

Nakamura, K., Y. Kaneko, K. Nakagawa, and H. Hanado, 2021: Radiowave scattering characteristics of melting layer measured by a dual Ka-band radar system. *J. Meteor. Soc. Japan*, **99**, 1099–1114. <https://doi.org/10.2151/jmsj.2021-053>

**Plain Language Summary:** Specific attenuation and equivalent radar reflectivity in a melting layer were measured using a dual Ka-band radar system. When the two radars are arranged to face each other and a precipitation system comes between the two radars, they observe the system from opposite directions. The radar echoes suffer from rain attenuation, which appears symmetrically in both radar echo profiles. By differentiating measured radar reflectivity with range, the specific attenuation ( $k$ ) can be estimated. After obtaining the specific attenuation, the equivalent radar reflectivity ( $Z_e$ ) is estimated. Melting layer observations were conducted on a slope of Mt. Zao, Japan. The relationship between  $k$  and  $Z_e$  showed interesting characteristic which appears in a loop-shape on a  $k$ - $Z_e$  diagram. A simple theoretical study explained this characteristic.

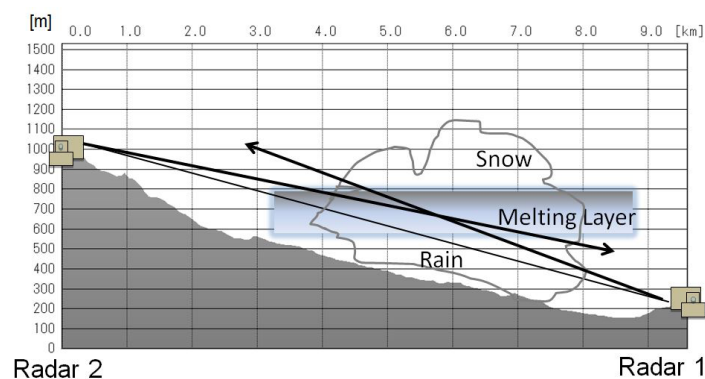


Fig. 1. Configuration of the melting layer observations at Zao Mountain slope.

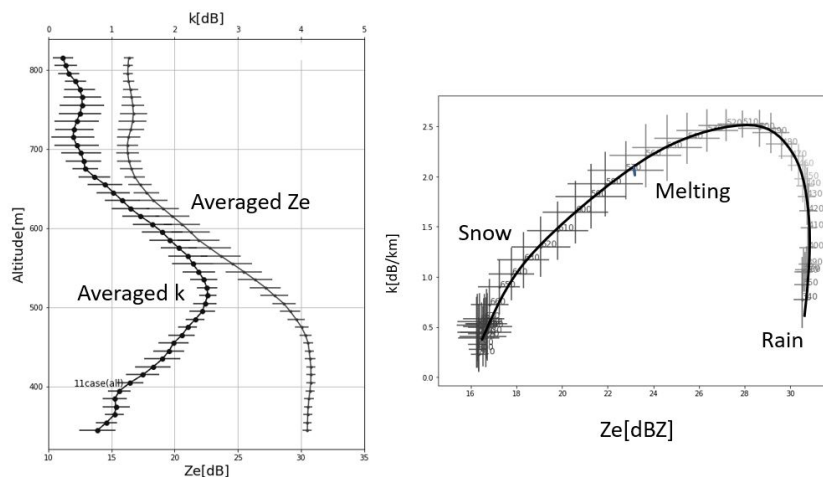


Fig. 2. Averaged  $k$ - $Z_e$  relationship for data on 1 March 2015. Left: The profiles of  $Z_e$  and  $k$ . The unit of the averaged  $k$  is shown in upper side of the figure. The height is relative to the lower site radar. Right:  $k$ - $Z_e$  diagram.

### Highlights:

- Ka-band radiowave scattering characteristics in a melting layer was investigated using a dual Ka-band radar system.
- Specific attenuation ( $k$ ) and equivalent radar reflectivity ( $Z_e$ ) were measured simultaneously.
- A loop-shape in the  $k$ - $Z_e$  diagram appeared for melting layer.
- The loop-shape was found to be due to permittivity and size change with Mie scattering effect.