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Interactive comment on "Future climate variability impacts on potential erosion and soil organic carbon in European croplands" *by* M. van der Velde et al.

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Reviewer comments

This study used the EPIC agroecosystem model to make predictions on soil C erosion losses in European cropland. The study is limiting in its potential for a number of reasons: 1) There is no discussion of the uncertainties in the variables and inputs used in the model, nor the uncertainties in the overall model itself. To state for example in L7-1o Pg 1571 that from 1981 to 2010 there was an estimate of 769 TgC lost due to erosion, has limited usefulness unless there is a sense of how uncertain that estimate is.

The reviewers are correct to request more detail on model uncertainties, which we have

now done as outlined below in the paragraph added to the discussion. "EPIC is a deterministic model which has been validated in several field studies, but with simulations such as those decribed here, there are many uncertainties associated with, for example, the quality of the driving data, the parameter set for all the different processes that are considered in the model, the characterization of the timing of agricultural practices, overall model structure, etc. In this study, we have kept all the settings equal and have only changed the weather inputs, meaning that the uncertainties due to the factors described above, whilst unquantified in this study, remain constant across the different weather scnearios. This allows us to make a comparison of the relative impact due to changes in climate variability, whilst maintaining a constant parameterisation. The numbers provided should be regarded as a reference to understand the magnitudes of stored and lost carbon rather than absolute and precise numbers, since uncertainties have not been formally quantified."

In addition the manuscript by Beer et al describing the development of the climate dataset used in our manuscript is now in press in the Journal of Climate.

2) Fate of eroded soil C: To determine rates of soil C loss is of limited usefulness since there is little understanding of the fate of that C under dynamic geomorphic conditions that occur in European cropland. Recent work has shown that most C that is eroded in croplands is simply redistributed within the landscape (eg. Berhe 2012; VandenBygaart et al. 2012) and not lost at all. Furthermore C that is buried within the landscape alters the overall budget of C since burial results in removal of C that can be replaced at the source of the original C in the eroded landscape position (dynamic replacement)(see Van Oost et al. 2005; Wang et al. 2014).

We agree with the reviewer that we do not consider the fate of the eroded carbon – this was not the purpose of the present study and we now explicitly acknowledge this in the text.

We briefly address this 'Determining the fate of the eroded carbon was not the purpose of this study and has not been addressed here. The deposition and subsequent

residence time of soil organic carbon (SOC) removed with eroded soil determines the actual contribution of SOC loss to CO2 levels' in the Introduction and have included a reference to the publication by Berhe et al., 2012.

3) Extreme climate events may not the most important factor affecting C loss due to erosion. Other critical factors are soil management such as tillage and cropping. For example (not all inclusive) tillage erosion is highly variable due to implement type, while cropping practices such as providing cover crops are highly influential on soil erodibility. The authors do discuss some of these limitations in a partial manner but anyone evaluating the usefulness of the model results will have little confidence in the accuracy of the outputs, even considering that it is a broad-scale attempt.

We agree that soil management is, and will be, a critical factor. We emphasize this further by including the following statement in the Discussion section:

In addition, agricultural soil management can lessen, amplify or mediate the interaction between physiographic terrain characteristics and changes in climate variability (Bernoux M. et al. (2006) Agronomy for Sustainable Development, 26, 1-8). Several location specific conservation practices are known to reduce erosion and transport of sediments downslope

(http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/home/?cid=nrcs143$_0$26849),

including contour farming, filter strips, vegetative barriers, sediment basins and conversion to pasture. In addition, many measures are expected to increase SOC content and overall soil quality by managing crop residue on the soil surface year round while reducing till operations prior to planting, such as minimum and reduced tillage, and by producing sufficient and timely quantities of crop residue from conservation crop rotations.

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