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# PEDOLOGICAL IMPLICATIONS OF STRONG WINDS IN SOUTH DOBROGEA

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## Abstract

*Winds are strong atmospheric phenomena, with a great impact on South of Dobrogea land. In meteorology, atmospheric phenomena are defined as characterized by air currents speed ≥ 15 m/s (calculated for a period of 2s). The synoptic activity, the average wind speed ≥ 10m/s (calculated for a period of 10 s) is included under „warning message", its hazardous weather phenomena. The winds in gusts (which for 1 s-20 s, have a speed ≥ 5 m/s compared with the average value in the range set), „warning messages" are transmitted when the speed is ≥ 12 m/s.*

*These atmospheric phenomena associated with strong turbulent motions, which involve essential changes in hydrothermal and gas regime of ecosystems and in areas where have a high, creating the characteristic morphological adaptations of plants and animals. Ecopedologia areas affected by strong winds in southern Dobrogea, are of concern from several points of view, because the repercussions of this phenomenon is felt in the state of soil fertility, and hence the stability of harvests. The phenomenon of strong wind, in Dobrogea, is extremely influential, sometimes decisive, in determining the extent and intensity of many processes of soil degradation and related to it, to establish agricultural technologies applied, with consequences for crops and production stability achieved.*

## INTRODUCTION

The ecopedology of surfaces affected by strong winds in Dobrogea deals with various aspects because of the consequences this phenomenon has on soil fertility and crop stability. The knowledge of strong winds climatology is important for their precise forecast and also, for the elaboration of more efficient protection methods against their harmful effects.

In meteorology, strong winds are defined as atmospheric phenomena characterized by air currents with a speed of ≥ 15 m/s (calculated for a time interval of 2'). In the synoptic activity, the average wind speed of ≥ 10 m/s (calculated for a time interval of 10') is included in the category of "warning messages", characteristic to the dangerous meteorological phenomena. For the blasts of wind (considered those that sustain a speed of ≥ 5 m/s for 1'-20', compared to the average value recorded for the given interval), the "warning messages" are transmitted when the speed is ≥ 12 m/s.

## MATERIAL AND METHODS

The analysis of strong winds in Dobrogea is based on the data obtained from the observations accomplished in six meteorological stations between 1965 and 2005 (Figure 1). Its purpose is the climatic characterization of the regime, of the occurrence probability (in the representative landscape points, with relatively complete recordings) and of its territorial distribution.

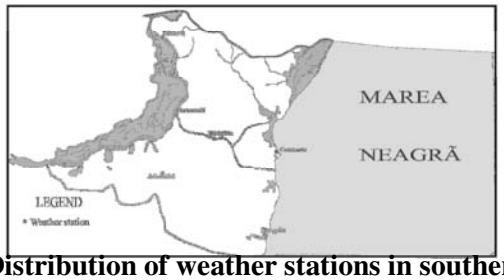


**Fig. 1. Distribution of weather stations in southern Dobrogea**

## RESULTS AND DISCUSSION

The frequency of strong winds ≥10 m/s decreases inside south Dobrogea as the distance from the sea increases. Considering this aspect, there is a tendency of wind intensification in the high, hilly and plateau zones in the south-west, or on the Danube bank (in Harsova), taking into account the fact that the air currents are channeled along the fluvial valley, where the frequency of strong winds ≥10 m/s is close to the one recorded on the Black Sea shore. On the sea surface, the frequency of strong winds ≥10 m/s increases.

The regime of directions characteristic to strong winds ≥10 m/s and ≥15 m/s was presented on seasons in Constanta and also in comparison for January and July in Valu lui Traian, Medgidia and Harsova. Thus is emphasized the way in which these winds are manifested in the eastern and western extremity of south Dobrogea.

