Which data assimilation method and data source for a multi-compartment hydrology/water quality model? Application on the PESHMELBA model in a small agricultural catchment

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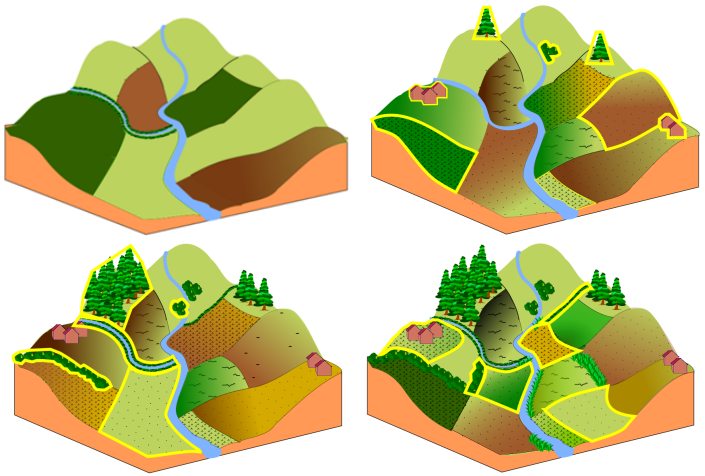
Introduction

Development of the **PESHMELBA** model (Rouzies et al. 2019) to simulate pesticide transfers and fate on small agricultural catchments

- ✓ Simulations of heterogenous landscapes (plots, vegetative filter zones, hedges, ditches and rivers)
- ✓ Modular structure to explore landscape management scenarios (decisison-making tool)



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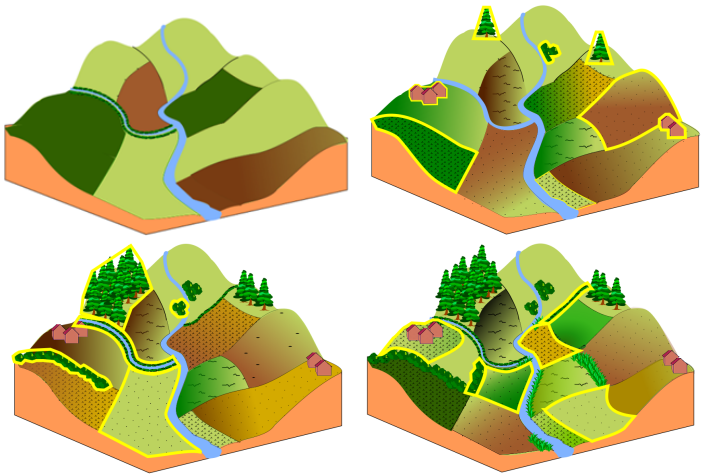

How to reduce uncertainties on PESHMELBA outputs ?
⇒ Development of a data assimilation framework to integrate different data sources

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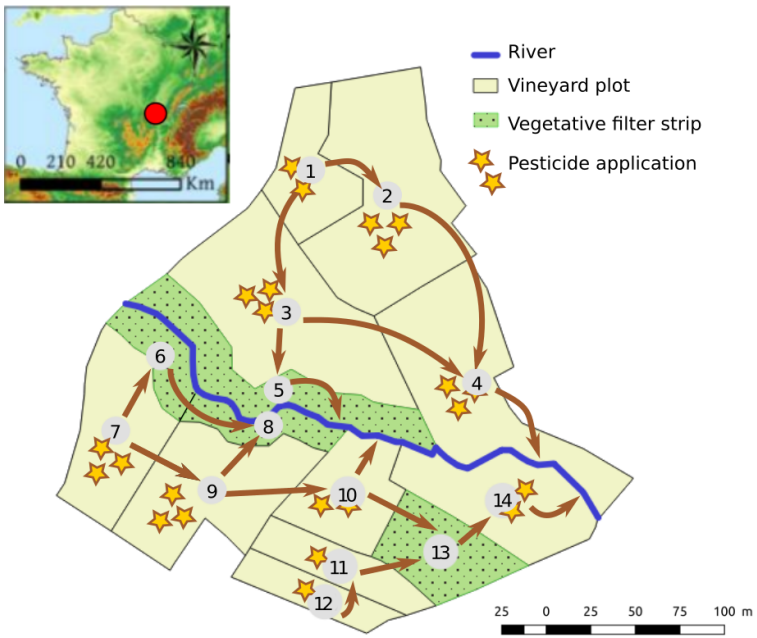
Case study

Virtual simplified catchment inspired from La Morcille catchment (Beaujolais region, France)



