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

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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

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

$\sigma$ 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