Dear Dr Panagos,

We sincerely thank you for your valuable comments on this manuscript. We have tried our best to incorporate all your suggestions. Detailed answers to the specific questions are given in the following paragraphs.

Comment 1: In the current study, the erosivity factor (R-factor) has high uncertainties. I am not in favor of functions which estimate erosivity based on annual of monthly rainfall values (you can see the low quality results with large pixels in R-factor). Currently there is an increasing availability of high temporal resolution rainfall data which allow to estimate rainfall erosivity according to the principles of USLE/RUSL/e. The recent publication and data availability of Global Rainfall Erosivity has demonstrated this and there are about 250 stations with measured R-factor in India.

Response 1: We agree that R factor estimated using high temporal resolution (sub – hourly) dataset based on the principles of USLE/RUSLE is better than that estimated using coarser resolution (monthly or annual) rainfall values. High-resolution rainfall datasets are available for the recent period (example R factor estimated in Global Rainfall Erosivity dataset for India uses hourly data of 250 rain gauges for 2007 – 2015). However, such high-resolution rainfall datasets are not available for the entire study period that starts from 1962 (selected as per the availability of sediment yield records). Since significant annual and decadal variability in the rainfall pattern exists over India, R factor estimated for the recent period may not be a true representative of the study period ranging from 1962 – 2008. Hence, we used IMD dataset for the study that are available at a spatial resolution of 0.25 degree for 1901 – 2013 based on more than 6,000 rain gauge stations over India. Further, the framework proposed for quantifying and propagating uncertainties in SE, SDR and SY estimates, which is the main focus of this paper, is applicable for R factor derived from different resolution datasets based on different principles.

Comment 2: Regarding soil erodibility, the recent developments show that also soil structure and Stoniness should be taken into account. Moreover, an additional source of uncertainty has to do with interpolating methods (how did you produce surface maps from the Kfactor measurements) and the high organic carbon soils (there is literature about how to interpolate K-factor and how to face the issue of high soil organic carbon).

Response 2: The present study accounts for soil structure in K factor estimates by using soil structure classification (sc) given by Wischmeier and Smith (1978). The equation (c) in Table 2 provides the equation for K factor estimate, and the structure classification codes are given in the annotation (page 15, line 23).

The Garra basin has primarily three kinds of soil textures: loam, sand and sandy loam (Figure 2c) with negligible amount of gravels. Hence, stoniness is not accounted in the K factor estimates. We will explicitly mention this fact in the revised manuscript.

Soil in the Garra basin has organic matter (OM) less than 0.2%. This value is much smaller than 4%, the maximum range of OM for which Wischmeier and Smith (1978) equation for K factor estimate is applicable.

The K factor is obtained based on NRSC (National Remote Sensing Center) soil dataset available at a spatial resolution of 56m. Thus, no interpolation is performed in estimating K factor map. Instead, the interpolation was performed by NRSC in preparing the soil data. Since NRSC did not provide the interpolation uncertainty, it was not included in the study. This limitation arising due to non-availability of interpolation error in soil data (also present in rainfall and LULC data) will be mentioned in section 5 (Limitations) of the revised manuscript.

Comment 3: In the topographic factor, authors do not discuss the pixel size issue. There much higher uncertainty when LS-factor is calculated with pixels of 90m resolution compared too much higher resolution of 25m (all this has been discussed in European application of LS-factor). Moreover, I see values of LS-factor = 2465 .This is impossible for soil coverages.

Response 3: In the literature review section, we have given references that discuss the issue of LS factor uncertainty due to cell size variation (page no. 2, line 25). However, this issue was not discussed in length because the objective of this paper is not to study the effect of cell size variation on LS factor uncertainty, but rather to provide a methodology to estimate LS factor uncertainty arising due to errors in DEM (geo-location and elevation errors). Different resolution DEMs obtained from different measurement techniques (remote sensing or ground based survey) may have different geo-location and elevation errors resulting in different LS factor uncertainties. The proposed methodology can be used to estimate LS factor uncertainty irrespective of the DEM resolution or measurement techniques used for its preparation.

Yes, LS factor can not be so high. We made a mistake in plotting the LS values. Figure 1 (a) below shows the correct values of LS factor. The maximum value of LS factor in the study region is 53. Since it was a plotting error, it has no effect on the subsequent results.

