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Joint AMO and PDO manifestations in multidecadal climate anomalies and winter wheat yield in Ukraine

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New knowledge about the patterns of climate variability is essential either from the theoretical point of view or for the applied aspects. At the same time grain yield is one of the most important socio-economic development parameters. It is particularly of current interest to Ukraine since Ukrainian grain is in significant demand in the global market. The development of the theory of long-term prediction of grain yields is an extremely important line of research for the sustainable development of Ukraine, especially during economic crisis.
The basis for decadal-multidecadal variability of grain yields is climate variability. As an integral indicator of regional climate variability the parameters of cyclonic activity were used. Variability of cyclonic activity, in turn, is modulated by the main decadal-multidecadal climate signals or processes in the ocean-atmosphere system: Atlantic Multidecadal Oscillation (AMO) and Pacific Decadal Oscillation (PDO).
Consequently, the goal was set – to study quasi-periodic decadal-multidecadal variability of the parameters of cyclones (frequency and depth) and the grain yield in Ukraine (on the example of winter wheat), as well as to find the association of these characteristics with the large-scale processes in the ocean-atmosphere system.
For the implementation of the goal, the analysis of the following characteristics was done: frequency and depth of cyclones (1948–2006) over Ukraine and the Black Sea obtained using NCEP/NCAR reanalysis data and regional winter wheat yield (1945–2008) in the three agroclimatic zones of Ukraine: steppe, forest steppe, woodland.
The most important results of our study are the following.
The climatic shift in 1965–75 associated with multidecadal processes in the ocean-atmosphere system was found in the variability of cyclonic activity and winter wheat yield.
The composite analysis of the studied characteristics showed that during the negative PDO phase or positive AMO phase cyclonic activity is 20–50% higher and the winter wheat yield is 10–15Cwt/ha higher than during the positive PDO phase or negative AMO phase.
The multivariate regression analysis showed that the joint influence of AMO and PDO in winter determines 55–60% of cyclonic activity variability and about 45–50% of variability of winter wheat yield in Ukraine.