The association of north and north-eastern directions with strong-predominant winds can be observed from the Black Sea littoral to the western extremity of Dobrogea, especially in winter. Their frequency is high in the points where the landscape configuration orients wind on these directions, for example on the Black Sea shore (in Constanta) or on the Danube bank (in Harsova). At the meteological stations located in the relatively high landscape, there is an increase in the frequency of western strong winds, for example, in Medgidia in January. In these points, the western strong winds or those oriented by landscape from the western sector of the horizon can become dominant in summer. This phenomenon can be observed in July in Medgidia and Valu lui Traian.

In the daily evolution, there is an accentuation of strong winds at night and in the morning. Their frequency, of the total of these cases, did not drop under 70% in

winter and under 50% in the other seasons – at intensities of ≥15 m/s and under 50% in winter and autumn and under 40% in spring and summer – at intensities of ≥10 m/s. The diurnal interval is when the strong northern and north-eastern winds weaken, especially in summer.

As a whole, the annual frequency of strong winds (north and north-east) in Constanta exceeded 70% of the total cases ≥10 m/s and 90% of the total cases ≥15 m/s. Generally, on the Black Sea shore and the bank of littoral lakes, the annual frequency of strong winds ≥10 m/s oscillates between 3% and 4.5% (10-16 days). The most part of the high plateau area of South Dobrogea is included in this frequency register.

Winter is the season with the highest frequency of strong winds. On the sea shore and the bank of littoral lakes, the frequency of strong winds ≥10 m/s oscillates between 5% and 9% (4-8 days), while in the plateau zone, they oscillate between 3% and 6% (3-6 days). At the meteorological stations located in the aerodynamic shelter zones, the frequency of these winds is reduced below 3% (1-2 days).

In spring, the frequency of strong winds decreases, oscillating between 2% and 4% on the littoral and most of south Dobrogea – at intensities of ≥10 m/s and up to 1% - at intensities of ≥15 m/s. A high frequency of strong winds ≥10 m/s is recorded in the marine space (approx. 15% - 2 weeks) and in those areas of orographic intensification of the air currents (almost 14% - 16 days).

Summer is the season with the most reduced frequency of strong winds ≥10 m/s, which reaches 8% (one week) in Constanta and 5% (approx. 5 days) in Medgidia and Adamclisi. In the rest of south Dobrogea, the seasonal frequency oscillates between 0.5% and 1.5%, reaching 0.1% in the sheltered zones.

In autumn, the frequency of strong winds ≥10 m/s intensifies again exceeding 14% (almost 2 weeks) in Constanta and 11% (approx. one decade) in Medgidia. The frequency of these winds oscillates between 3% and 4% at the Black Sea shore and on the bank of the great littoral lakes, while in the most part of south Dobrogea it oscillates between 1%, except the sheltered zones, where it drops under 1%.

The annual variation of strong winds ≥10 m/s is characterized by the reduction of the frequency from winter to summer. Also, there is a tendency of shift of the maximum frequency in winter towards December and January in the marine space and towards February in the southern sector of the littoral, inside the land of Dobrogea.

The maximum frequency was also noticed in December, at some weather stations with short observation period (e.g. Cernavoda). In these cases, the curves of strong wind frequency appear generally disparate and fragmented due to the short period of observation needed for an actual image of the characteristics of the climatologic regime of these phenomena.

**Pedological implications of strong winds in South Dobrogea**

The ecopedology of surfaces affected by strong winds in Dobrogea deals with various aspects because of the consequences this phenomenon has on soil fertility and crop stability. Like other regions, similar in terms of the geographical makeup (limestone and green schists), the morphological subunits that make up the agroecosystem - the plateaus of Istria, Casimcea, Negru-Voda and Carasu are completely organized for irrigations and many of the analyzed aspects involve this element.

The soil covering, developed on such a structural and lithologic support could only concur with the pedogenetical factors, to which vegetation and the climatic conditions contributed in particular. But, if the former are considered passive factors in the production of soil, the vegetal blanket and the climate had a particular dynamics, their influence being felt in the distribution area, and especially in the soil quality and preservation state.

