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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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This study by van der Velde M. et al. is an interesting contribution, modeling the effects of future climate variability scenarios on soil erosion and dynamics of soil organic carbon pools in European croplands. Overall, the study is of high quality, and its results

can be considered an important addition to the broad field of modeling of the effects of climatic change on geochemical cycles. Yet, similarly to other modeling studies, the major uncertainty confronting the obtained data is the inability, at many times, to predict the fate of the detached soil organic carbon, i.e., whether the predominant process it goes through is emission as carbon dioxide to the atmosphere (Lal R. et al. (2004) Science, 304, 393), or sequestration through burying in deeper soil layers / deposition in surface water bodies. This uncertainty is clearly demonstrated by the authors, who cite Van Oost K. et al. (2007, Science, 318, 626-629), regarding the possible trapping of the detached soil organic carbon in certain structures, increasing its residence times compared to that under the original soil, and making erosional processes as net carbon sink derivers. Yet, regardless of the fate of the detached soil organic carbon, it is important to mention that its decreased concentrations in the uppermost soil layer degrade the quality of soil and decrease the potential productivity of the agro-ecosystem (Lal R. and Pimentel D. (2008) Science, 319, 1040-1042). The major comment as regards this manuscript is the repeated statement by van der Velde M. et al. in the Abstract, Implications (sub-section 3.4), and in the beginning of the Discussion (section 4), stating that erosion rates depend on the spatial conjunction of expected changes in climate variability and the relevant physiographic conditions. Such a statement seems to be inaccurate and could be misleading. It is well acknowledged that croplands' management practices considerably affect their soil's erodibility, and consequently, also the dynamics of their soil organic carbon. Even in this manuscript, the authors mention (in the Discussion [section 4]) that soil erosion is also related to management practices. However, beyond this mere statement, the authors do not expand the discussion on this topic. The only exception is the mention (also in this section) of two specific adaptation interventions to be undertaken by farmers, including: (1) increasing irrigation rates, aimed at augmenting crop root growth; and (2) the avoidance of harvesting failed crops in order to enable the incorporation of their biomass to the soil. The main obstacle related to the 1st means is the lack of access to water, as experienced in extensive continental, Mediterranean, and semi-arid climatic regions across Europe (and moreover, in other continents). The main drawback regards the 2nd means is the potentially confusing perception embedded in it. It is stressed that consecutive, rational, intentional, and active decision-making by the farmers related to implementation of conservation agricultural practices is of great importance in terms of soil erosion control and soil organic carbon sequestration (FAO, The economics of conservation agriculture. ftp://ftp.fao.org/agl/agll/docs/ecconsagr.pdf). As shown in previous studies, such conservation practices, and particularly reduced tillage systems (e.g., non-inversion tillage [such as paraplowing], strip tillage, occasional tillage, or no-tillage), can effectively decrease soil erosion and reduce loss of soil organic carbon, both during the growing season and the subsequent off-season (e.g., Bernoux M. et al. (2006) Agronomy for Sustainable Development, 26, 1-8). Also, in conjunction with such reduced tillage systems, the implementation of complementary conservation agricultural practices would further decrease rates of soil erosion, minimize soil organic carbon detachment, and reduce the environmental footprint of crop production. Such practices could include several combinations of on-site retention of crop residues, manuring or composting, implementing of crop rotation, inter-cropping, cover cropping, and the growing of perennial forages (Stavi I. and Argaman E. (2014) Carbon Management, accepted). Therefore, despite being outside of the focus of this study, the authors may want to elaborate on some generic information about the potential of conservation agricultural practices in mitigating soil erosion, with the resultant decreased rates of decomposition (or burying in depositional sites) of soil organic carbon. It seems that this would best fit into the last paragraph of the Discussion (section 4), where the authors mention the study limitations and uncertainties.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/11/C320/2014/bgd-11-C320-2014-supplement.pdf

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Interactive comment on Biogeosciences Discuss., 11, 1561, 2014.

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Fig. 1.