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A global Bayesian sensitivity analysis of the 1d SimSphere SVAT model using the GEM-SA software

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Sensitivity analysis consist an integral validatory check of an all-inclusive validation of any multi-level code computer simulation model before the latter is used in performing any kind of analysis of operation, particularly so if a model is going to be used on an operational basis.

A software platform/tool called GEM SA developed for performing a global sensitivity analysis (GSA) adopting the Bayesian theory is tested herein in the 1d SVAT model SimSphere with the aim to identify the most responsive model inputs, detect their interactions and derive absolute sensitivity measures concerning the model structure. The present study represents the first implementation of a global sensitivity analysis (GSA) method in SimSphere whereas the method presented here can be potentially adopted and applied to other simulation models including SVAT models. This study is very timely in terms of the overall validation of the model, considering that its use was recently proposed in modelling methodology for the operational retrieval of surface moisture content by National Polar-orbiting Operational Environmental Satellite System (NPOESS) and NASA in a series of satellite platforms scheduled to be placed in orbit in the next 12 years starting from 2009.

The employed GSA method was found capable of identifying the most responsive model inputs and also of capturing the key interactions structure between the model inputs in the simulation of each of the target quantities on which the GSA was conducted. The dominant input parameters which were found to consistently control the predictions of the considered outputs by the model were the topography parameters (slope, aspect) as well as the fractional vegetation cover and surface moisture availability. The implications of these findings for the use of the model are also discussed.

Keywords: *SimSphere, BACCO GEM-SA, SVAT model, sensitivity analysis, Gaussian process emulator*