Definition of deflation potential of a wind and many years avarage rates of defiation in Belarus conditions

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Abstract. Index of the deflation potential of wind (B_i) has been calculated. Three groups of areas have been distinguished in Belarus: with low, moderate and high B_i values. Besides, this parameter is considered as a basis for definition of many year-average rates of deflation (D) on original, adapted to the conditions of Belarus technique.

Key words: deflation, deflation potential of wind, agrotechnological groups

INTRODUCTION

It is known that the appearance and intensity of deflation is predetermined by cumulative influence of a lot of the factors (features of a climate, soil-vegetative cover, anthropogenous landscapes transformation, their geomorphological characteristics etc.). In turn, each of the listed factors is the complex system including series subordinated parameters, as a group influencing on development of process. So, in the system of "climatic factor" is possible to include the following components as: temperature of air and superficial layer of soil, quantity of atmospheric precipitation, relative humidity of air and number of days with relative humidity less than 30 %, feature of wind mode (speed of wind and its impulses, repeatability of winds with sufficient for development of process by speeds), number of clear days and much other. A feature of a soil-vegetative cover is, first of all component composition of soil and degree of their covering by vegetation, anthropogenous transformation – area of drained peatlands and geomorphology of territory - its absolute altitude.

MATERIALS AND METHODS

The works of a number of the researchers carried out in different time and in the different countries testify to an opportunity of calculation of the active factor deflation as functions of wind speed. In our study the wind mode peculiarities were taken into account by means of a dimensionless integrated parameter "Deflation potential of wind" (DPW). For the first time this term and method of it calculation were offered by G. Larionov (Moscow State University).

For definition of DPW sizes we used the data on average speeds and repeatability of winds of the certain high-speed gradation and also meaning threshold speeds of wind for different types of soils. DPW was determined for 47 meteorological stations of republic for most deflation-danger periods as: April - May and September - October at different threshold speeds of a wind - 5, 10 and 15 m sec^{-1} a series survey maps was made (formula 1).

$$B_i = 0,001 \sum_{1}^{12} \overline{u}_j^3 f_j \frac{1}{1 + 10^{8(1-\overline{u}/u_{?i})}} \tag{1}$$

where: Bi - deflation potential of a wind for certain threshold speed (DPW); uj - average speed of a wind for certain speed gradation, m sec^{-1}; fj - repeatability of winds certain speed gradation from total number of supervisions for one month in %; uoi - threshold speed of a wind, m sec^{-1}.

RESULTS & DISCUSSION

The physical DPW sense is that it characterizes deflation, spreading force of a wind, i. e. taking into account its values (alongside with other factors) it is possible to judge about predisposition of territory to deflation appearance. Besides this parameter is a basis for definition many year-average rates of deflation on original, adapted to the conditions of Belarus technique, dependence (2):

D = CZ (1+10$^{4.44-0.4Z}$)$^{-1}$, (2)

where D - intensity of deflation, t ha^{-1} per one year,

C - coefficient of proportionality;

Z – is calculated in accordance with the following formula:

Z=BiK$_b^{mBi-0.22}$, (3)

where Bi (DPW) - deflation potential of wind at its certain threshold speed;

K_b - agro deflation index of crop rotation;

m - coefficient equal at threshold speeds of a wind 5, 7, 9, 11, 15 m sec^{-1}1.695; 1.691; 1.673; 1.637 and 1.509, accordingly.

The high deflation potential of wind occur within the heights and some districts of the Belarussian Polesye. The abrupt increase of deflation danger take place in this region exactly. This fact is perhaps explain by combination of high deflation potential of wind and other factors (more high the temperature of air and soil surface, reduce of relative humidity, quantity of atmospheric precipitation, high quantity of deflation danger soils (up 50 to 90% in structure of arable soils including degraded peat lands). The moderate deflation potential of wind occur within the plains of republic and some district of the Belarussian Polesye.

On the basis of study of structure soils Belarussian Polesye (southern areas of republic most subjected to wind erosion) the typization of soil cover was executed. Within the limits of considered territory five types of lands which can be accepted in quality of agro technological groups having certain component structure of soils and a degree of deflation danger, were determined.

Many year-average rates of deflation (D) were determined for different agro technological groups of lands and various crop rotation types, as it is known, that last render direct influence on intensity deflation processes. Necessary for account of this parameter data are resulted in the table.

Table. Crop rotation types and coefficients for account of many year average rates of deflation (fragment)

| Groups of lands | Types of crop rotation | Crop ratio, % | | | | | Kb | E |
		Tillage crops	Spring cereals	Winter cereals	Perennial grasses	Permanent grasses		
II	Cereal-Clean-tilled	6.3	12.4	25.0	6.3	50.0	0.82	1
V	Grasses-Cereals	-	12.5	12.5	-	75.0	0.92	1

Example of many year average rates of deflation calculation (formulas 2 and 3) for the first and fifth agro technological groups of lands, accordingly:

$$Z = 1.22 \cdot 0.82^{1.637 \cdot 1.22 - 0,22} = 0.857$$

$$D = 0.001 \cdot 0.857 \cdot (1 + 10^{4.44 - 0.4 \cdot 0.857})^{-1} = 10.7 \approx 11 tha^{-1} Z = 1.22 \cdot 0.92^{1.637 \cdot 1.22 - 0.22} = 1.052 D =$$

CONCLUSIONS

On the basis of many years meteorological data index of the deflation potential of wind (B_i) has been calculated (for the first time for Belarus territory). Three groups of areas were distinguished in Belarus: with low, moderate and high B_i values. The map-scheme of this indicator for different threshold speed of wind was made up. Distribution on types of soil cover has been carried out. The five agro technological groups of lands were determined. Each of these groups was characterized by definite component composition of soil. The many year-average deflation rates were estimated as - from 1 to 15 ton of soil per hectare in a year.