

Relationship between the periodicity of snow mass flux and meteorological factors obtained in Sapporo and Memuro

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Blowing snow reduces visibility. In some cases, it may cause traffic accidents. In order to reduce the number of traffic accidents caused by blowing snow-induced poor visibility, it is necessary to accurately predict the occurrence of blowing snow and the visibility at that time. According to Matsuzawa et al. (2002), the visibility can be estimated from snow mass flux, but snow mass flux is affected by several meteorological factors such as snowfall amount and wind speed. The purpose of this study is to estimate the visibility during a traffic accident that occurred in Miyagi Prefecture in January 2021, and to clarify the relationship between the periodicity of snow mass fluxes and meteorological factors that cause poor visibility.

Based on Matsuzawa et al. (2002), we estimated the visibility at the time of the accident. As a result, it was found that the visibility decreased rapidly with the increase in wind speed, and dropped to less than 50 m at the time of the accident.

The Fourier transform of snow mass flux divided by particle size, wind speed, temperature, and precipitation amount observed in Sapporo and Memuro showed that snow mass flux responded to the weekly cycle observed in wind speed and precipitation, and also responded to a cycle of a few days observed in precipitation. This may be due to the high proportion of snowfall particles rather than drifting snow particles, since the height of the snow particle counter was 1.5 m.

In addition, the daily variation of wind speed and temperature was observed in Memuro, so that snow mass flux responded to a daily cycle. According to Rikiishi et al. (2006), convection due to diurnal solar radiation occurs in the Tokachi Plain, and it is assumed that strong northwesterly winds blow at the surface due to this effect. The diurnal cycle (wind speed and temperature) may be an indication of these regional characteristics of Memuro. In both Sapporo and Memuro, there were periods shorter than 10 minutes, suggesting that there may have been fluctuations of several minutes during the traffic accident in Miyagi Prefecture.

A multiple regression analysis was conducted with the wind speed, temperature, and precipitation as explanatory variables and snow mass flux as the objective variable. The results showed that snow mass flux increased with increasing wind speed in both Sapporo and Memuro, but the effect of wind speed weakened as the particles became larger. Inertial drag acts more strongly on large snow particles than viscous drag when they fly through the air. Therefore, the larger the snow particle, the weaker the effect of wind speed. In both Sapporo and Memuro, snow mass flux with decreasing temperature, which is consistent with Takeuchi (1991) who showed that blowing snow are more likely to occur with decreasing temperature.

Keywords: blowing snow, visibility, fourier transform, multiple regression analysis