Holistic information evaluation of divergence of soil's properties by using of legacy data of large scale monitoring surveys

Irina Mikheeva

Institute of Soil Science and Agrochemistry of Siberian Branch of Russian Academy of Sciences, Soil geogrphy and genesis, Novosibirsk, Russian Federation (pulya80@ngs.ru)

Identification of tendencies of soil's transformations is very important for adequate ecological and economical assessment of degradation of soils. But monitoring of conditions of soils, and other natural objects, bring up a number of important methodological questions, including the probabilistic and statistical analysis of the accumulated legacy data and their use for verification of quantitative estimates of natural processes. Owing to considerable natural variability there is a problem of a reliable assessment of contemporary soil evolution under the influence of environmental management and climate changes.

When studying dynamics of soil quality it is necessary to consider soil as open complex system with parameters which significantly vary in space. The analysis of probabilistic distributions of attributes of studied system is informative for the characteristic of holistic state and behavior of the system. Therefore earlier we had offered the method of evaluation of alterations of soils by analysis of changes of pdf of their properties and their statistical entropy. The executed analysis of dynamics of pdf showed that often opposite tendencies to decrease and to increase of property can be shown at the same time. However to give an adequate quantitative evaluation of changes of soil properties it is necessary to characterize them in general. We proposed that it is reasonable to name processes of modern changes in soil properties concerning their start meaning by the term "divergence" and investigate it quantitatively. For this purpose we suggested to use value of information divergence which is defined as a measure of distinctions of pdf in compared objects or in various time. As the measure of dissimilarity, divergence should satisfy come conditions, the most important is scale-invariance property. Information divergence was used by us for evaluation of distinctions of soils according heterogeneity of factors of soil formation and with course of natural and anthropogenous processes. This characteristic allowed to allocate the most changed and vulnerable kinds and layers of soils, and also to range natural changes and anthropogenous impacts in size of their influence on properties of the soil.

Case study was conducted on considerable part of the Priirtyshskaya plain in South of Western Siberia. Climate here is sharply continental and droughty. Soils were formed from ancient lake and alluvial deposits. It determined their mainly easy particle size distribution and spatial diversity of the texture. It is possible to judge rates and extent of manifestation of processes of degradation on alteration of properties of the main types of soils here: chestnut soils and Haplic Chernozems.