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SOME PROBLEMS IN WIND ELABORATION

Neki problemi obrade vjetra

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In meteorological practice the elaboration of aerological data is made by different methods depending on measurement instruments and the purpose of elaborated data.

Until recently, at two aerological stations in Yugoslavia the radiotheodolite GMD - 1A and the radiosonde VIZ 1680 MHz has been used. For the monthly aerological data radiosounding data are processed by the West-German computer programme "SONDA 3" of October 1969.

In this programme the calculation of wind data is based on height-pressure, or height-time curves and the measured elevation and azimuth angels are smoothed in order to eliminate as much as possible measurement and telecommunications errors. As the series of elevation and azimuth angles are measured at equidistant time intervals the moving average is used as the computation method. The arithmetic mean is calculated from three consecutive angle values and the result to the middle value allocated.

The same procedure is applied also to the position coordinates for every minute.

The second part of wind calculation comprises the elaboration of wind components. In one interval of three points the slope of the tangent line at the middle point is calculated by the slope of connecting line of both outer points, i. e.

$$x_i = \frac{X_{i+1} - X_{i-1}}{2t} \qquad (1)$$

where t is the time interval of measured data (e.g. t = 60 s).

The corresponding is valid for the y-component:

$$y_i = \frac{Y_{i+1} - Y_{i-1}}{2t} \qquad (2)$$

Finally, all velocity components are smoothed by moving average as described earlier. It should be added that the elaboration of velocity components encompasses all components with 2-minute intervals for one-minute data.

In our daily practice the described method by the "SONDA 3" programme is only partially used. Only the time smoothing is applied: the position coordinates of one-minute data are elaborated as shown above for a two-minute interval. As locations where local topographic factors may significantly influence the lower part of the boundary layer as in the case of Bora and Košava winds in our country, the picture of the vertical velocity profile gained by tripple smoothing of wind data may be in a notable degree distorted from the "real" condition.

We have selected two examples of wind elaboration procedures up to 3000 m for the data of two radiosoundings made on March 6th, 1982 at 15^{15} and 18^{15} hours GMT (Jurčec, 1984). In both cases strong Bora winds had blown in Dalmatia and the wind peaks in the lowest 1000 m above ground reached more than 25 ms^{-1}. By the "SONDA 3" method in the first case (Fig. 1) we have a rather fast change of wind speed in the lowest few hundred meters above ground with a wind peak of 25,5 ms^{-1} at 810 m a.s.l. At higher levels the wind speed changed quite gradually. Using elevation and azimuth data measured at one minute intervals (method B) the vertical wind speed change is more pronounced but with the wind maximum slightly greater (26,4 ms^{-1}) at the same level. The height differences between consecutive points are on the average 380 m. The wind speed differences between the values at the same levels up to 3000 m are in the range of 0.5-3.0 ms^{-1}, and are most distinctive in the lower Bora layer. A more detailed pictured of wind profile could be obtained if we take wind data measured at half-minute intervals (method A). The wind maximum of 27.3 ms^{-1} at 810 m is followed by several wind speed decreases and increases which results in differences of wind velocity in relation to the "SONDA 3" method at some levels up to 3.4 ms^{-1}.

With regards to wind direction differences between several methods we notice from Fig. 1. that they are quite small and only at some levels amount to 15 degrees.

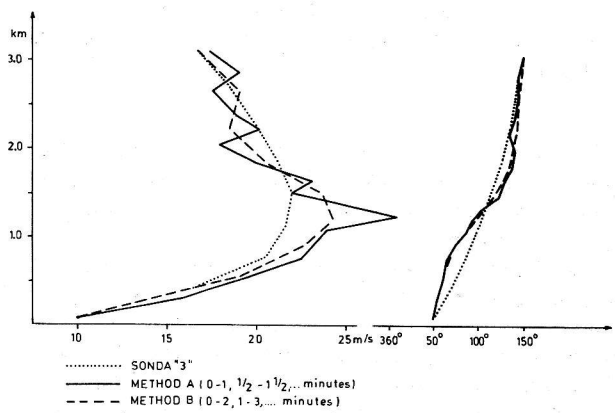

Fig. 1. Vertical profile of wind speed and direction obtained by radiosounding on March 6, 1982. 18^{15} (GMT)

Sl. 1. Vertikalni profil brzine i smjera vjetra dobiven radiosondažom 6. 3. 1982. u 18^{15} sati (SGV) trima metodama obrade vjetra

The second case investigated (Fig. 2) shows even greater wind speed differences, especially at the level of maximum wind speed.

