PestLCI - a model for estimating field emissions of pesticides in agricultural LCA

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Life cycle assessment (LCA) involves assessment of resource consumption and emissions caused by the provision of a given service over the whole life cycle of the products it involves, from the cradle to the grave. The quantification of exchanges with the environment during the life cycle of a product or service is a specific element of LCA termed life cycle inventory (LCI). Estimation of chemical emissions in agricultural LCA is typically based on standard emission factors which at best are determined by a few physical-chemical substance properties and the use scenario of the chemical compound. Dynamic and realistic models capable of predicting compartment specific mode of entry fractions for various chemicals and uses under specific temporal and use circumstances are scarce. This lack of appropriate models to estimate emission fractions results in a lower accuracy when accounting for one of the major corner stones in any LCA, chemical emissions, and it inevitably influences the outcome of the impact assessment, where the environmental impacts are normally assumed proportional to the emissions in LCA.

PestLCI is a modular model for estimation of pesticide emissions from field application to the different environmental compartments. It estimates the fractions of the applied quantity which is emitted to the air, surface water, and groundwater compartment based on information which will normally be available to the model user about: type and time of application, crop species and development stage, geological and meteorological conditions and the area of application, and properties of the active ingredients of the pesticide. The use and capability of the model is illustrated through two realistic Danish case studies, but the modular structure of the model will allow adaptation to conditions valid for other regions of the world.

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