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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Use of satellite and modelled soil moisture data for predicting event soil loss at plot scale" *by* F. Todisco et al.

Anonymous Referee #2

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General Comments: I have read the manuscript entitled "use of satellite and modeled soil moisture data for predicting event soil loss at plot scale" with great interest. The research tried to improve the rainfall and runoff erosivity index in the classical Universal Soil Loss Equation (USLE) to estimate event soil losses by using soil moisture data. Efforts have previously been made by modification of USLE equation (USLE-M; USLE-MM), however the models still experience shortcoming by overestimation (underestimation) of soil losses for low (high) erosive events (caused by lack of consideration of runoff). The authors considered the runoff by modifying eq. 3 to eq. 4 (Soil Moisture for Erosion Model (SM4E) by introducing soil moisture content that can easily be estimated compared to event surface runoff coefficient. This is of great scientific relevance for which this manuscript is written. However, the use of satellite soil

moisture products (level of soil moisture saturation) and the conversion to soil moisture content comes with uncertainties which the authors have not addressed. As presented by Kinnell (2014; 2015), soil moisture data (also from satellite) can be used to estimate event surface runoff. If rainfall intensity is known or precipitation for that matter (which can easily be measured) for certain storm period together with the catchment characteristics (curve number) and soil moisture, the event surface runoff can be accurately (and easily) be determined for different landscapes. I expected to authors compared these two approaches using the satellite based soil moisture data (locally validated using the water balanced approach) and possibly downscaled to appropriate (plot) scale. The authors cannot also run away from the inability of their model to predict well soil loss during high intensity summer (dry) event because it is directly influenced by the soil moisture conditions. The manuscript also dealt a lot on the comparison between satellite soil moisture vs modeled. For example the comparisons in Fig. 3 could have been useful if the comparison was between SM4E and USLE-M / USLE-MM model results. The results could have provided clearer explanation for the disparities in wet and dry periods than what is given in this manuscript. It's not convincing why the authors choose to use two sets of soil moisture data in the analysis. Another weakness of the manuscript is the lack of uncertainty analysis. The satellite based soil moisture data is subject to levels of uncertainty from the satellite product to the process of converting into root zone soil moisture data (using Soil Water Index, subject to calibration). And so is the soil moisture estimated from soil water balance model (involves calibration parameters). The robustness of the model performance presented is lacking. Specific comments: Pg 2952 line 7 & 14: provide additional description of satellite soil moisture & soil water index method used extensively (underlying mathematical formulations) and possible errors / uncertainties. Pg 2956, section 4.5 – The SM4E model should account for high intensity rainfall under low antecedent soil moisture during summer (dry) events. The soil infiltration capacity is an influencing factor that the authors need to consider. Pg 2960 line 14: 45% (37%) model performance - meaningful is the levels of uncertainty is presented Pg 2961 line 7 – 8: Not conclusively. Not supported by data

/ statistical analysis shown. Technical corrections: Pg 2946 line 24: Soil provides us with food, biomass and raw materials - is a mix of terminologies that mean the same Pg 2947 lines 27, 28, 29: sentence is long, and not clear. No clear distinction between process-based models and USLE / RUSLE Pg 2951 line 24: insert the year Pg 2953 line 3: check units for K. Show the units for L, S, C, P for consistency Pg. 2953 line 13 & 14: Shorten the sentence Pg 2954 line 2 – 5: not clear (re-write) Pg 2954 line 5: explain briefly what linear and power models Pg 2954 15 – 19: avoid long sentences Pg 2955 line 3 – 4: give the equations Pg. 2958 line 2 – 6: too long sentence Pg 2958 section 4.4 – Mix up of methodology and results. Pg 2960 line 1 – 9: not necessary Figure 4: maintain uniformity with figure 3 and edit captions Figure 5: split A and B References: Kinnell, P. I. A.: Modelling event soil losses using QREI30 index with RUSLE2, Hydrol. Process., 28, 2761–2771, 2014. Kinnell, P. I. A.: Accounting for the influence of runoff on event soil erodibilities associated with the EI30 index in RUSLE2, Hydrol. Process., 29, 1397–1405, 2015. COMMENTS ENDED.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 2945, 2015.