

Interactive comment on “Contrasting pH buffering patterns in neutral-alkaline soils along a 3600 km transect in northern China” by W. Luo et al.

Anonymous Referee #2

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This is a piece of very interesting study. The authors collected soils along a 3600 km long transect across northern China, and determined soil pH buffering capacity (pHBC) using classic protocol of HNO₃ addition, along with soil and climatic variables. Statistical analysis further demonstrated that carbonate content was the primary determinant of pHBC in the carbonate containing soils and CEC was the main determinant of buffering capacity in the non-carbonate. Intriguingly, soil pHBC was also positively related to aridity index and carbonate content across the carbonate containing soil transect. The large scale survey of soil pHBC and other variables will be of great help toward developing optimized strategies for risk assessment and landscape management under rapidly changing environments.

I have only two major concerns as following.

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(1) Generally speaking the higher soil pH, the stronger soil pH buffering capacity. It is thus quite unusual that in carbonate-containing soil that there is a negative relationship between soil initial pH and soil pHBC. If this is true, soil initial pH would not have significantly positive correlation with carbonate, i.e., SIC. Since the authors determined SIC content, it is thus interesting to see what kind of correlation exist between initial soil pH and SIC. In addition, it seems highly unlikely that non-carbonate containing soil released no any CO₂ gas upon 2M HCl addition. Pls explain. Meanwhile, it is also likely that the protocol has some drawbacks for pHBC measurement. For example, how about pHBC measured by addition of H₂SO₄? The authors may briefly discuss the advantage and drawbacks of HNO₃-based pHBC measurements.

(2) Please provide data about the relationship between soil aridity and initial soil pH. In addition, please provide information about acidification process and rate of soils in northern China in the introduction section. The authors repeatedly stated that acidification rate and processes are important but they provide no solid evidence in support of these statements.

Specific comments

(1) Page 13216 Lin 20-21. The authors present no data of rates, risks and impact of acidification.

(2) Page 13217 Line 1. Please delete some references as 7 might be too much for one statement. Or you can simply assign these reference to different topics you would like to emphasize

(3) Page 13217 Line 21. The study in 1992 and 2000 are not recent studies.

(4) Page 13217 Line 11-18. I would like to see justification of why large-scale study is required.

(5) Page 13217 Line 26. Please briefly explain the mechanisms of how high temperature, high evaporation and low precipitation can increase carbonate precipitation?

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- (6) Page 13217 Line 29. I guess the authors may start this paragraph by saying there are three main pH buffering mechanisms in soils. And then explain it in detail.
- (7) Page 13218 Line 5. What is the cause of soil acidification in northern China? Nitrogen deposition or sulfur deposition, pls specify their relative contributions if flexible.
- (8) Page 13219 Line 9. Please cite appropriate reference for Chinese soil classification.
- (9) Page 13219 Line 11. What does soil fertility mean?
- (10) Page 13225 Line 13-14. It may refer to non-carbonate soils?
- (11) Page 13225 Line 13-14. Please provide the estimated amount of CO₂ released from soil acidification.
- (12) Page 13226 Line 10. Replace who demonstrated with demonstrating
- (13) Page 13226 Line 19. Delete between our results and previous results
- (14) Page 13226 Line 20. It seems more likely to be associated with the structure (i.e. type) of soil organic matter rather than quantities. If it is caused by the quantities, then one would be able to see significant correlations.
- (15) Page 13228. The figure legend might be wrong. It is a mere correlation between longitude and initial soil pH, and pH change upon acid addition was shown in the inset?
- (16) Page 13229. It is quite perplexing that there is soil inorganic carbon in non-carbonate soils.

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