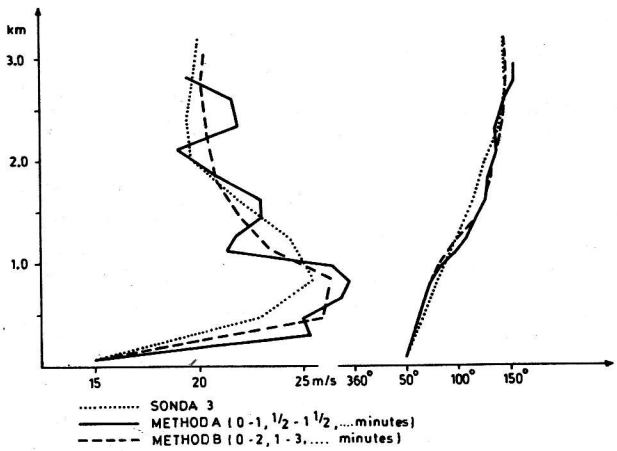

Fig. 2. Vertical profile of wind speed and direction obtained by radiosounding on March 6, 1982, 15^{15} (GMT)

Sl. 2. Vertikalni profil brzine i smjera vjetra dobiven radiosondažom 6. 3. 1982. u 15^{15} sati (SGV) trima metodama obrade vjetra

The wind velocity profile by the "SONDA 3" method depicts a smooth change of wind height, and the peak wind at 1500 m a.s.l. is 6 ms^{-1} smaller than the maximum wind speed elaborated by the method B. Above the level of maximum wind the methods A and B show small irregularities in wind profile which account in relation to wind velocity curve calculated by the "SONDA 3" method differences to nearly 3 ms^{-1}. In this case wind direction profiles elaborated by different methods show differences up to 20 degrees and indicate more realistic wind shear.

Conclusion. The problem of wind elaboration has been noticed also in Serbia, where the wind Košava shows a very pronounced wind maximum in the boundary layer. The intensity of this maximum is also diminished by the "SONDA 3" method. For the realistic appraisal of wind elaboration problem one should estimate a much greater number of cases than we have here, but in our opinion even our experience justifies our proposal that at all locations with strong winds in the surface layer the wind data should not be smoothed by the "SONDA 3" method. We believe that the use of one-half minute data may secure a more realistic wind profile and the elaboration of wind data in aerological practice should be changed and the "Bora" and "Košava" cases not investigated by classical methods. The only supposion we impose is the quality of measured wind data: if the measuring system is not adequately serviced and controlled, the "SONDA 3" method would give better results.

REFERENCE:

Deutscher Wetterdienst.: Programm zur elektronischen Auswertung von Radiosondenaufstiegen Sonderbeobachtungen des Meteorologischen Observatoriums Hohenpeissenberg, Hohenpeissenberg, 1960.

Jurčec, V., 1984: Strong bora case in Zadar and upstream bora layer characteristics. Zbornik met. i hidrol. radova, 10, 105 - 108.

SAŽETAK

U radu su razmatrane razne metode obrade visinskog vjetra. Pokazano je da metoda "SONDA-3", kojom se podaci kuteva i izračunate komponente (položaja) vektora vjetra glade kliznim srednjakom dovodi do značajnog umanjivanja maksimuma brzine vjetra u graničnom sloju, što se osobito manifestira u slučaju jake bure. Korištenjem podataka kuteva u jednominutnim (metoda B) i poluminutnim razmacima (metoda A), koji se ne glade kliznim srednjacima dobiva se realističnija slika vertikalnog profila vjetra. Na 2 izabrana primjera bure pokazano je da se u sloju do 3000 m mogu višestrukim glađenjem umanjiti maksimumi brzine vjetra do 3,4 ms^{-1}. Glađenje podataka kuteva i komponenata vektora vjetra ne dovodi do značajnijih promjena u vertikalnom profilu smjera vjetra.

Predloženo je da se metoda "A" primjeni kod svih slučajeva jakog vjetra u graničnom sloju (npr. kod bure i košave). Metodu, međutim ne valja primjeniti ako kvaliteta mjerenih podataka nije dobra (zbog slabog rada uređaja).