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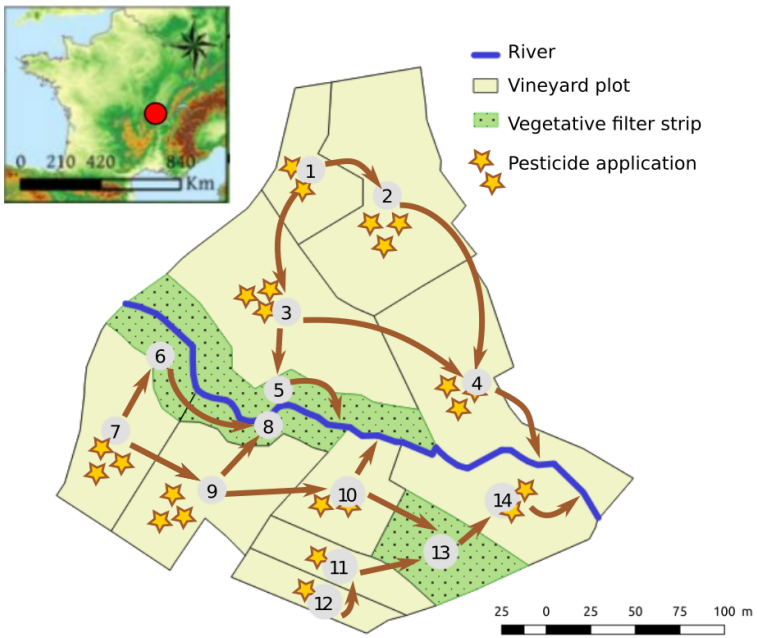
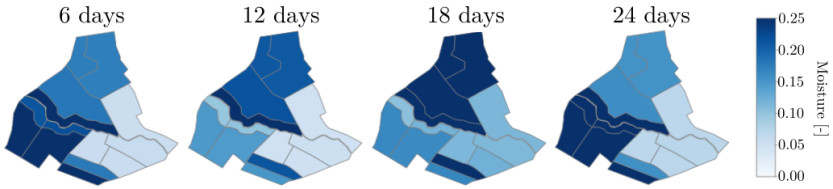
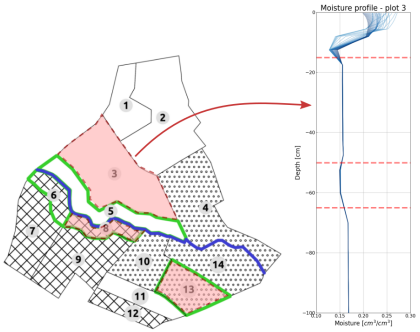


Data sources (virtual) available:

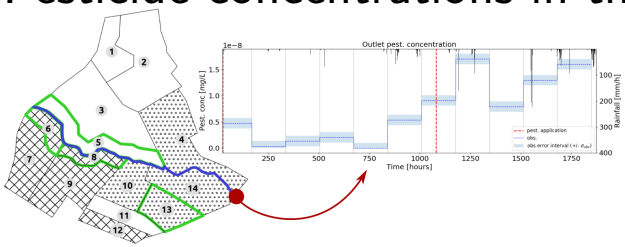
✓ Surface moisture images (radar)



✓ Ponctual vertical moisture profiles (EMI)

