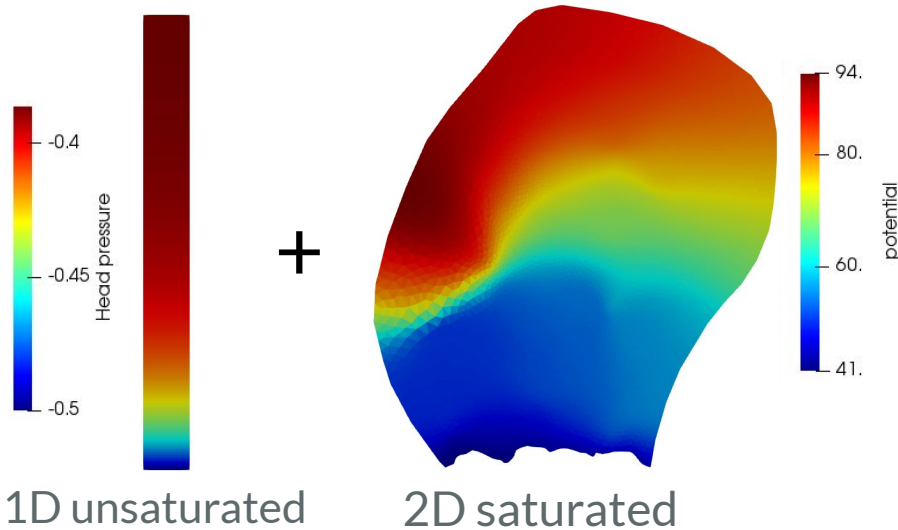
<sup>1</sup> : Institut de Mécanique des Fluides de Toulouse (IMFT) - Université de Toulouse, CNRS-INPT-UPS, Toulouse FRANCE

<sup>2</sup> : Commissariat à l'Energie Atomique et aux énergies alternatives (CEA), DAM, DIF, F-91297 Arpajon

# Equation and tools

OpenFOAM → porousMultihaseFoam toolbox<sup>1,2</sup>  
The Open Source CFD Toolbox

$$\frac{\partial \theta}{\partial t} = \nabla \cdot \left( \frac{\rho g}{\mu} K(h) \nabla h \right) + s.$$



Dedicated 3D optimization required

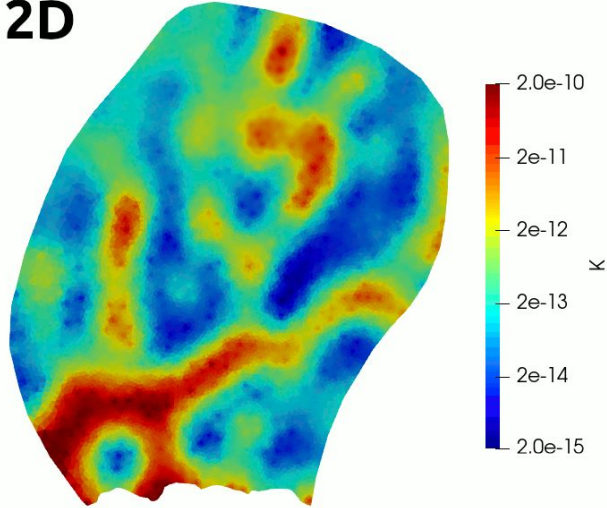
1 : Horgue et al. 2015, *Computer Physics Communications*

2 : Horgue et al. 2022, *Computer Physics Communications*

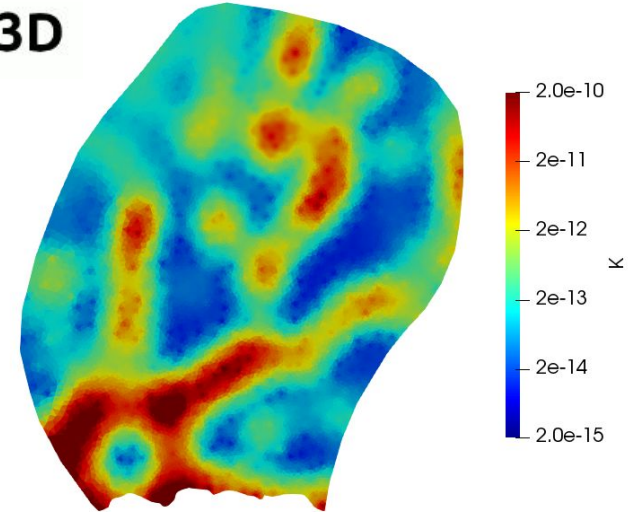
# 3D optimization

Steady optimization of the permeability  $K$   
using the pilot points method<sup>3</sup>

