

Leverage C- (Sentinel 1) and L-band (UAVSAR) radar observations to retrieve soil rms height and moisture

**Goal: to improve X and Ku-band radar
SWE retrieval
Supplement SWE retrieval for thick
snow**

Leung Tsang¹, Jiyue Zhu¹

Do-Hyuk “DK” Kang^{2,3}, and Edward Kim²

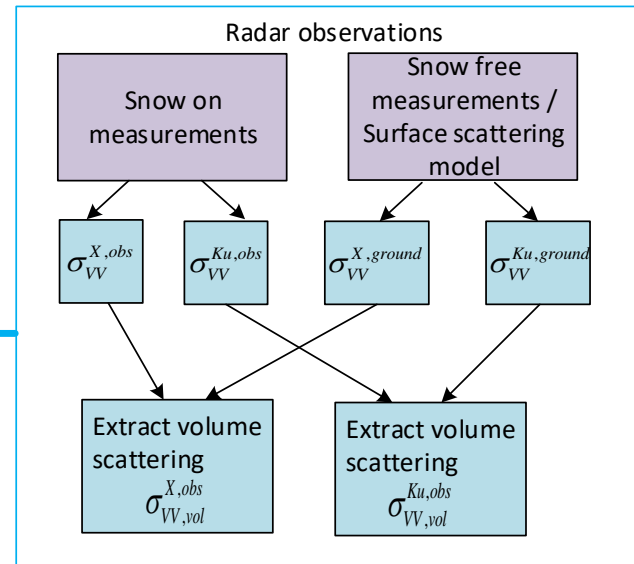
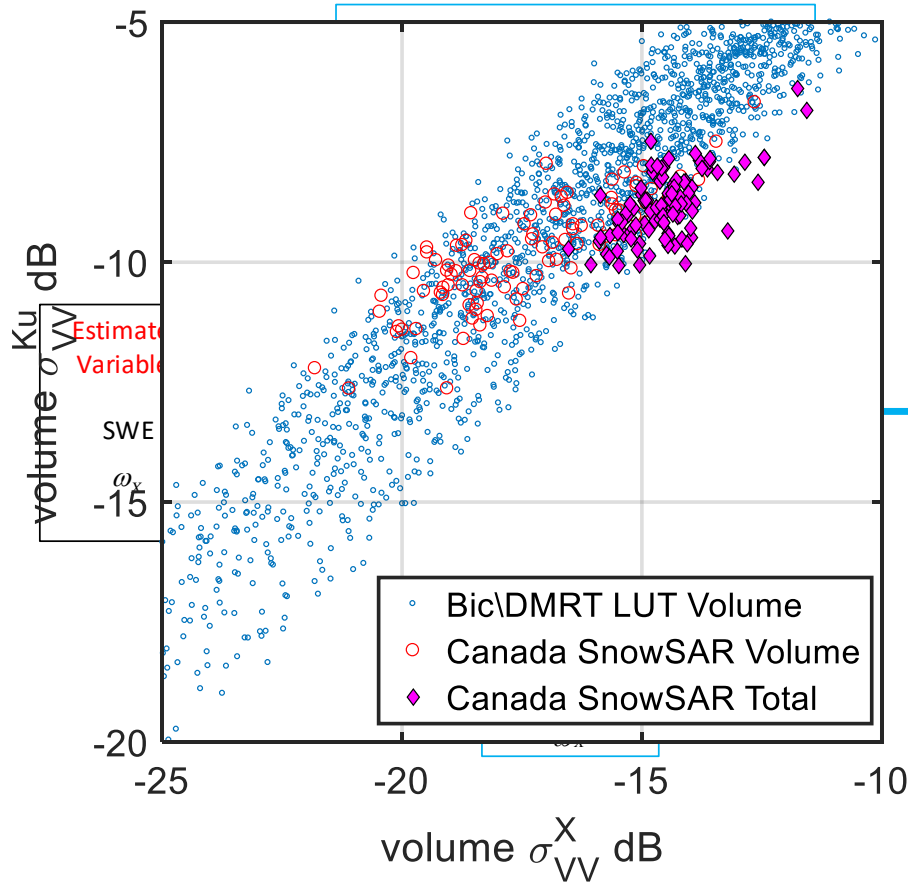
¹ Radiation Laboratory, Department of Electrical Engineering and Computer Science, The University of Michigan, Ann Arbor, 48109-2122 MI USA

² NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

³ ESSIC, University of Maryland, College Park, MD, 20740, USA



X and Ku radar SWE retrieval: Why is soil rms height and moisture important?