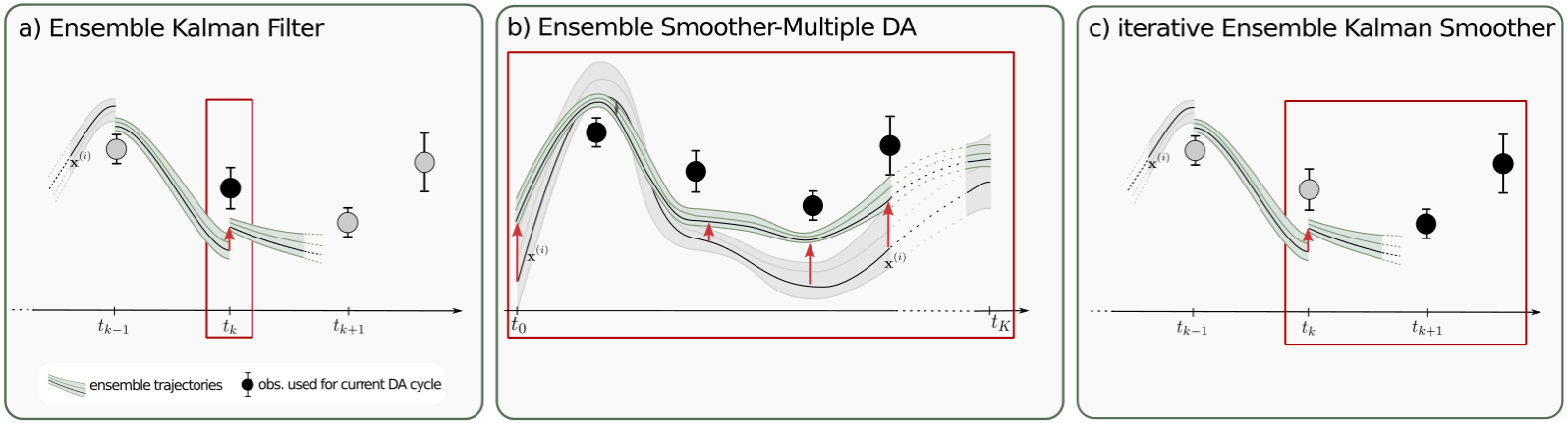


✓ Pesticide concentrations in the river



Comparison of DA methods

Assimilation of surface moisture images to correct vertical moisture profiles (freq=6 days) and comparison of 3 DA methods:



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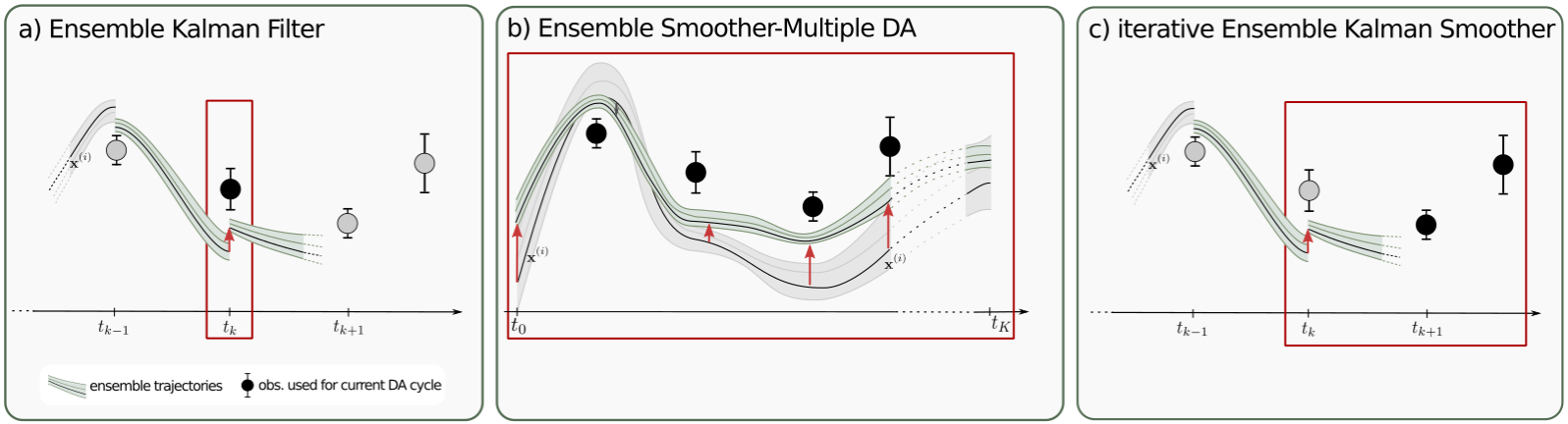
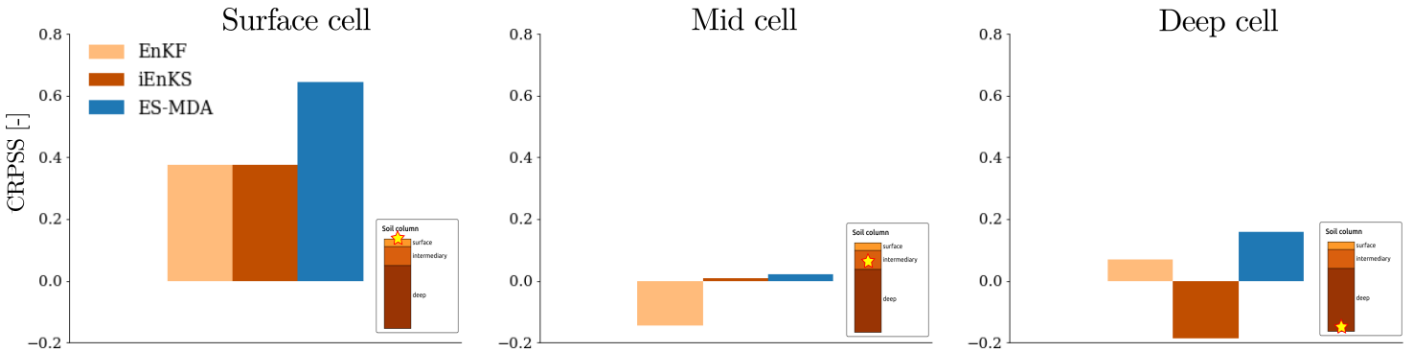


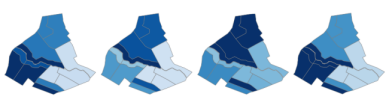


Catchment-averaged CRPSS score (the closer to 1, the better DA performs) of each DA method to correct surface, intermediate and deep moisture.

