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## **ARPEGES, A METHOD TO ASSESS THE RISK OF SURFACE WATERS CONTAMINATION BY PESTICIDES AT THE NATIONAL SCALE**

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### **Summary**

Arpeges is an innovating and coherent method to assess the potential surface water's contamination by pesticides at the national scale. In France, it was implemented at Water Framework Directive water bodies' scale. The objectives are to identify of vulnerable zones and to determinate the main risk factors implied in pollution transfer according to the considered zones. Actually, this method allows a better understanding and a ranking of pollution's causes considering three essential aspects of the contamination: uses, environmental vulnerability to pesticides pollution and substances properties. The method is mostly based on transfer processes. In order to take into account the seasonal temporal variability, analyses are separately carried on winter and summer, and both acute and chronic approaches of the risk are considered. The segregation between these two risks is built on the different processes transfer times to reach surface waters. 18 relevant variables describing pesticides transfer are chosen (infiltration, pedology, drainage, climate, buffer zones...); they are aggregated according to up to date expert knowledge thanks to a Bayesian network to obtain pesticides contamination. This tool allows associating an uncertainty factor to each result and contributing to increase the adaptability of the method. Intermediary results as environmental vulnerabilities are relevant to identify the main causes of transfer.

### **Introduction**

Awareness about pesticides contamination of freshwater is rising and measures to control it have been taken. At the European level, the Water Framework Directive implementation requires a coherent method to assess water bodies' status. In this context, the Arpeges method [1] was created to explore the potential surface water's contamination by pesticides at a national scale. It allows an identification of vulnerable zones and a first determination of main risk factors in chemicals transfers.

### **Materials and methods**

The method proposes better knowledge and a ranking of pollution causes considering three essential aspects of the contamination: uses, environmental vulnerability to pesticides transfer and chemicals properties. It is essentially based on the understanding of pesticides transfer dominant processes. In order to consider temporal variability, analyses are separately carried on winter and summer, both with an acute and a chronic risk approach. The segregation between the two risks is built on the different processes transfer times to reach surface waters. 18 relevant variables describing pesticides transfer are chosen (infiltration, pedology, drainage, climate, buffer zones...); they are aggregated according to up to date expert knowledge thanks to a Bayesian network [2] to obtain pesticides contamination. The method is designed for the cocktail of molecules applied on the water body's basin. The following graph shows a summary of the method:

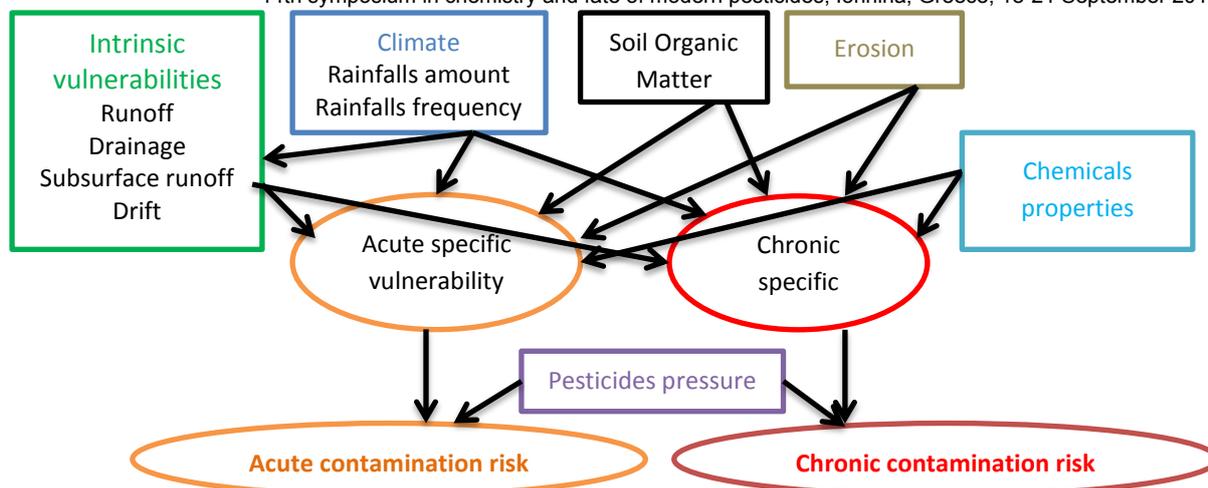


Figure 1 : Scheme of the global aggregation of the Arpeges variables

## Results and discussions

Intermediary results as the maps of the environmental vulnerabilities are useful to understand causes of chemicals transfers. The final result discriminates water bodies status, as shown on figure 2. This method considers the different pesticides transfer processes and the relative environmental vulnerability which is an important determinant for risk assessment but rarely taken into account at the national level.

### Chronic contamination risk during winter season

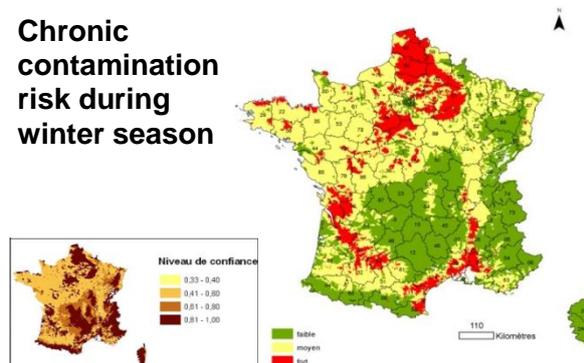


Figure 2 : Chronic contamination risk by pesticides in winter

It was created to be coherent on large scale to discriminate zones. Furthermore, the probabilistic approach allows associating an uncertainty factor to each result and increasing the adaptability of the method. It has not been validated towards contamination observations in water bodies, but some French experts confirm results are consistent with the local knowledge. A current weakness of the final risk maps is the data available and used so far to take into account pesticides pressure. Actually, for this variable accurate and spatialized data for large scales are not available yet.

## Conclusion

The Arpeges method is a homogeneous risk assessment of pesticides water contamination by pesticides. In order to validate this method we are currently working on a one by one molecule approach to avoid the cocktail approach uncertainty. We are thus implementing a comparison with monitoring data, recorded since 97.

## Acknowledgements

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## References

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