

## ***Interactive comment on “Trends in soil solution dissolved organic carbon (DOC) concentrations across European forests” by M. Camino-Serrano et al.***

### **Anonymous Referee #2**

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Review on work of Camino-Serrano et al. (March 2016) Analysing an european-scale dataset on dissolved organic carbon (DOC) in soil solution, the study seeks 1) to determine the temporal evolution of DOC under forests during the last twenty years (1991-2011) and 2) to correlate it with changes of environmental factors (e.g. atmospheric N & S depositions) in order to propose a mechanistic understanding of DOC evolution. The main hypothesis is that the current increase of DOC content in european surface waters arises from an increase in soil solution DOC content resulting from the recovery of past acidification. The study presents interesting results deserving publication in BG such as 1) an overall increase in DOC content in the organic and the deepest mineral layers and 2) the correlation of this increase with changes in atmospheric N & S depo-

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sitions and tree growth. However, saying that this article is not very clear is litotes. The abstract and introduction are rather well written. However, the result and discussion sections are extremely hard to read, the number of figures and tables is not tenable (I counted 27 items, figures+tables) and the usefulness of numerous statistical analyses is not convincing since they provide similar results and conclusions. I think that an effort of synthesis is necessary to simplify messages and prevent a dilution of important results with accessory observations. For example, at the end of the reading of your manuscript, I was not able to say whether sulphate depositions increase or decrease soil solution DOC content. In your abstract, it is suggested that DOC concentrations and sulphate depositions are positively linked, a statement which is then contradicted in the manuscript (e.g. L412-413 but L348-349). Moreover, it would be useful to create a figure summarizing the main chemical reactions and biological processes controlling soil solution DOC content. More fundamentally, I am not sure that the measurement of soil solution DOC provides an accurate estimate of the amount of DOC flowing out of terrestrial ecosystems (and supply of DOC to surface water). The leaching of DOC happens at specific moments of the year depending on hydric balance (precipitation-evapotranspiration), soil type, plant activity etc. I am even sure that the DOC soil solution concentration can be inversely related to DOC leaching in some conditions. Just an example: soil solution DOC concentration is higher in summer than in winter, but DOC leaching only occurs in winter in France. This issue could explain why the present study fails to show clear overall trend in soil solution DOC at individual plot and soil depths. A warming-induced change of ecosystem water balance could also contribute to changes in DOC content in soil solution and surface water. Therefore, I suggest to present (in manuscript or in supplementary materials) the volume of water harvested in lysimeters or calculations of theoretical water balance (precipitation-evapotranspiration). I am not really convinced by the relevance of removing the breakpoints. These breakpoints are not necessary the result of site disturbances (change of sensors etc) but could result from sudden change of atmospheric chemical composition or ecosystem functioning. After all, SO<sub>2</sub> emissions by human activities have been reduced by 70% during 90s.

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The terminology used in the manuscript is often not clear. The term “trend” is vague and does not specifically refer to change with time. The terms “trend slope”, “trend direction” and “relative trend slope” are even more difficult to understand. The terms “depositions” and “troughfall” are interchangeably used, I suggest you to use only one of the two terms. The term “fertile soil” is weak and, as usual, does not refer to measurable variable. The fact that tree growth is high does not necessary mean that the soil is fertile. The tree growth is often linked to forest dynamics and age (tree growth of old forests is typically slow irrespective of soil characteristics; tree growth after forest disturbance (drought events, storm etc) is typically high because tree mortality allows the recruitment of seedling with fast growth rate).

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