Hydrol. Earth Syst. Sci. Discuss., 9, C4027–C4029, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C4027/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Local sensitivity analysis for compositional data with application to soil texture in hydrologic modelling" *by* L. Loosvelt et al.

Anonymous Referee #1

Received and published: 28 August 2012

The paper presents a methodology for performing a sensitivity analysis with compositional data, and applies it to quantify sensitivity of simulated soil moisture content to changes in soil texture using the TOPLATS hydrological model.

Overall I enjoyed reading this paper. It is well written, the methodology is clearly explained, and the results are interesting.

My main comment relates to the need for additional discussion on the following points:

- generality of results: can the results be generalized to other PTFs, hydrological models, or even other parameter values of the same model? For example, it seems the

TOPLATS makes the relatively strong assumption of moisture equilibrium above the water table, then what do the results imply for more general unsaturated flow models?

- other uncertainties: the computed sensitivity values are classified from very high or low (P8863, L20-25); how to these values compare to other model uncertainties? Some discussion is needed to put these results into broader perspective of other model uncertainties (e.g. accuracy of the PTFs, which is not mentioned), also in the context of using the results for guiding sampling strategies (section 3.2).

Other comments:

- P8842, L18-19: this sentence sounds very cryptic, try to reformulate

- P8842, L25: not clear what is meant here by "standard statistical methods"; the dirichlet distribution handles compositional data and is quite standard.

- P8846, L21: it would be good to give more details about how moisture is computed in the model. This sentence implies that moisture is assumed at equilibrium above the water table, if so please state this explicitly. That means that soil moisture sensitivities are directly determined by the retention curve (as modeled by the PTFs) and depth of the water table (vertical location on the retention curve). This is important information for interpretation of the results (see also comment above about generality of the results).

- P8847, L9-10: I suggest removing quotes from accuracy and reliability

- P8847, L13: please explicitly list the PTFs that were used in this study

- P8847, L17: particle density of 1.4 seems much too low, for example quartz has density around 2.6

- P8848, L6: please list the model parameters and their values

- P8848, L10-12: for completeness, specify how far these meteo stations are from the basin

- Eq. 8: the "omnidirectional" sensitivity index is computed using only three directions (M=3). Can you justify this? Did you do computations with M>3?

- Eq. 9: why take absolute values of the sensitivity functions? Don't you want to estimate curvature here, which should be small for the first-order analysis to be accurate.

- figure 4a: x-axis values are not clear

- figure 9: typically, porosity of sand is less than that of clay, so which soil types to the curves represent in this figure?

- figure 9: the y-axis is mislabeled as "hydraulic head", it should be suction or capillary pressure head.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 8841, 2012.