

Heat Accumulation in Soils of Belarus

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Abstract : The research analyzes absolute maximum soil temperatures registered at 36 gauge stations in Belarus from 1950 to 2013. The main method applied in the research is cartographic, in particular, trend surface analysis. Warming that had never been so long and intensive before started in 1988. The average temperature in January and February of that year exceeded the norm by 7-7.5 °C, in March and April by 3-5 °C. In general, that year, as well as the year of 2008, happened to be the hottest ones in the whole period of instrumental observation. Yearly average air temperature in Belarus in those years was +8.0-8.2 °C, which exceeded the norm by 2.0 - 2.2 °C. The warming has been observed so far. The only exception was in 1996 when the yearly average air temperature in Belarus was below normal by 0.5 °C. In Belarus the value of trend line of standard temperature deviation in the warmest months (July-August) has been positive for the past 25 years. In 2010 absolute maximum air and soil temperature exceeded the norm at 15 gauge stations in Belarus. The structure of natural processes includes global, regional, and local constituents. Trend surface analysis of the investigated characteristics makes it possible to determine global, regional, and local components. Linear trend surface shows the occurrence of weather deviations on a global scale, outside Belarus. Maximum soil temperature appears to be growing in the south-west direction with the gradient of 5.0 °C. It is explained by the latitude factor. Polynomial trend surfaces show regional peculiarities of Belarus. Extreme temperature regime is formed due to some factors. The prevailing one is advection of turbulent flow of the ground layer of the atmosphere. In summer influence of the Azores High producing anticyclones is great. The Gulf Stream current forms the values of temperature trends in a year period. The most intensive flow of the Gulf Stream in the second half of winter and the second half of summer coincides with the periods of maximum temperature trends in Belarus. It is possible to estimate a local component of weather deviations in the analysis of the difference in values of the investigated characteristics and their trend surfaces. Maximum positive deviation (up to +4 °C) of averaged soil temperature corresponds to the flat terrain in Pripyat Polesie, Brest Polesie, and Belarusian Poozerie Area. Negative differences correspond to the higher relief which partially compensates extreme heat regime of soils. Another important factor for maximum soil temperature in these areas is peat-bog soils with the least albedo of 8-15%. As yearly maximum soil temperature reaches 40-60 °C, this could be both negative and positive factors for Belarus's environment and economy. High temperature causes droughts resulting in crops dying and soil blowing. On the other hand, vegetation period has lengthened thanks to bigger heat resources, which allows planting such heat-loving crops as melons and grapes with appropriate irrigation. Thus, trend surface analysis allows determining global, regional, and local factors in accumulating heat in the soils of Belarus.

Keywords : soil, temperature, trend surface analysis, warming

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