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Impact of land use, soil and DEM databases on surface runoff assessment with GIS decision support tool: A study case on the Briançon vineyard catchment (Gard, France)

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Runoff and associated erosion represent a primary mode of mobilization and transfer of pesticides from agricultural lands to watercourses and groundwater. The pesticides toxicity is potentially higher at the headwater catchment scale. These catchments are usually ungauged and characterized by temporary streams. Several mitigation strategies and management practices are currently used to mitigate the pesticides mixtures in agro-ecosystems. Among those practices, Stormwater Wetlands (SW) could be implemented to store surface runoff and to mitigate pesticides loads. The implementation of New Potential Stormwater Wetlands (NPSW) requires a diagnosis of intermittent runoff at the headwater catchment scale. The main difficulty to perform this diagnosis at the headwater catchment scale is to spatially characterize with enough accuracy the landscape components. Indeed, fields and field margins enhance or decrease the runoff and determine the pathways of hortonian overland flow. Land use, soil and Digital Elevation Model databases are systematically used. The question of the respective weight of each of these databases on the uncertainty of the diagnostic results is rarely analyzed at the headwater catchment scale. Therefore, this work focused (i) on the uncertainties of each of these databases and their propagation on the hortonian overland flow modelling, (ii) the methods to improve the accuracy of each database, (iii) the propagation of the databases uncertainties on intermittent runoff modelling and (iv) the impact of modelling cell size on the diagnosis. The model developed was a raster approach of the SCS-CN method integrating re-infiltration processes. The uncertainty propagation was analyzed on the Briançon vineyard catchment (Gard, France, 1400 ha). Based on this study site, the results showed that the geographic and thematic accuracies of regional soil database (1:250 000) were insufficient to correctly simulate the hortonian overland flow. These results have to be weighted according to the soil heterogeneity. Conversely, the regional land use (1:50 000) provided an acceptable diagnostic when combining with accurate soil database (1:15 000). Moreover, the regional land use quality can be improved by integrating road and river networks usually available at the national scale. Finally, a 5 m modelling cell size appeared as an optimum to correctly describe the landscape components and to assess the hortonian overland flow. A wrong assessment of the hortonian overland flow leads to a misinterpretation of the results and affects effective decision-making, e.g. the number and the location of the NSPW. This uncertainty analysis and the improvement methods developed on this study site can be adapted on other headwater catchments characterized by intermittent surface runoff.