Development of low-cost meteorological detecting system for poor visibility occurred by snowstorm

*Yui Kobayashi[1], Kyoya Watanabe[1], Masataka Imai[1,3], Kensuke Watanabe[1,3], Nobuyasu Naruse[1,2], Yukihiro Takahashi[1,3]

1.Global Science Campus, Hokkaido University, 2.Institute for the Advancement of Higher Education, Hokkaido University, 3.Graduate School of Science, Hokkaido University

1. Background
Snowstorm occurs frequently in winter of cold regions. Occurring the poor visibility with the snowstorm, we might die getting lost, and sometimes a car crash also causes. Depending on weather conditions, a dangerous situation can be created called as whiteout. About the whiteout, however, the definition remains ambiguous, and there is no sufficient explanation in physics. On the other hand, the snowstorm has been well explained by many researchers; the snowstorm refers to a condition in which snow particles move by the strong wind. The snowstorm generation condition is below; the temperature is less than 2.0 ℃, the wind speed is more than 5.0 m/s, in general. To avoid the accidents due to the snowstorm, some studies for snowstorm danger alert system have been reported. However, there are some problems in the monitoring of the poor visibility, using video analyses or using visibility-meters, because these systems require constantly video monitoring and the cost is high. Although the risk of snowstorm (whiteout) has been forecasted from the entire weather situation, we have to develop further local observation network, because the snowstorm itself depends largely on the local terrain and local weather.
2. Purpose of this study
In this study, we have developed the low-cost meteorological detecting system for poor visibility occurred by the snowstorm or the whiteout. This work is the first step for setting up the observation network to minimize the weather disaster suffered by the poor visibility.
3. Summary of system
On the basis of the weather conditions of the snowstorm generation (the wind speed 5 m/s over and the temperature below 2 ℃), the first step was to develop the poor visibility detecting system within the total cost of 20,000 yen. The features are follows.
Battery driving to measure the temperature and the wind speed, and to send the detecting data by wireless apparatus (Xbee). This is for micro-scale meteorological measurements in the near future. The system to measure the change of visibility by using the intensity changes of semiconductor laser.
Especially, relating to the 2), we measured the intensity of laser, which was placed at a distance of 2-20 m. We found that the laser should be set within 10m from the photodetector, considering from the signal-to-noise ratio. We also checked our developing system using video recording, and we found that it can be the alternative for visibility meter.

Keywords: snowstorm, poor visibility, disaster prevention, whiteout