The b) ES-MDA best improves surface moisture estimates **but** no strong effect of DA to correct deeper moisture.

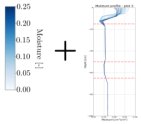
Multi-source assimilation

DA based on b) ES-MDA + Integration of other sources of data



Surface moisture from radar

+



moisture profile

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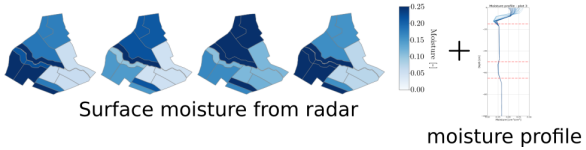

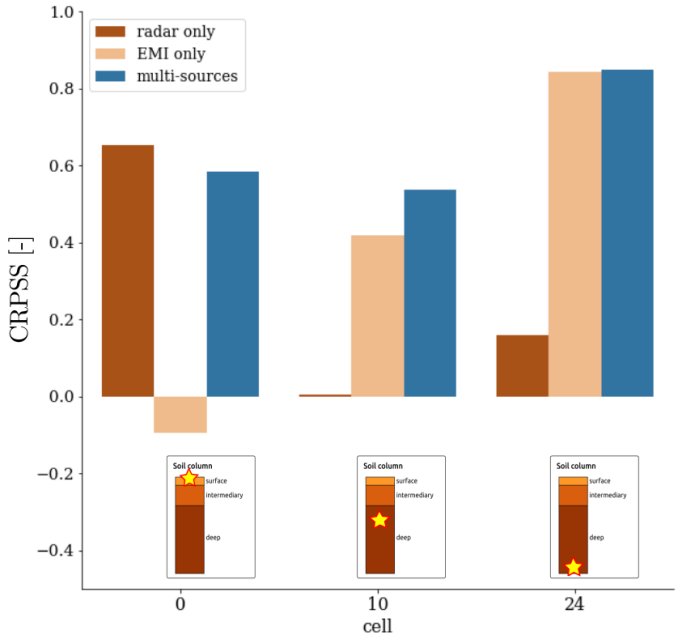

...**but** no effect to improve simulation of pest. concentration at the outlet

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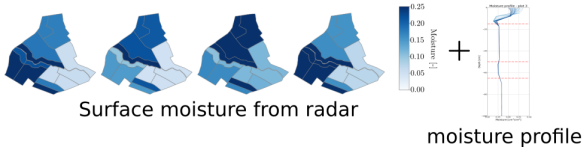

