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Peshmelba : a spatially explicit model to decipher the relative importance of agricultural practices versus landscape arrangement on pesticide transfers.

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Abstract: Pesticide transfers are a big threat for aquatic ecosystems and freshwater quality. These chemicals originate mainly from agricultural areas where they are applied, resulting in a diffuse but persistent pollution of water bodies. These transfers are highly influenced by the landscape organization and by the choices made regarding pesticide applications. Ditches, tile drainage or roads often act as shortcuts to transfer pesticides whereas hedges, vegetative filter strips, artificial wetlands or riparian zones can efficiently retain and degrade these pesticides before they reach the streams.

We hypothesized that this complex, spatial landscape arrangement coupled to discrete human choices regarding pesticide application is key to represent pesticide exports at the catchment scale. We developed Peshmelba model to explicitly represent the spatial arrangement of different landscape elements. Peshmelba continuously models the dynamic connections between these elements, which are intrinsically linked to their water content repartition. It also takes into account pesticide application and root extraction from different land cover. Dominating processes for each compartment are built in different modules, constituting the building blocks of the model. They are then coupled in OpenPALM, a devoted open-source coupler. This modularity facilitates scenario generation to explore the sensitivity of pesticide transfers to different spatial organization and agricultural practices.

We applied the model on a 1km² agricultural and contrasted catchment, located in Brittany (France). Downstream, the catchment is constituted of small plots surrounded by hedges, whereas land consolidation with hedges removal has been carried upstream. Besides, pesticides application and export have been monitored for 10 years. Preliminary results show the importance of agricultural practices avoiding applications when soil wetness is close to saturation as well as the critical role of hedges which retain pesticides on lands. This demonstrates that Peshmelba is a promising tool to assess both landscape organization and agricultural practices impacts on pesticides exports to aquatic ecosystems.

Keywords: *Pesticide Transfers; Spatialized modeling; Human interaction; Landscape scenario*