講演番号	334

Effect of snowfall on detection characteristics of automotive millimeter wave radar

Kengo Sato [1)] **Kazuma Togashi** [1)] **Kouji Morikawa** [2)]

Naoto Hagino [3)] **Hideo Inoue** [3)] **Shigeo Kimura** [1)]

1) National Research Institute for Earth Science and Disaster Resilience,Snow and Ice Research center.
1400 Tokamati, Shinjo, Yamagata, 996-0091, Japan (E-mail: kg-sato@bosai.go.jp)
2) Meteorological Research Institute for Technology
1-30-17 Hongou, Bunkyou, Tokyo, 113-0033,Japan
3) Kanagawa Institute of Technology.
1030 Shimoogio, Atsugi, Kanagawa, 243-0292, Japan

KEY WORDS: safety, intelligent vehicle, driving support/driver support, wet snow, millimeter-wave radar

We propose an equation representing the reduction rate of received signals on in-vehicle millimeter-wave radars due to wet snow accretion utilising publicly available meteorological data such as those from the Automated Meteorological Data Acquisition System. To derive this equation, we conducted signal reduction tests on millimeter-wave radars with varying the liquid water content (LWC) and thickness of snow specimen, alongside wind tunnel tests measuring snow accumulation growth on flat plates. The proposed equation is a function of the LWC and spatial density of the falling snow, as well as time.

To make the equation describing the attenuation of millimeter-wave radar signal intensity caused by wet snow accretion(Sato et al. 2024) more practical for real-world applications, we modified the proposed equation so that the lquid water content and snow depth required for the calculation can be determined using publicly available surface meteorological data(Fig.1).

In the modified equation, the liquid water content is determined arbitrarily under given meteorological conditions based on a snow accretion index derived from air temperature and relative humidity, while the snow accretion is calculated from the spatial density derived from snowfall intensity.

An evaluation of millimeter-wave radar signal attenuation using measurement results from Shinjo City, Yamagata Prefecture, in 2013 revealed that under meteorological conditions conducive to snow accretion, the millimeter-wave radar signal intensity attenuates by approximately 30% within about 120 seconds(Fig.2).

Since the attenuation of the millimeter-wave radar received signal is expressed as a linear function of the properties of the snow accretion on the radome, it can be expressed using a general formula without being limited to the coefficients of the function presented by Sato et al. (2024). Furthermore, just as the snow accretion growth rate could be expressed in terms of the spatial density of snowfall, it can be expressed as a function of snowfall intensity, and generalization is possible by selecting function coefficients that better fit actual conditions.

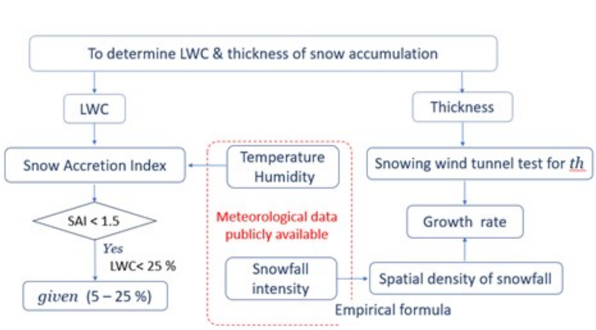

Fig.1 Calculation flow for snow accretion depth and liquid water content

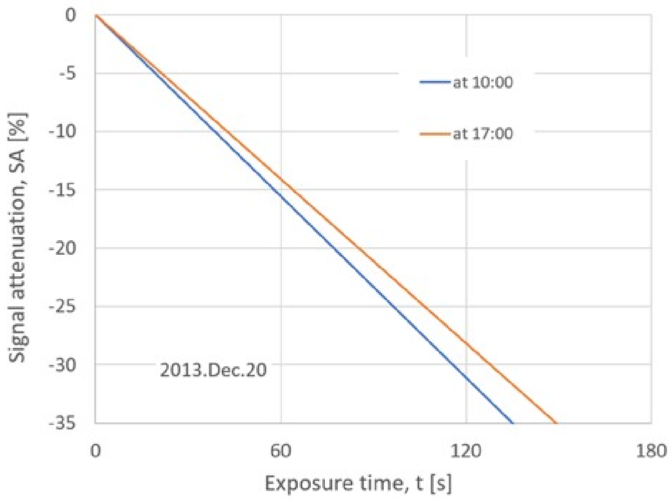

Fig.2 Relation of Exposure time and signal attenuation