ABSTRACT: A study of the changes in the atmospheric pressure $P$, the potential gradient $V'$ of the atmospheric electric field near the ground, and the medical condition of cardio-vascular patients treated at the Sanatorium. The health of some patients was found to deteriorate during periods of the $P$ and $V'$ sharp changes. Juxtaposition of findings obtained during different seasons allowed the authors to conclude that changes of the $P$ are an accompanying rather than affecting factor responsible for changes in cardiac patients' health condition during shifts in weather.

INTRODUCTION

This report has been composed by specialists in the field of meteorology and treatment at health resort, united in their effort to find opportunities for using the atmosphere electric field data in a complex of parameters. These parameters are employed in measures taken in order to reduce the extent of meteorotropic responses in cardio-vascular patients under treatment at sanatoriums.

The fact is that such responses occur during changes of weather often accompanied by changes of the atmospheric pressure $P$. The changes are assumed to be responsible for meteorotropic responses in cardio-vascular patients. Some fundamental works [Israel, 1961, Reiter, 1960] showed that the changeability of the atmosphere electric field potential gradient $V'$ becomes sharply enhanced when fronts pass, local instabilities occur that result in precipitation. The Russian authors’ attention was attracted by this as well [Ovcharova et al., 1976]. However, no specific data in the form of generalized results of the juxtaposition of $V'$ and $P$ records were presented in literature references. That is why, as suggested by E.P. Borisenkov in 1986, the juxtaposition of the $V'$ and $P$ records was carried out for the period from January 1985 to March 1986. These records were carried out at the Research-Experimental Base of the MGO situated in the Voeikovo Village near St. Petersburg. By barograms, three- or four-day periods were chosen when considerable changes of the $P$ (a drop and a growth in succession) with an amplitude not lesser than 10-15 mb occurred. For over a year the number of such periods was 10. During sharp changes of the $P$, the $V'$ behaviour was characterized by...
the following specifics. First, the high changeability of the V’ as manifested, among other things, in transitions from positive to negative values within an hour. Second, a relatively long-lasting period of a negative field existence. Third, a forestalling of the negative field maximum by its absolute value, in respect to the minimum of the P. These findings were published in an article by [Borisenkov, 1988].

DATA DESCRIPTION.

From the standpoint of the contemplated task, involving data on cardio-vascular patients’ condition during considerable changes of the V’ and P seemed logical enough. These studies began in 1997. They used the data from cardio-vascular patients at the Sanatorium "Sestroretsky Kurort" situated on shore of the Finnish bay, approximately a 37-km distance north-west of St. Petersburg. The data on the P were obtained from the Sanatorium’s bio-climatic station. The mean hourly values of the V’ were provided by the atmospheric-electric station “Voeikovo” of the Russian meteorological network, situated approximately a 50-km distance east of the Sanatorium. The main criterion of the groups of patients’ medical condition involved a 24-hour number M that sought medical attention, although other criteria were also used. The physical examination method was as follows: according to the P data, periods of time were chosen for study, as it had been done in 1986, and the juxtaposition of data obtained was performed by V’, P and M parameters for the chosen periods. An additional condition in choosing the period under study included the completeness of the V’, P and M data. These studies involved mostly the autumn-winter seasons, as during these particular seasons large-scale changes of the atmospheric pressure had occurred. But the juxtaposition of the V’, P and M data was also performed for periods with high changeability of the V’: during late-spring and summer time, i.e. in those periods when the transition to negative values of the V’ had occurred against the background of lesser changes of the P.

RESULTS.

On a more extensive basis, it proved possible to corroborate the findings of the study by Borisenkov, 1988, stating that a reliable and obvious association exists between considerable changes of the P and V’. Thus, starting from 1997, 57 periods of time with changes of the P were studied. In 52 cases, the drop of the P was accompanied by diminishment of the V’ and transition of the V’ to negative values. The analysis of the cardio-vascular patients’ condition at the sanatorium enable us to establish that patients felt worse during sharp changes of the P and V’. In 48 cases out of 52, the number of seeking medical attention M increased. It was confirmed that all the cases of a sharp change of the V’ during autumn-winter period were accompanied by considerable changes of the P, temperature, cloudiness, and precipitation, i.e. the phenomena specific for the atmospheric front passages. However, when cold atmospheric fronts with a behind-frontal cloudiness passed, cases of sharp changes of the V’ and increase in the M were revealed against the background of a growing P.
During late-spring and summer time, in the periods of sharp changes of the $V'$, the number of seeking medical aid increased although changes of the $P$ were insignificant in these periods.

In Figure 1, an example is presented concerning changes of the $P$, $V'$ and $M$ within a single observation time interval taken at random from among those chosen for the study. These are data for 17 – 20 February 1998, on the abscissa axis: Moscow time. As can be seen, a drop of the $P$ was accompanied by sharp changes of the $V'$ up to the appearance of negative values. The changes were associated with a cyclonic activity and a passage of a warm front over the Leningrad Region which induced some precipitation. The condition of the meteorolabile cardio-vascular patients sharply deteriorated on 18 – 19 February, as can be seen from the increment of the number seeking medical attention $M$.

![Graph](image)

Figure 1. The changes of the $V'$, $P$ and $M$ on 17 – 20 February 1998. On the abscissa axis: Moscow time in hours. On the ordinate axis: conventional units; 10 points of the ordinate scale correspond to 100 V/m, 4 mb, and two seeking medical attention per day. The zero value of the ordinate axis corresponds to 1000 mb. The $M$ values are also indicated on the graph.

A considerably more detailed description of the observation data and of the findings is given in the works as follows: [Borisenkov et al., 2000a, Borisenkov et al., 2000b]. These data are presented for the first time at a conference on atmospheric electricity.

CONCLUSION

Juxtaposition of the observation data on sharp changes in the atmospheric pressure and in the atmospheric electric field potential gradient enabled the authors to draw a conclusion that changes of
the P are an accompanying rather than affecting factor responsible for changes in the cardio-vascular patients’ condition during shifts in the weather.

Not denying a doubtless effect of the whole complex of meteorological factors directly or indirectly affecting the condition of sick persons, in particular the condition of cardio-vascular patients, the effect of the factors inducing considerable changes in the atmospheric electric field seems to be a crucial one and manifests itself in any season of the year.

Inclusion of data on the atmospheric electric field into the bulk of factors underlying the identification of unfavourable meteorological periods might prompt a more reliable determination of such periods as well as the use of increased measures for the medical control of meteoro-labile patients.

REFERENCES


