Geophysical Research Abstracts
Vol. 15, EGU2013-10827, 2013
EGU General Assembly 2013

Storm-driven pesticide dynamics in a catchment system

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Loss of pesticides from agricultural land in runoff and subsurface flow during rainfall events poses a significant concern for water quality, with adverse effects on drinking water and aquatic life. Pesticide mobilisation and transport is affected by runoff and erosion processes which leads to different flow pathways and pesticide residence times in a catchment. In the soil and sediment environment pesticides can be a significant component of surface water contamination because of their persistence in soil and sediment and that they have a tendency to desorb back into water over time.

A lowland agricultural catchment upstream of a drinking-water supply reservoir in the South West of England is being used to investigate pesticide dynamics at the catchment scale during individual storm events. Pesticide concentration in water and suspended sediments were determined from samples taken at incremental changes in stream flow incorporating both rising and falling river levels. The study aims to determine the relative partitioning of pesticides transported in the dissolved phase or adsorbed to sediment. Analyses of soil, sediment and water from across the catchment aids understanding of the interaction between different media and can be used to determine the importance of dissolved and sediment-bound pesticide dynamics during individual storm events.

Initial results imply that processes of transport and desorption are occurring in both soils and river and reservoir sediments which are likely to be an important factor for timing of pesticide movement. This suggests soil and sediment are acting as a sustained source of contamination to surface water. However; interactions between these different media are complex. Investigation of the molluscicide metaldehyde, showed this to be present in stream water at concentrations greater than 0.1 μg μl-1 nine months after application.

Storm event analysis shows peak pesticide concentration in the stream to coincide with storm hydrograph peaks indicating pesticides are moved directly from hillslopes to the fluvial environment by surface runoff. During storm events, individual pesticide concentrations in streams were found to be greater than 2 μg μl-1 in the dissolved phase. Depending on the compound chemical properties, some pesticides can also be transported adsorbed to sediments. Together, these processes generate elevated concentrations of pesticide in surface water systems and cause contamination by transport and deposition of pesticides in the lower reaches of the catchment.