

Interactive comment on “Ion’s association in soil and vadose zone of Azov-Black sea region” by A. A. Batukaev et al.

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On behalf of my co-authors, thanks a lot for your positive and constructive comments and suggestions on our manuscript. The authors examine the possible interpretation of the properties of aqueous solutions in the soil and saturation zone on the theoretical base of chemical equilibrium in electrolyte. This is commendable. An opportunity opens not only to state the current situation in model or natural disperse systems under the influence of water, but also to better understand and quantitatively describe the dynamics of the system. The approach is useful for understanding geochemical processes in the soil and the vadose zone. This will help build a true use of soils and landscapes, to promote the well control of mass transfer, ensure geohygiene and soil health.

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There are comments.

Comment 1. The data of article reflect the properties of important, but only one component of dry steppe chestnut soil complex. It should be better to indicate the level of representativeness and meaningful of data and, particularly, the model, for the whole complex of chestnut soils. In addition, geochemical processes are the sign not only of brown soil, but the vast majority of soils worldwide. In our opinion, the authors should assess the degree of universality of the developed approach to the description of the behavior of water systems in soils and vadose zone.

Answer We agree with the reviewer that the composition of the soils of research object is much more diverse than we have given in the article data. However, we have taken to study one of the most complex objects of geochemical phenomena in soil and unsaturated zone. According to the reviewer's proposal we do assess the degree of universality of developed approach for description of water systems in soil and unsaturated zone. For this, the supplement text to the "Methods" for the final version of the article is as following:

The article presents the data reflecting the characteristics of the only one soil component of chestnut complex soil cover of dry steppe zone – solonchak solonetz. This choice stems from the fact that it is one of the most difficult objects of study of geochemical phenomena. In this sense, the data obtained are representative as the evolution model of soil complex under halogenesis peculiar to the vast majority of soils on the globe. On this basis, we believe the data and model are a universal approach to research the behavior of water systems in saline soils and vadose zone.

Comment 2. Most of the soils of the world are under the influence of anthropogenic factors of evolution. Besides, it is not just a factor, but the powerful driver of heavy deterioration of soil. Authors should indicate which new threats to the soil, vadose zone, the biosphere as a result of agriculture and other impacts on the environment can be discovered on the basis of developed simulation. Should also be shown the

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new ways to control soil and aeration zone, appeared in the focus of the research.

Answer. We are grateful to the referee for this comment. It opens new horizons for research in many ways far beyond tabled article topics. Let us try to briefly highlight the most important provisions of the anthropogenic drivers of soil evolution, which can be open based on our modeling system. For this to the section "Discussion" of article final version we add the following text:

Most soils in the world are under the influence of anthropogenic evolution factor – agriculture and other environmental impact. The new danger in relation to calcium-carbonate system of soil and aeration zone is a high rate mass transfer as the result of distortion of carbonate-calcium balance in soil solution and aeration zone. This determines the need for new findings in management of soil and aeration zone focused on reducing a mobility of matter, especially for technological tools that will overcome a dangerous entrainment of useful substances from the soil, as well as receipt and accumulation of unfavorable substances at agriculture and irrigation.

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