2D



3D



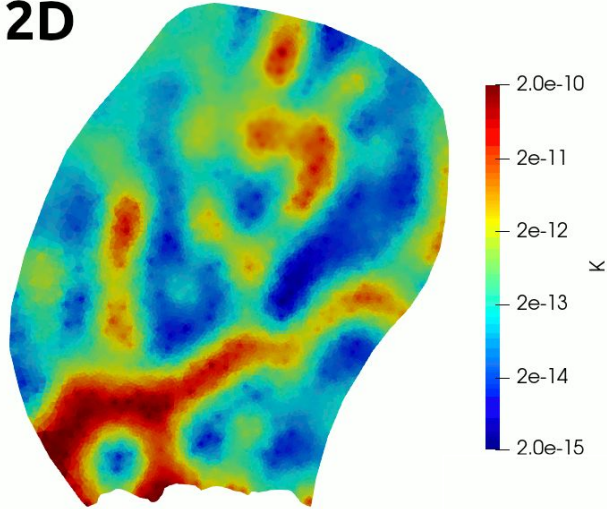
3 : Renard et Tognelli, 2016,  
*Journal of Hydrology*

|           | 2D     | 3D      |
|-----------|--------|---------|
| CPU time  | 10 min | 11520 h |
| mesh size | 71k    | 14M     |

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Steady optimization of the permeability  $\mathbf{K}$   
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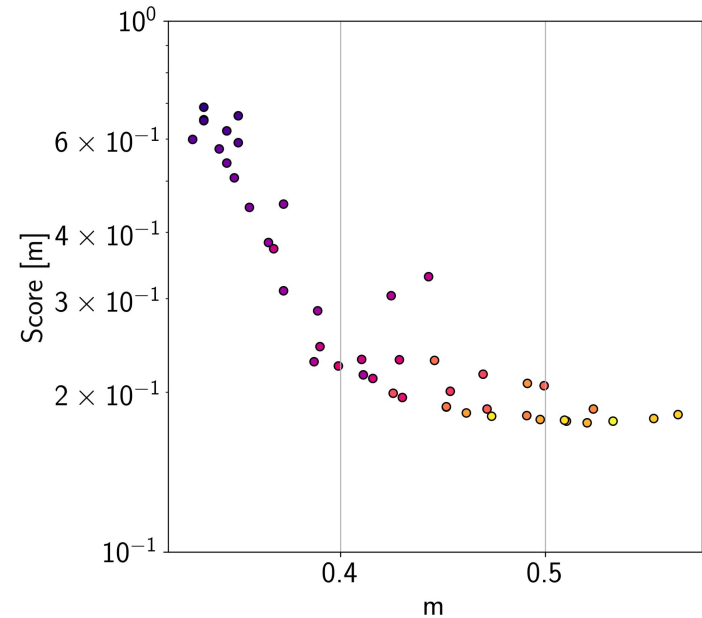
2D



3 : Renard et Tognelli, 2016,  
*Journal of Hydrology*

|           | 2D     | 3D      |
|-----------|--------|---------|
| CPU time  | 10 min | 11520 h |
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Transient optimization of the permeability model  
(van Genuchten<sup>4</sup>) parameters  $\Delta\theta$ ,  $\alpha$  &  $m$   
using Nelder-Mead method

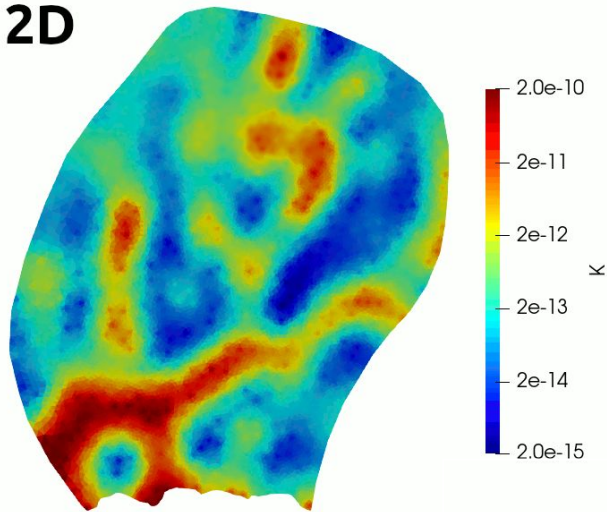


4 : van Genuchten, 1980,  
*Soil Science Society of America Journal*

# 3D optimization

Steady optimization of the permeability  $K$   
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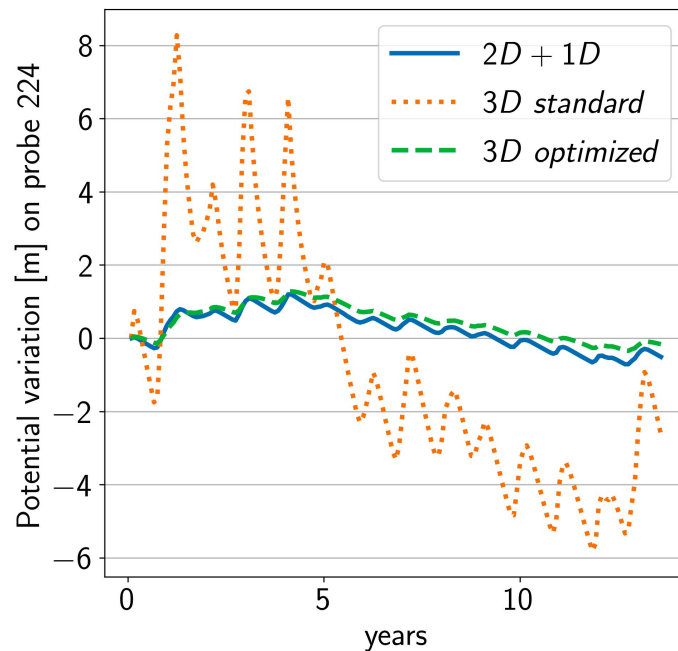
2D



