Assessing the Variability of Snow Surfaces

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Intro:

Variability in snow surface roughness is rarely incorporated into climate or hydrological models, yet it has the potential to have a large impact on both latent and sensible heat for a snow dominated system. We looked at the spatial variability of snow surface roughness using the data collected by the NASA Cold Land Processes Experiment (CLPX) during the winters of 2002 and 2003 for nine 1 km² study sites across northern Colorado.

Objectives:

- To better understand the amount of variability in surface roughness
- To determine what drives these processes of roughness
  - Topography, land cover, etc.

Background:

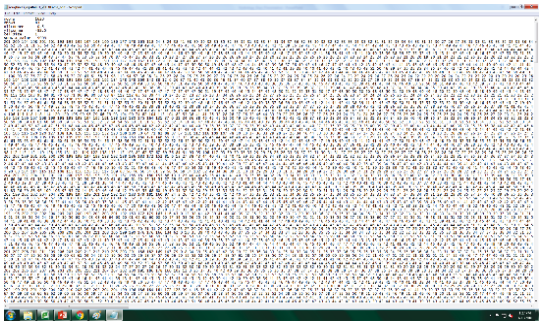
- Latent heat flux (Q_E): $$Q_E = -L_S(K_E)\left(\frac{\partial P_Y}{\partial[\ln\left(\frac{Z}{Z_0}\right)]}\right)$$
- Z_0 = f(surface)
  - Varies by land cover, e.g., forest, fields, snow
- But Z_0 varies over space
  - This is due to variations in the surface over space
- Especially for snow

Process:

The snow surface identification process of Fassnacht et al. (2009) was used to define the snow surface interface.

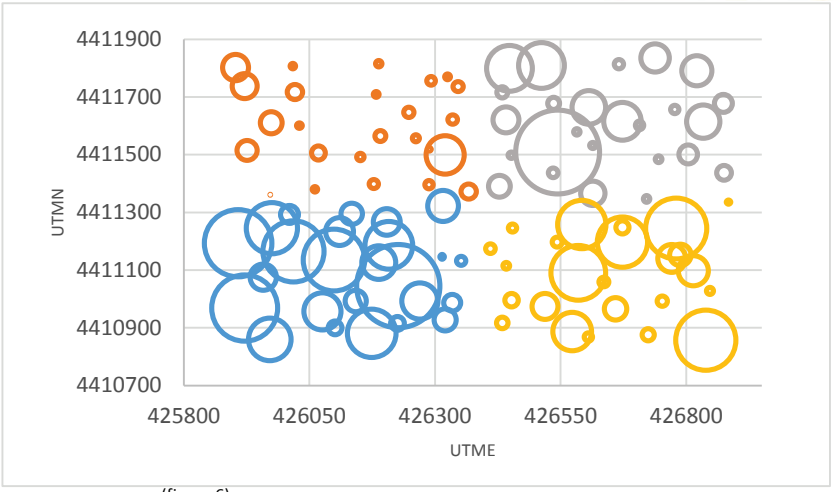
- Photo roughness_iop4faa03_20030328 (figure 1)

- Photo editing (figure 2) roughness_iop4faa03_20030328_edit
- Converting the photo into ASKII (figure 3)



left (figure 2), above (figure 3)

- ACKII to Excel
- Detrending, standard deviation, etc.
- Statistical analyses

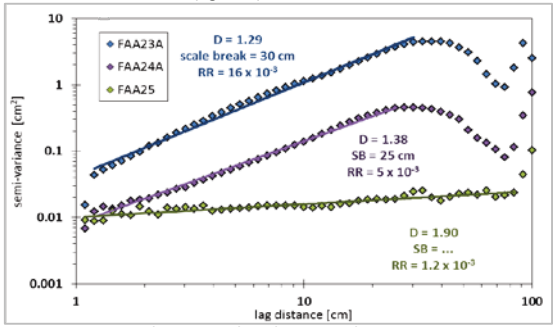


(figure 6)

Results:

- Possible implications
  - How it could be used to model
  - How this info could affect other models

(figure 4)

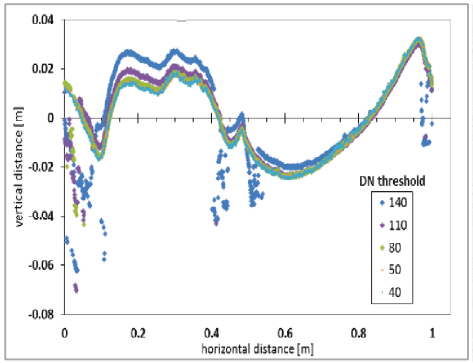


- Variograms showing the distance between two points and the difference in variance
  - RR: random roughness
  - D: fractal dimension
- SB: scale break

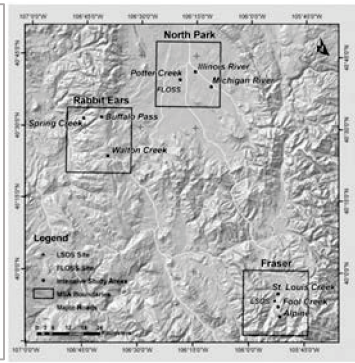
Future Work:

- Continued work on the Fraser data set
- Continued work on the CLPX data set
- Finish production of the entire Alpine data set Variogram
- Threshold sensitivity testing

(figure 7)



(figure 8)



Works cited:

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