Multi-point meteorological observation for Cross-country skiing

*Tadashi Okami[1], Shohsi Kawarabayashi[1], Nana Iwadate[1], Tomomi Teraoka[1], Kyoya Watanabe[1], Yui Kobayashi[1], Nagoya Katsuhama[1], Hirokazu Fujiwara[1], Eiki Furuta[1], Genta Suzuki[1], 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

On the performance in cross-country skiing, weather data, such as the temperature, the humidity, and the snow surface temperature, is essential information to select the wax that is covered to reduce the friction between the ski and the snow surface. Generally, the wax is empirically selected from the judgment of weather data measured in one place of competition venue. The above mentioned weather conditions, however, are must be different between the sunny and the shade place, and depend on the degrees of wind speed. Therefore, judging from the weather data obtained at a specific area, we should not select the wax. The whole weather data on the cross-country course are needed.
To compensate for the drawback, the simulation softwares have been used to estimate the snow temperature on the course; the idea has been adopted in a foreign national team. Since it has been estimated from meteorological measurements at very limited position, it is unclear whether the simulated data is consistent with the actual weather conditions. Thus, if we could analyze the weather based on multi-point observation, the wax can be scientifically selected and we can make the strategy of the race.
This study aims 1) multi-point meteorological observations, and 2) measurements of the coefficient of dynamic friction for cross-country skiing. In this study, we focused on 1).
We have developed a multi-point meteorological observation system which can record every minute, temperature, humidity, illuminance to judge whether it is sunny place or not, and wind speed which affect snow surface condition in actual cross-country skiing course (Hokkaido, Date-city). We made ~60 sets of the above sensors, and set up the observation system on the actual course. Observed meteorological data was recorded through the collection in a coordinator (Arduino) and through the sending by wireless communication (XBee pro). Next, we discuss the way to select optimal wax in comparison the actual meteorological data with the simulated using software (snowpack).

Keywords: Multi-point observation, Cross-country skiing, Wax, XBee, snowpack