A STUDY OF BLOWING SNOW BY THE NEW INDEX

Abstract

by

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Visual observation on the natural snow surface shows that the phenomenon of blowing snow changes by an index P_b. The phenomenon is related strongly to wind velocity V(m/s) and air temperature T(°C). The index was set up by way of experiment as follows:

$$P_b = aV - bT. \qquad (1)$$

Where a(s/m) and b($°C^{-1}$) are the coefficients, and the author assumes a = b = 1. Then, the dimentionless equation P_b called "blowing snow index" is defined:

$$P_b = V - T.$$

On the snow surface on Shonai Plain (Honshu, Japan) 152 visual observations of the phenomenon were carried out at 9:00 every day. Observation points were set up on the plain at Tsuruoka C., Hirata T., Uza T. and Amarume T. Results from these observations were classified in 3 groups, namely, no blowing snow, slightly blowing snow and heavy blowing snow.

Figure 1 shows the obtained numbers n of each group. In the group of no blowing snow, the mean P_b is 3.1. In

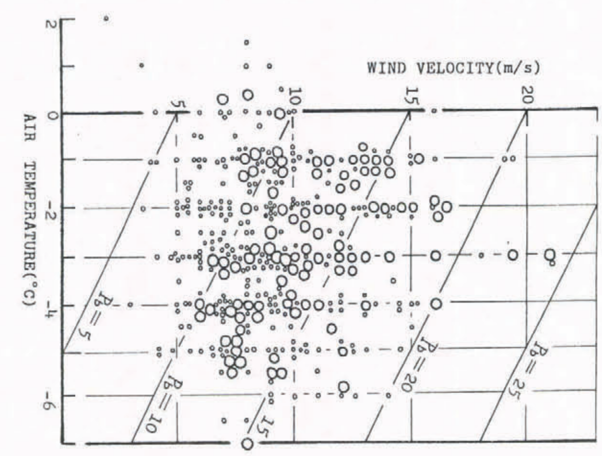

Fig.1. Grouping of observation numbers against P_b. A: no blowing snow, P_b = 3.1, B: slightly blowing snow, P_b = 11.4, C: heavy blowing snow, P_b = 14.2.

the slightly and heavy groups, P_b is 11.4 and 14.2 respectively. From the tendency shown on figure 1, it could be assumed that blowing snow phenomena do not happen in $P_b<7$, slightly blowing snow happens in $7 \leq P_b < 12$, and heavy blowing snow happens in $12 \leq P_b$.

At the same places, the amount of blowing snow transport Q (g/m·s) was measured 367 times. Values of Q were measured using a box blowing snow gauge. Up to this time, Q had been written as follows:

$$Q = 0.03V^3$$

Now, the author attempts to write as:

$$Q = \alpha P_b^3$$

the mean values of Q = 16.4 g/m·s and P_b = 12.1 were obtained from those measurements.

The obtained α from those measurements have a wide range of fractuations. Then, the coefficient α is estimated as follows:

$$\alpha = 0.011 \pm 0.014$$

The phenomenon of blowing snow depended remarkably on wind velocity, air temperature, degrees of hardness of a snow surface and diameters of snow particles. Therefore, it seems that to describe the tendency of the phenomenon by only P_b is inadequate.

The obtained Qs are grouped in accordance with P_b, namely, Q<20 g/m·s to $7 \leq P_b < 12$, Q≥20 g/m·s to $12 \leq P_b$. Figure 2 shows the distribution of Q as parametered by P_b.

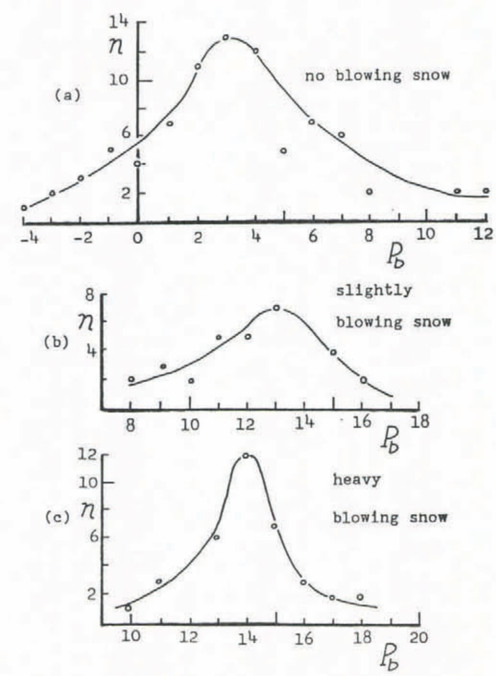

Fig.2. Distribution Q against P_b; white small circles: Q<20 g/m·s, white large circles: Q≥20 g/m·s.

The attempts to describe the initiation condition of blowing snow and the blowing snow transport Q by the index P_b are studied. The effectiveness of P_b on blowing snow are summarized in the following: (1) On the condition $P_b<7$, the snow surface has no blowing snow, $7 \leq P_b < 12$ has slightly blowing snow and $12 \leq P_b$ has heavy blowing snow. (2) On the estimation of transportation, Q could be expressed as follows:

$$Q = 0.011 P_b^3$$

but, the coefficient had wide ranging values.

In the particular case $7 \leq P_b < 12$, the amount of snow transportation showed Q<20 g/m·s, and the other case, $12 \leq P_b$, showed Q≥20 g/m·s. For these reasons, the index has a simple but useful characteristic on initiation condition of the blowing snow, but has little usefulness for the transport Q.