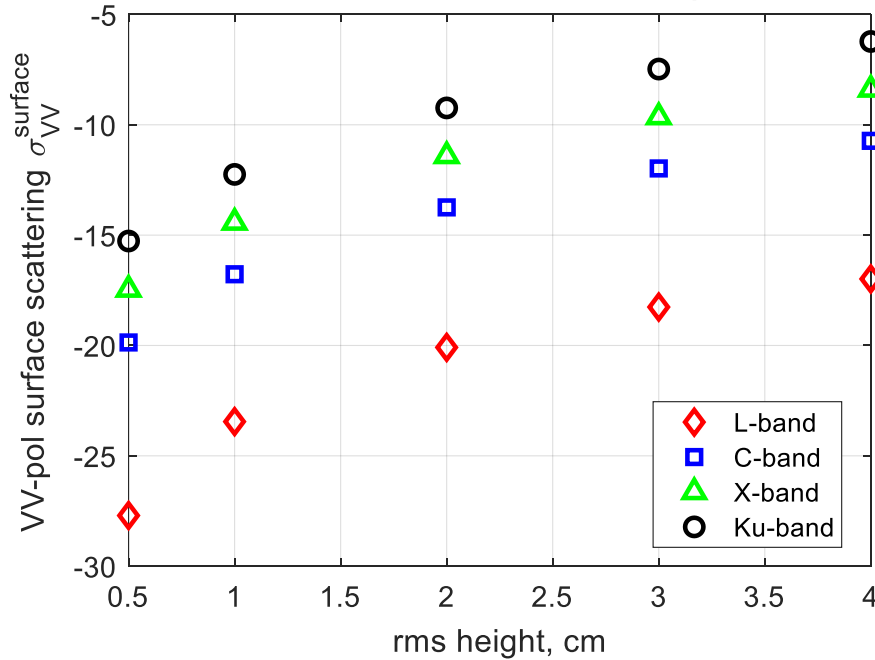


X and Ku band radar observations have **surface scattering of soil that depend on rms height and soil moisture (SM)**

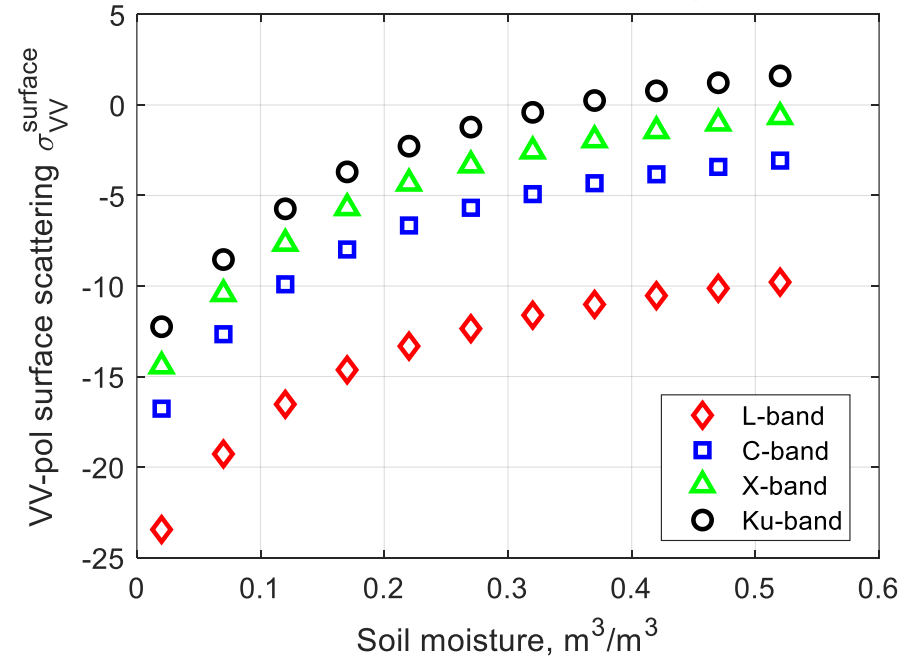
Procedure: retrieve rms height and soil moisture

Surface scattering $\sigma_{pq}^{\text{surface}}$ from soil at L, C, X and Ku band

