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Snow Hydrology (CEWA 568)
Winter 2025

Midterm Report

Accurately predicting snowmelt timing and SWE is essential for managing water storage, flooding risks, and agricultural needs in regions that rely heavily on snowmelt runoff. However, traditional snow monitoring methods such as manual snow surveys are time-consuming, labor-intensive, and limited in spatial coverage, especially in remote or inaccessible areas.

Here, we propose to try and answer the below questions:

- Can spaceborne C-band InSAR from Sentinel-1 accurately estimate SWE at a large scale?
- How does this estimation compare with L-band InSAR from previous studies utilizing NASA's UAVSAR for SWE estimation? https://tc.copernicus.org/articles/17/1997/2023/tc-17-1997-2023-discussion.html

See https://github.com/Jack-Hayes/SWEet-InSAR#readme for more information and references.

Here, we select a site in Colorado's San Juan National Forest. This is because the snowpack in this region is dry. Given the dielectric properties of dry snow, microwaves are able to penetrate dozens of meters through dry snow. Water, on the other hand, has an extremely high dielectric constant and allows for essentially no penetration of microwaves. This is the basis of the research question. This is commonly done with backscatter rather than phase differencing, but I want to learn InSAR.
https://www.routledge.com/Introduction-to-Microwave-Remote-Sensing/Woodhouse/p/book/9780415271233?srsltid=AfmBOoqDh3

We're using Sentinel-1 bursts rather than entire swaths to save time and because our study region is small. We're also utilizing NASA OPERA CSLC products due to their rigorous coregistration and corrections which are explained more in 01_OPERA_phase_unwrap.ipynb

00_SAR_intro.ipynb shows how we downloaded the CSLC bursts. Our biggest limitation right now is processing interferograms as seen at the end of 01_OPERA_phase_unwrap.ipynb. If this continues to be an issue over the next week or so, I will plan to switch to NASA OPERA RTC backscatter products for the same analysis as those data are much easier to process and interpret in this context. I'm confident I would be able to perform analysis and wrap up this project with that data in a couple of weeks if needed. This would be quite similar to Ayush's project, though.