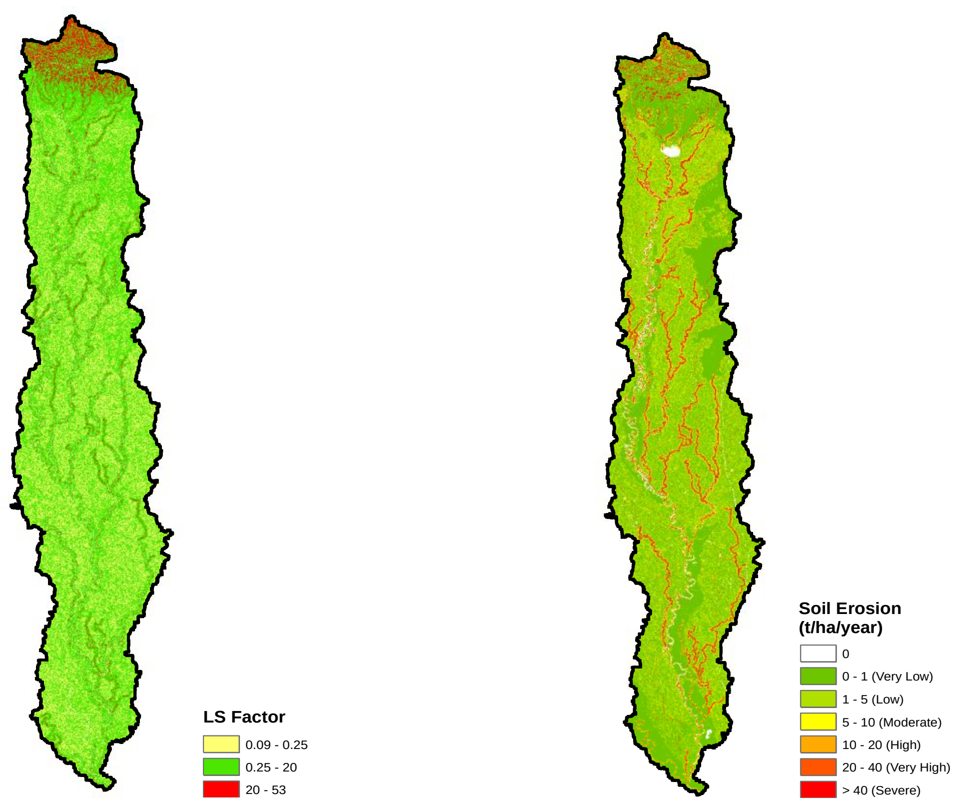

Figure 1 (a) Modified LS factor (b) re-classified soil erosion map

Comment 4: The cover management factor is the most uncertain in USLE applications. In the manuscript it is not clear (Table 3c) how you got those C-factor ranges and how you calibrate at pixel level? The use of remote sensing on vegetation density may help you on this.

Response 4: Yes, we agree that the cover management (CP) factor is the most uncertain among other RUSLE factors. This is evident in our results shown in Fig 6(c), where the magnitude of CP factor uncertainty is much higher than other factors.

The C factor ranges given in Table 3 are obtained from Morgan (2009; table 6.2, page no. 122). The ranges for different LULC classes were used to estimate uncertainty in C factor by assuming a triangular distribution that spans the entire range of C factor (equation (i) in table 2).

The vegetation density obtained using remote sensing (vegetation indices) can provide an alternative method to quantify C factor and its uncertainty. This will be mentioned in the revised manuscript.

Comment 5: Also how did you find the P-factor values? The literature has quite different values.

Response 5: The P factor is obtained from Morgan (2009; table 6.3, page no. 123). The table provides P factors for contour and strip cropping based on slope conditions.

Comment 6: (a) The first concluding remark is not valid. this is obvious! (b) The soil erosion map could have at least 6-7 classes to show a clear distinction between low erosion , low medium , medium, high , severe, etc (with colours from Green to Red). (c) Tables should be self-explained. I don't agree with the current structure presenting the equations in the table and having the factors and annotations in separate page. It is not easy for readers.

Response 6:

a) The point is not a concluding remark, but it summarises the work done. We will remove this point from the revised manuscript.
b) Figure 1(b) in this response shows the soil erosion map with six classes (increased from four in the original manuscript). We hope that the new figure distinguishes different soil erosion areas.
c) Thanks for the suggestion. In the revised manuscript, symbols will be explained along with the equations in which they are used.

References:

Morgan, R. P. C. Soil erosion and conservation. John Wiley & Sons, 2009.

Wischmeier, W. H., & Smith, D. D. Predicting rainfall erosion losses. Agricultural Handbook no. 537, US Department of Agriculture. Science and Education Administration, 1978.