The predominant soils are: chernozems (CZ), cambic chernozems (CC), yellowish soils (SB) and redzina soils (RZ), all part of the mollisol soils, lithosols (LS), regosols (RS) and coluvisols (CO), all belonging to the non-evolved, cut or sloppy soil class.

The problem of research, in the context of the themes proposed, targeted the following aspects:

- the destruction of the structural aggregates and degradation of texture state, caused by strong winds;
- erosion (surface and depth), as a result of the deflation process;
- the filling of the river bed with sediments fallen from the slopes and brought by the wind;
- the salinization-alkalization phenomenon as a result of transport by means of wind of the particles resulted from marine evaporation and deposited together with the loess layer;
- irrigation and the process of excess humidity, temporarily stagnant, caused by wind intensity and direction;

It is well known that south Dobrogea represents a transition region for the Romanian ecopedological area, from steppe soils generated by the extreme climate, dry and strongly xerophytic of the Black Sea basin, to the forest-steppe soils, characteristic to the Danube basin. A specificity of the landscape is given by the loess deposits, with variable thickness (from tens of cm to tens of meters) which deposited on a pre-existing landscape with hard stratigraphical organization. The loess also constitutes the parental material on which all the soils that belong to the mollic class (and not only) were formed.

The fact that these phenomena exist even in regions located at over 100 km from the shore (Esichioi, Dumbrăveni etc) and irrigations were not used at the research date (to emphasize a secondary salinization) support without a doubt these statements. Moreover, recent researches accomplished by Irina Pozdneakova all over south Ukraine confirm the presence of sodium in the soil's absorptive complex (1996). Wind was the agent that spread by air the saline powders resulted from the marine evaporation over the entire basin of the Black Sea and deposited with the loess in the last part of Pleistocene.

## CONCLUSIONS

1. The wind factor is responsible for the degradation of the layer of fertile soil (Table 1).

***Table 1***

**Size and structure of disaster areas during 1980-2009 strong winds**

| **Aria** | **Disasters per year average surface** | **Affected by strong winds which** | |
|---|---|---|---|
| | | ha | % of the affected area |
| Albeşti | 629 | 252 | 40.1 |
| Ciocârlia | 630 | 271 | 43.0 |
| M. Kogălniceanu | 1694 | 89 | 5.1 |
| Nazarcea | 393 | 82 | 20.9 |
| Negru Vodă | 1741 | 561 | 32.2 |
| Dorobanţu | 1204 | 300 | 24.9 |
| N. Bălcescu | 1164 | 44 | 3.8 |
| Poarta Albă | 591 | 30 | 5.1 |
| Săcele | 832 | 172 | 20.7 |
| Târguşor | 1912 | 15 | 0.8 |
| Independenţa | 176 | 176 | 100.0 |
| Peştera | 868 | 300 | 34.0 |
| Vultur | 619 | 619 | 100.0 |
| Adamclisi | 209 | 209 | 100.0 |
| Ostrov | 2324 | 8 | 0.3 |
| Total South Dobrogea | 28066 | 3128 | 11.1 |

2. Limestone, green schists and detritus resulted from their alteration was uncovered where the wind forces reached considerable intensities and the

lithologic substrate was made up of consolidated material. A characteristic of the action of strong winds in Dobrogea on soil genesis is represednted by the occurrence of the salinization and alkalization process. The research done on a large ecological area, exceeding the territory of south Dobrogea, demonstrates the presence of sodium in the loess deposits and at considerable depth (0.80 - 1.50 m). This has only one explanation: the sedimentation of saline powder with the Pleistocene loess dust.

3. The strong winds in Dobrogea have an extreme influence, sometimes decisive, on the establishment of the degree and intensity of many soil degradation processes, on the establishment of the used agricultural technologies with consequences on the crop stability and productions obtained.

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