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Soil erosion is a major environmental problem in agricultural regions of Europe, where it leads to both on-site and off-site impacts. Sediment is also a preferential vector of contaminants, such as metals and radionuclides. The Chernobyl power plant accident that occurred on 26 April 1986 led to a particularly strong contamination of soils in Cs-137 (half life of 30 years) in several European regions, and particularly in the so-called "Plavsk contamination hostpot" located in Western Russia. Concentration of radioisotopes in sediment accumulated in the river valleys of this region constitutes a major potential threat for public health. The Lokna river drains a 182 km² strongly contaminated and ungauged cultivated catchment. We used a runoff and erosion model to understand and quantify sediment transfer across the cultivated landscape of this catchment after 1986. LANDSOIL is an event-based and spatially distributed model that requires several input data regarding land cover, farming practices and rainfall. Soil and vegetation characteristics were derived from Landsat imagery, and we used a World View image to extract tillage directions within the catchment. Rainfall scenarios were reconstructed by combining local and regional available data. Model simulations show the dominance of tillage erosion in this catchment. Significant water erosion only occurs after heavy storms. To validate the model outputs, we propose to combine results from a USLE-based model, Cs-137 inventories and sediment fingerprinting. Overall, we show the useful contribution of remote sensing data to model erosion in regions characterized by the lack of GIS databases and monitoring networks.