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Accounting for pothole associated non-contributing area in the Canadian Land Surface Scheme

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A significant part of the Canadian prairies is covered by potholes. Connectivity between potholes varies with time, thereby varying the surface storage and thus the runoff contributing area. Despite its importance, these features are not explicitly represented in many land surface schemes, used in climate models. In this study, the Canadian Land Surface Scheme (CLASS), which is used in the Canadian regional and global climate models, is modified for the treatment of these pothole regions. The proposed scheme allows dynamic contributing areas to be quantified based on the relationship between potential surface storage and contributing area at the grid cell level, which is non-linear. This is extracted from DEMs using a grid-based simulation model. The impact of these modifications on the regional hydrology is assessed by comparing two offline simulations, performed with the original and modified versions of CLASS, driven by atmospheric forcing data from the European Centre for Medium-Range Weather Forecasts (ECMWF) reanalysis (ERA-Interim), for the 1980-2011 period, over the pothole region of the Canadian prairies. Results suggest statistically significant decreases in surface runoff, during the spring seasons, for the simulation with the modified scheme, compared to the original version of CLASS. The streamflows in this simulation is in better agreement to those observed. This study thus demonstrates the importance of non-contributing area in land surface models for realistic simulation of hydrological processes.