Literature Review of :

**SUBGRID SNOW DEPTH COEFFICIENT OF VARIATION SPANNING ALPINE TO SUB-ALPINE MOUNTAINOUS TERRAIN**

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**light detection and ranging**" or "laser imaging, detection, and ranging"

Main Idea:

Looking at the Colorado Mountains, They came up with a Coefficient of Variability of Snow Depth ( CV\_ds ). This CV\_ds was significantly greater in alpine regions. Mean or average snow depth was a driver of the variability of CV\_ds.

CVds decreased nonlinearly with increasing snow depths.

This negative correlation is attributed to the static size of roughness elements (topography and canopy) that strongly influence seasonal snow variability.

Subgrid CVds was also strongly related to topography and forest variables; important drivers of CVds included the subgrid variability of terrain exposure to wind in alpine areas and the mean and variability of forest metrics in subalpine areas. Two statistical models were developed (alpine and subalpine) for predicting subgrid CVds that show reasonable performance statistics.

Quotes: Things of note

Goal of this paper:

The objectives of this research were to (1) determine the range of *CVds* values that are observed within varying grid resolutions throughout the study area, (2) evaluate the effects of mean snow depth, forest, and terrain characteristics on subgrid *CVds*, and (3) develop a methodology for characterizing *CVds* within complex mountainous terrain. This research aims to help advance understanding of the variability of subgrid snow distributions, and inform more accurate representations of subgrid snow variability that can be used within physically-based models.

References to check:

Liston (2004) presented an approach of effectively representing subgrid snow distributions in coarse-scale models by using a lognormal probability density function and an assigned coefficient of variation (*CV*). This approach only requires an estimation of the *CV* parameter (i.e. standard deviation divided by the mean),

Representative values of the *CV* of snow water equivalent (*CVSWE*) and snow depth (*CVds*) have been published by many field studies (refer to Table 1 and Figure 2 from Clark *et al.*, 2011) and have been summarized based on vegetation and landform type (Pomeroy *et al.*, 1998) and classified globally, based on air temperature, topography, and wind speed regimes (Liston, 2004). However, the range of published *CVSWE* and *CVds* in complex mountainous terrain (i.e. the mountain snow class from Sturm *et al*., 1995) is quite variable and a parameterization has not been well defined.

They took Linear models to predict the Coefficient of Variability for alpine and subalpine grids based ono Canopy density, surface slope, Vegetation height, topographic position index. Removed those that had VIF greater than 2 and ensure p-value >.05. They used 10 fold cross-validation.

SWE… MM

Statistically significant difference p < 0.01 between alpine and subalpine study grids were observed for depth of snow, stand dev of snow depth, and Coefficient of variability of snow depth.

This function suggests that Coefficient of variability of snow depth is a systematic decrease with increasing snow depth. This suggests that relative subgrid snow variability is importantly related to the total snow accumulation of a given year.

In the alpine regions, it is important to look at the variability of wind exposure and sheltering and influenced CVds.

Subalpine grids were most negatively correlated with the Vegetation height and canopy density suggesting that forest structure is important driver for subgrid variability with increases in forest canopy coverage generally reducing CVds.

This study evaluates sthe subgrrid variability of Snow depth, but SWE is most fundamental snowpack variable of interest in land surface processes.

This study outlines a methodology for utilizing lidar-derived snow datasets for investigating subgridsnow depth variability and potentially improving its representation with physically-based modeling applications. At fine grid resolutions, subgrid snow depth coefficient of variation generally increased with its variability decreased with increasing grid resolution. Study grid CVds exhibited a wide range across the study area and subgrid variability was found to be greater in alpine areas than subalpine.

Snow depth was the most important driver in CV sd variability in both alpine and subalpine areas.

There was a systematic nonlinear decrease with CVsd with increasing snow depth. They predicted the coefficient of variability of snow depth.