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CONTAMINATION OF DRINKING WATER SUPPLY WELLS BY PESTICIDES FROM SURFACE WATER SOURCES

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Summary. Drinking water wells are often placed near streams because streams often overly permeable sediments and the water table is near the surface in valleys and so pumping costs are reduced. However, streams can be a threat to the quality of the water drawn from these wells. Previous studies have examined the hydraulic connection between wells and surface water. Here that work is extended through the development of a model that is designed to examine contaminant transport from streams to drinking water wells pumping from underlying aquifers. The model considers groundwater flow forced by recharge, regional groundwater flow, and stream boundary conditions. The model is configured to consider various geologic settings including fracture transport in clays and short circuiting down well casings. Contaminant transport includes sorption and degradation processes. The governing equations are solved using the software Multiphysics, which provides finite element solutions to a user defined set of partial differential equations.

The model is applied to examine the transport of pesticides to drinking water wells from surface water bodies. Two pesticides are considered: an older pesticide MCPP which is mobile and non degradable; and glyphosate (Roundup) a newer biodegradable and strongly sorbed pesticide. With a given surface water contaminant concentration, the extent of pesticide contamination at the wells is determined. Travel times and dilution/attenuation rates are calculated. Statistics on the geology and the placement of water supply wells are employed to determine the likely extent of pesticide contamination of drinking water from surface water sources in Denmark. Global sensitivity analysis employing Monte Carlo simulations and the method of Morris is used to identify dominant model parameters. Specific examples from Denmark are used to provide perspective on results and the implications for drinking and surface water management are discussed.