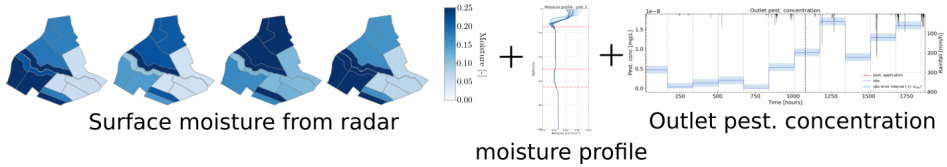

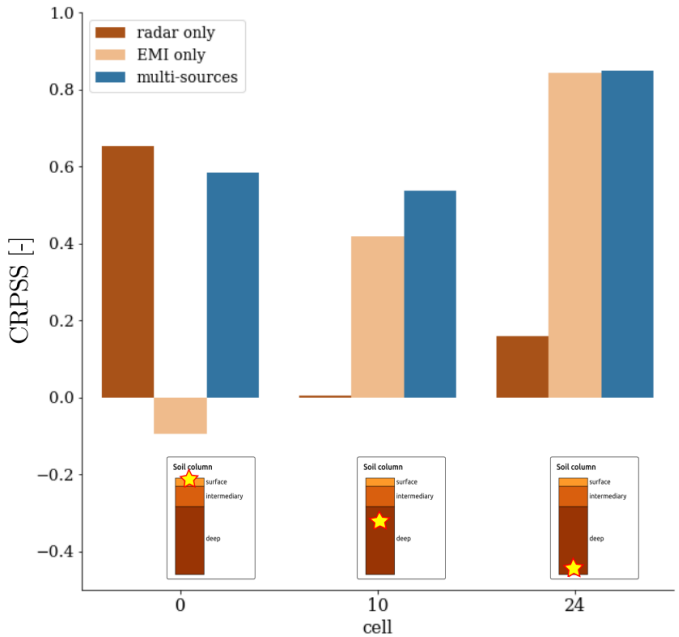

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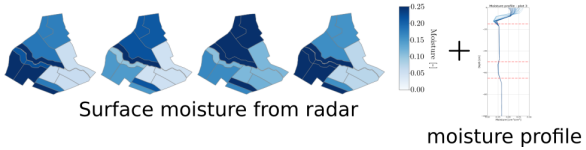

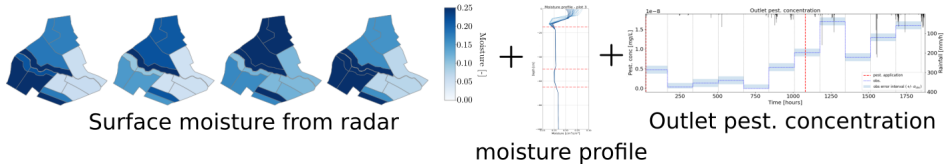

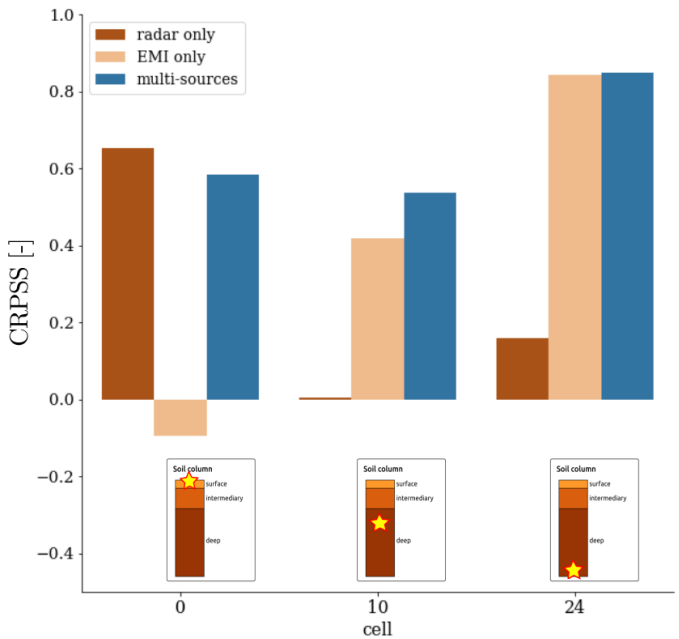

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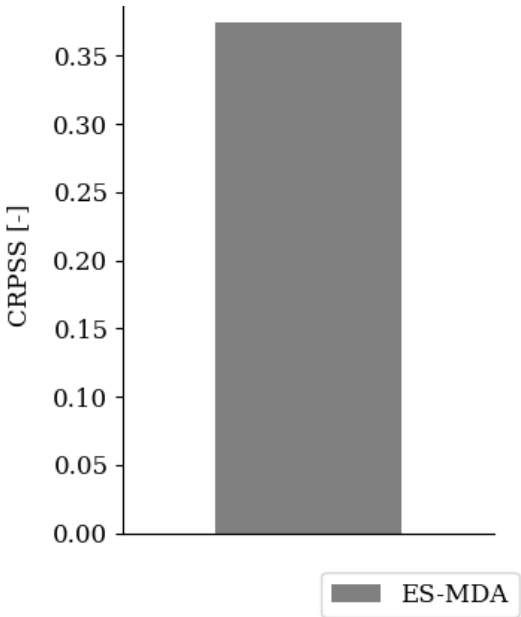

Catchment-averaged CRPSS score (the closer to 1, the better DA performs) on outlet pest. concentration

⇒ inclusion of pesticide observation necessary to improve simulation of pest. concentration at the outlet

Conclusion

- ✓ DA framework set for pesticide transfer model PESHMELBA
- ✓ Ensemble Smoother with Multiple Data Assimilation identified as most efficient method for this case study
- ✓ Correction from a compartment hard to propagate to other compartments:
  $\Rightarrow$ need for various data sources

$\Rightarrow$ Paves the way for future applications of DA at the scale of a real catchment

Thank you !

Any question ? Contact: emilie.rouzies@inrae.fr