3 : Renard et Tognelli, 2016,  
*Journal of Hydrology*

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# Future works

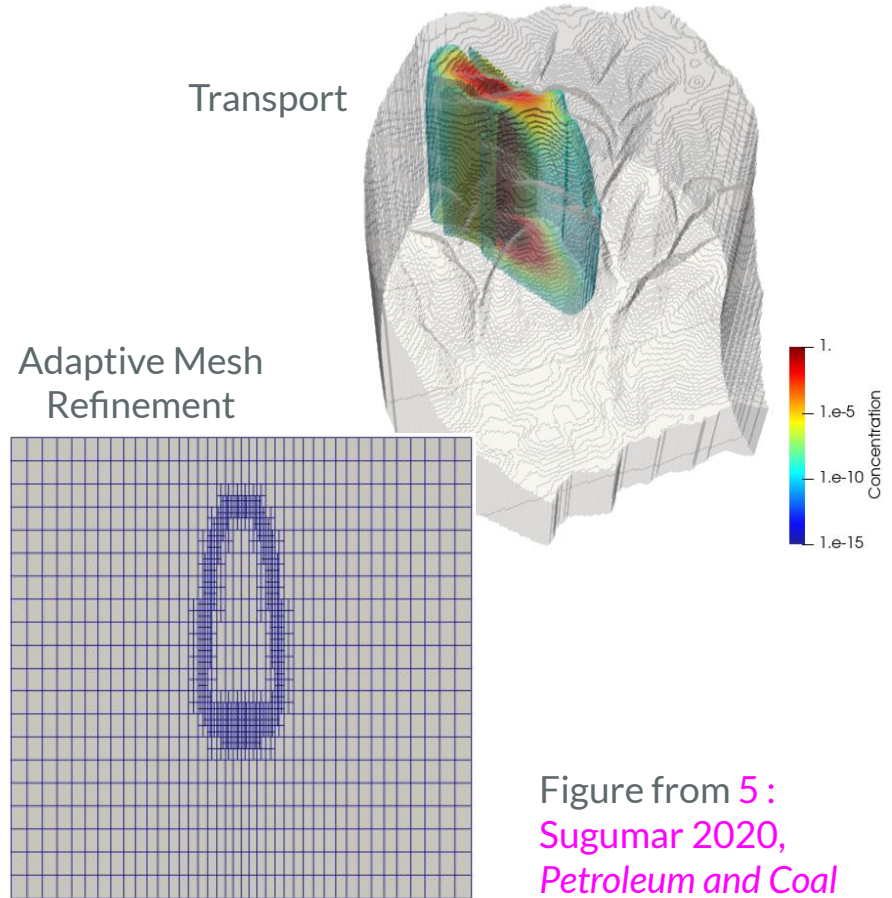
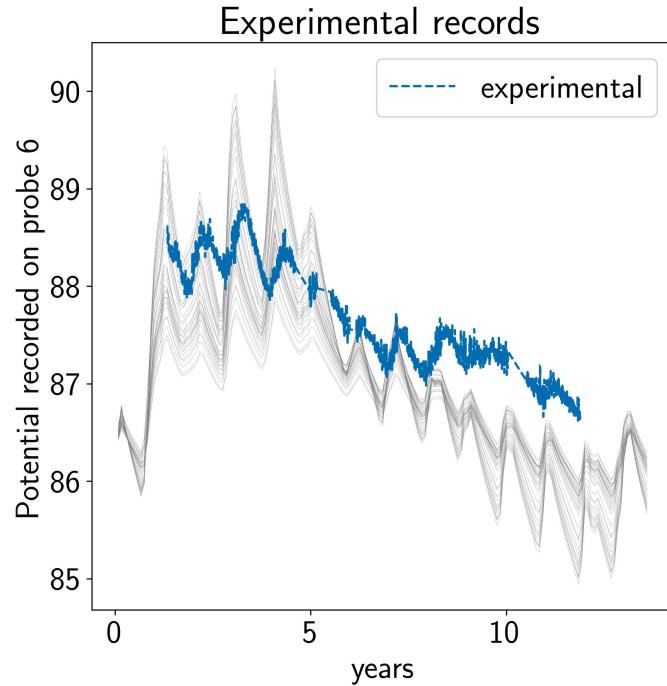


Figure from 5 :  
Sugumar 2020,  
*Petroleum and Coal*

# Thank you for your attention

Contact :

[gillien.latour@toulouse-inp.fr](mailto:gillien.latour@toulouse-inp.fr)