Risk assessment for pesticide contamination of groundwater with sparse available data

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The contamination of water resources by agrochemicals is recognized in industrial countries as a very important environmental problem, nevertheless in the most of developing and threshold countries the risks for health and environmental problems are not considered. In these countries agrochemicals, which are forbidden since several years in Europe (e.g. atrazine), are still in use. In some threshold countries monitoring systems are already installed for nutrients (e.g. N, P) and also a few for heavy metals, but so far the contamination by pesticides is hardly ever controlled, thus normally there is no data available about pesticide concentrations in soil, as well as in water.

**Motivation**

A new approach for pesticide contamination risk is developed by performing contamination risk maps that show the areas with high potentials for a contamination by pesticides. These maps should be used to initiate a systematic monitoring of the groundwater and surface water resources, as well as to increase the awareness of the farmers for the risk of contamination of the water resources and the environment, including health problems. The aim is to achieve a reduction of the application of contaminating pesticides, especially in areas of high risk for the contamination of water resources.

In a first step simulation models were applied at two study areas in Chile and Argentina, for instance PESTAN (US EPA), to calculate the fate of nutrients and pesticides to the groundwater.

The results of PESTAN have shown the risk of contamination by pesticides, nevertheless to analyze the impact on the water resources, especially for the groundwater, it is required to evaluate the risk at the basin scale, or at least at a sub-basin scale, therefore an index for pesticide contamination risk is been developed.

The index is calculating the leaching of pesticides for each soil layer.

The actual infiltration rate is calculated by a balance of precipitation, irrigation, runoff, evapotranspiration and other losses and is limited by the maximal infiltration rate.

The input data is prepared in GIS maps at the basin or sub-basin scale, additional data should be inserted in a data base for precipitation, irrigation and pesticide application. The index is calculating the contamination risk for groundwater and surface water in each raster cell of the GIS maps and the results are visualized with GIS by producing risk maps.

**Results**

The results of the simulation models, like PESTAN, show that there are potentials for the contamination of the water resources, especially by atrazine. The first results of the new pesticide contamination risk approach at the basin scale are showing also the high risk of the contamination for the groundwater as well as for the surface water. Especially the results for atrazine show the need for action by initiating an appropriate monitoring for the control of the agrochemical contamination in these areas.

On this account the findings should be used by local researchers to improve the knowledge and the awareness of farmers and other stakeholders (e.g. water agencies, drinking water supply companies) about the contamination of the water resources by pesticides, especially to promote a reduction of the application in the highest risk areas.

**Methods**

A new approach for pesticide contamination risk is developed by performing contamination risk maps that show the areas with high potentials for a contamination by pesticides. These maps should be used to initiate a systematic monitoring of the groundwater and surface water resources, as well as to increase the awareness of the farmers for the risk of contamination of the water resources and the environment, including health problems. The aim is to achieve a reduction of the application of contaminating pesticides, especially in areas of high risk for the contamination of water resources.

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**Previous Publications**


**Figure 1:** Leaching of different pesticides for a soil profile in Argentina

**Figure 2:** Variables of the pesticide contamination risk index

The soil moisture of each layer is been filled up to the field capacity, before the water is starting to flow into the next soil layer. The leaching of the pesticide is calculated in dependence of the solubility and the sorption capacity that has a strong relation to the organic carbon content of the soil.