A probabilistic approach to exposure assessment for downwind deposits of spray drift

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A PROBABILISTIC APPROACH TO EXPOSURE ASSESSMENT FOR DOWNWIND DEPOSITS OF SPRAY DRIFT

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Deposition of spray drift onto surface waters is a major cause for the risk of exposure to pesticides for aquatic organisms. This risk is particularly high for surface waters alongside pome fruit orchards, where pesticide sprays are applied in a sideways or an upward direction. Recently a spray drift model has been developed to estimate pesticide deposits onto downwind off-target areas next to fruit orchards. Using this spray drift model, an exposure assessment model has been developed to estimate risk of exposure to pesticides for aquatic organisms in edge-of-field watercourses next to pome fruit orchards in the Netherlands. For arable crops, typically, the risk of exposure is much less, considering pesticide concentrations in the edge-of-field watercourse. However, the total area for arable crops is much higher than that for fruit orchards.

This paper describes the probabilistic processes concerning the countrywide risk assessment using a exposure model for one field and one ditch. Spatial and temporal variables are distinguished. Spatial variables include regional distributions of orchards and different types of watercourses, various water levels and continuously varying growth stages during the year. Temporal variables include frequency distributions of wind speed and direction and ambient temperature. 90% risk levels of predicted environmental concentrations (PEC) in surface water can be determined for various spray application schemes including multiple spray applications during a year. In an extensive simulation study the PECs in the watercourses were computed for all possible spatial configurations. A spatio-temporal statistical analysis on these simulations resulted in a quantitative risk assessment for a representative set of spray application schemes. Various model features (including drift mitigation, crop-free zones) result in a versatile exposure assessment model with a high level of realism.

The spray drift deposits onto the water surface can be used as input for models describing the fate of pesticides in the watercourses. In this way, a realistic simulation study on the exposure to and fate of pesticides in surface waters can be performed to quantify exposure risk levels for aquatic organisms. The countrywide exposure risk model supports higher-tier assessment studies for the authorization of plant protection products.