

PROPOSAL OF A CORRECTION COEFFICIENT FOR THE ESTIMATION OF GROUND
SNOWFALL AMOUNTS BASED ON X-BAND MULTIPLE PARAMETER RADAR
PRECIPITATION DATA

Satoshi Omiya, Tetsuya Kokubu, Hiroki Matsushita, Masaru Matsuzawa

Civil Engineering Research Institute for Cold Region (CERI), PWRI

Hiragishi 1-3, Toyohira-ku, Sapporo, 062-8602, Hokkaido JAPAN

somiya@ceri.go.jp

1. Introduction

In order to carry out effective winter-time road management, which involves decision making regarding when to close roads and when to launch winter service vehicles, it is essential to accurately estimate snowfall amounts in different spots. X-band multiple parameter radars (hereinafter referred to as “X-MP”) that have been established all across Japan by the Ministry of Land, Infrastructure, Transport and Tourism are widely used as an effective means to monitor concentrated heavy rains and localized downpours. Meanwhile, X-MPs still have some problems in terms of the accuracy of snowfall amount estimations. This study aims to compare publicly distributed X-MP radar precipitation data during snow against actual ground snowfall amounts and to improve the accuracy of ground snowfall amount estimations based on X-MP data.

2. Methodology

There are two X-MP stations (Ishikari Station and Kita-Hiroshima Station) near Sapporo City, Hokkaido Prefecture. This study compares and analyzes synthesized radar precipitation data obtained through X-MP observations against actual ground snowfall amounts and examines how we can improve the accuracy of snowfall amount estimations based on X-MP data. The X-MP radar precipitation data used in this analysis was downloaded from the Data Integration and Analysis System (DIAS) ¹⁾. Actual ground snowfall amounts were observed at CERI’s Ishikari Blowing Snow Test Field (43 degrees, 12 minutes north latitude and 141 degrees, 23 minutes east longitude). This test field constantly collects weather data, including wind direction and velocity and temperature. Figure 1 shows the locations of the two X-MP stations and the Ishikari Blowing Snow Test Field. Ground snowfall amounts were measured with the Double Fence Intercomparison Reference (DFIR), a gauge recommended by the WMO ²⁾, and a weighing precipitation gauge (Geonor T-200B).

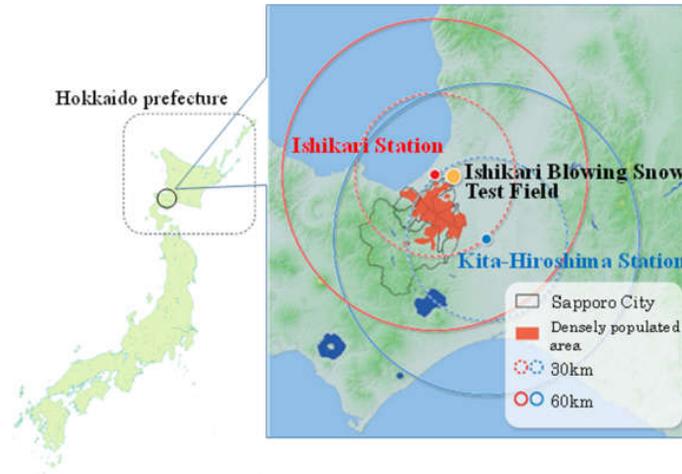


Figure 1 Locations of the two X-MP stations and Ishikari Blowing Snow Test Field

3. Data analysis

The comparison analysis used data collected during wintertime over three years (December 1 to March 31 from FY2014 to FY2016). 250-meter-mesh X-MP radar precipitation data is distributed every minute. In this analysis, ten-minute precipitations were calculated based on X-MP radar precipitations in the mesh right above the DFIR. The calculated ten-minute precipitations were compared against ten-minute ground snowfall amounts. Since this study focuses on snow, only the data collected under a zero or lower ground temperature was used. While the X-MP radar precipitation data was collected in the air, the DFIR observation data was collected on the ground. This means that comparison of this data would require us to take into account the advection effect of wind for falling snow particles and the time that snow particles take to reach the ground. Here, we only analyzed data less than 0.3 m/s, and we assumed that the time to reach the ground was ten minutes.

4. Results

Figure 2 shows the relationship between X-MP radar precipitations and ground snowfall amounts (converted into water amounts). The dashed lines in the figure are isopleths at the ratio of 1:1. These results reveal that X-MP observations at the time of snow tend to overestimate ground snowfall amounts. The solid lines in the figure show an approximation formula between X-MP observation values and ground observation values. The determination coefficient R^2 is 0.55 and RMSE is 0.06 mm, which means that this formula well explains ground snowfall amounts. In other words, the accuracy of winter-time X-MP radar precipitations can be improved by using the coefficient of 0.71 of the formula shown in the figure as a correction coefficient.

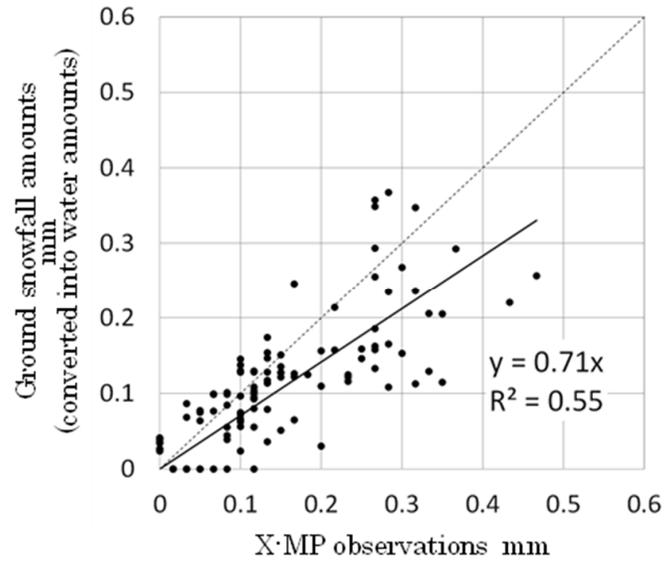


Figure 2 Relationship between X-MP observations and ground snowfall amounts

References:

- 1) Data Integration and Analysis System HP, <http://www.diasjp.net/en/>
- 2) Goodison et al. (1998): WMO Solid Precipitation Measurement Inter Comparison Final Report.