Soil moisture = 2%, ratio=10, $\theta_i=40^\circ$



rms height = 1 cm, ratio=10, $\theta_i=40^\circ$

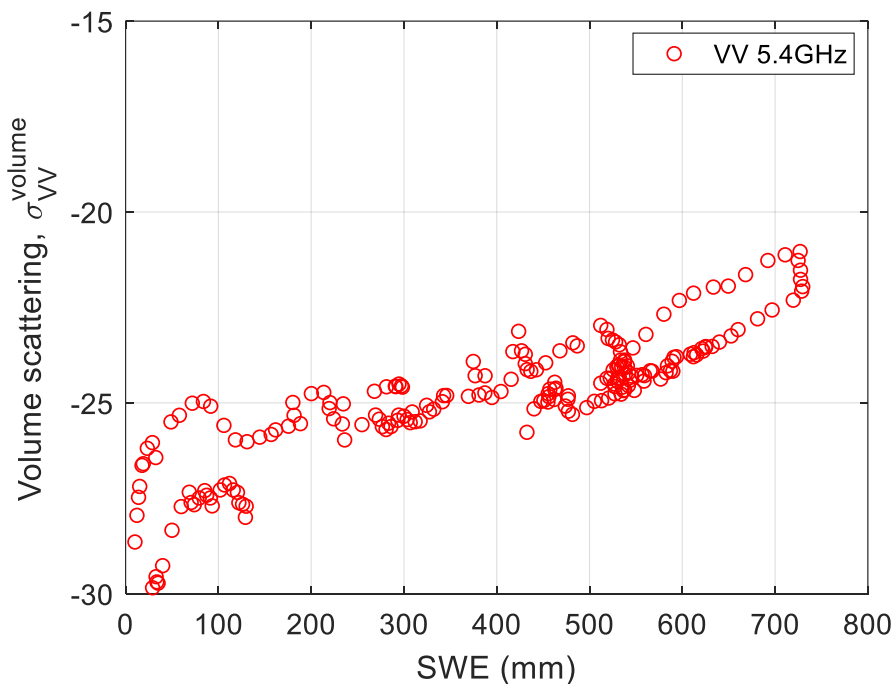
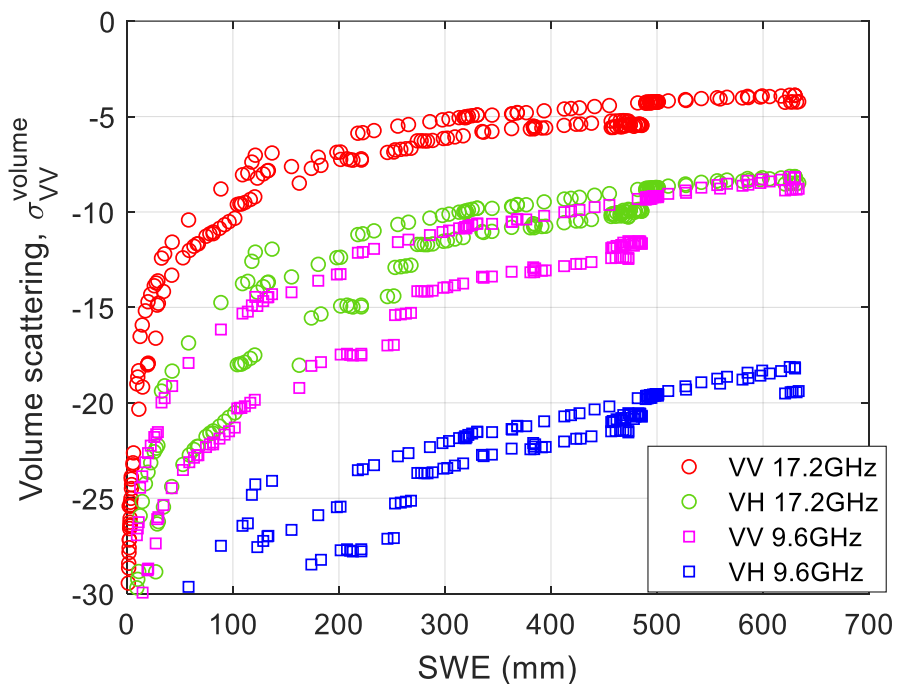


Step 1: Use C (blue) and L (red) band data to retrieve rms height and SM

Step 2: Use values of rms height and SM to get surface scattering at X (green) and Ku (black) band from Maxwell equations

SWE retrieval with C band (5.4GHz) data: sensitivity for thick snow σ of 5.4 GHz lower X band (9.6GHz) about 9dB

The snowpack is generated by snow physical model



- Thick snow: Snow depth > 1.5 m or SWE > 400mm
- Backscatter at X and Ku band saturate: 1dB range
- C band backscatter hold sensitivity: 4dB range