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Hydrology and Earth System Sciences Discussions

Interactive comment on "Coupling the modified SCS-CN and RUSLE models to simulate hydrological effects of restoring vegetation in the Loess Plateau of China" *by* G. Y. Gao et al.

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Short Comments

I enjoyed reading the paper by Gao et al. and I believe that the coupling of simple rainfall-runoff (as Soil Conservation Service - Curve Number, SCS-CN) and erosion (as Universal Soil Loss Equation, USLE) models is a good approach for the estimation of event soil loss. In fact, potentially, it can provide a simple tool to be applied in different regions and climates. Moreover, I fully agree with the authors that the soil

moisture conditions prior the rainfall events play a significant role for the estimation of runoff and, hence, erosion.

It is just for this reason for which I decide to post this (very) short comment that mainly deals with the hydrological part (SCS-CN method) of the paper. The method used by the authors to incorporate the Antecedent Moisture Conditions (AMCs) in the SCS-CN method is not clear. Basically, the antecedent 5-day rainfall, P_5, is used as indicator of the antecedent soil moisture conditions but (if I well understood) it is employed both for M estimation (equation (9)) and for modulating the CN_I and CN_{III} values (equations (16) and (17)). So, AMCs are updated continuously through equation (9) and with sudden jumps through equations (16) and (17).This procedure seems to me quite confusing. Moreover, by reading the paper results it can't be understood which is the effect of different AMCs for the rainfall-runoff events analyzed. For instance, how do the AMCs vary from event to event? Is this variability significant for runoff estimation? This is one of the main aspects of the paper but it is only marginally considered in the description of the results.

Additionally, there are several studies that attempted to incorporate actual soil moisture observation for the direct estimation of the Soil Potential Maximum Retention parameter, S, in the classical formulation of the SCS-CN method by assuming a simple linear relation (*Brocca et al., 2009a*) that is more clear of the approach used in the paper. In particular, the use of in situ (and modelled) soil moisture observations have been compared with the other indices based on antecedent rainfall, initial discharge and groundwater table for the estimation of S (*Brocca et al., 2009a*; *Tramblay et al., 2010*; *Tramblay et al., 2011*; *Coustau et al., 2012*). Additionally, satellite-derived soil moisture observations have been also employed for this purpose (*Brocca et al., 2009b; 2011b*; *Beck et al., 2010*). In all these studies the common aspect is that actual soil moisture observations (by in situ and remote sensing measurements) are the best indicators of the catchment wetness conditions providing a significant improvement for runoff estimation through the SCS-CN method. Based on that, the linear relation has been also

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incorporated in a continuous rainfall-runoff model (*Brocca et al., 2010; 2011a*) to obtain a low parameterized but reliable modelling tool aimed at flood simulation.

I believe the authors could try to test this simple approach in their study thus obtaining, in my opinion, more robust and easy to understand findings.

Reference

Beck, H.E., de Jeu, R.A.M., Schellekens, J., van Dijk, A.I.J.M. and Bruijnzeel, L.A (2010) Improving Curve Number based storm runoff estimates using soil moisture proxies. *IEEE J. Sel. Top. Applied Earth Observation and Remote Sensing*, 2(4), 1939-1404.

Brocca, L., Melone, F., Moramarco, T., Morbidelli, R. (2009a). Antecedent wetness conditions based on ERS scatterometer data. *Journal of Hydrology*, 364 (1-2), 73-87, doi:10.1016/j.jhydrol.2008.10.007.

Brocca, L., Melone, F., Moramarco, T., Singh, V.P. (2009b). Assimilation of observed soil moisture data in storm rainfall-runoff modelling. *Journal of Hydrologic Engineering*, 14 (2), 153-165, doi:10.1061/(ASCE)1084-0699(2009)14:2(153).

Brocca, L., Melone, F., Moramarco, T., Wagner, W., Naeimi, V., Bartalis, Z., Hasenauer, S. (2010). Improving runoff prediction through the assimilation of the ASCAT soil moisture product. *Hydrology and Earth System Sciences*, 14, 1881-1893, doi:10.5194/hess-14-1881-2010.

Brocca, L., Melone, F., Moramarco, T. (2011a). Distributed rainfall-runoff modelling for flood frequency estimation and flood forecasting. *Hydrological Processes*, 25 (18), 2801-2813, doi:10.1002/hyp.8042.

Brocca, L., Melone, F., Moramarco, T., Wagner, W. (2011b) What perspective in remote sensing of soil moisture for hydrological applications. In: C.M.U. Neale, A. Maltese, K. Richter (Eds), Remote Sensing for Agriculture, Ecosystems, and Hydrology XIII, *Proc.*

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of SPIE, Vol. 8174, 81740A (12 pp), doi: 10.1117/12.898034.

Coustau, M., Bouvier, C., Borrell-Estupina, V., and Jourde, H. (2012) Flood modelling with a distributed event-based parsimonious rainfall-runoff model: case of the karstic Lez river catchment, *Nat. Hazards Earth Syst. Sci.*, 12, 1119-1133, doi:10.5194/nhess-12-1119-2012.

Tramblay, Y., Bouvier, C., Martin, C., Didon-Lescot, J.F., Todorovik, D. and Domergue, J.M. (2010) Assessment of initial soil moisture conditions for event-based rainfall-runoff modelling. *J. Hydrol.*, 380(3-4), 387, 176-187.

Tramblay Y., Bouvier C., Ayral P.A., Marchandise A. (2011) Impact of rainfall spatial distribution on rainfall-runoff modelling efficiency and initial soil moisture conditions estimation. *Natural Hazards and Earth System Sciences*, 11, 157-170. doi: 10.5194/nhess-11-157-2011.

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