Environmental Drivers of Snow Melt in a Burned Forest in the Western Oregon Cascades

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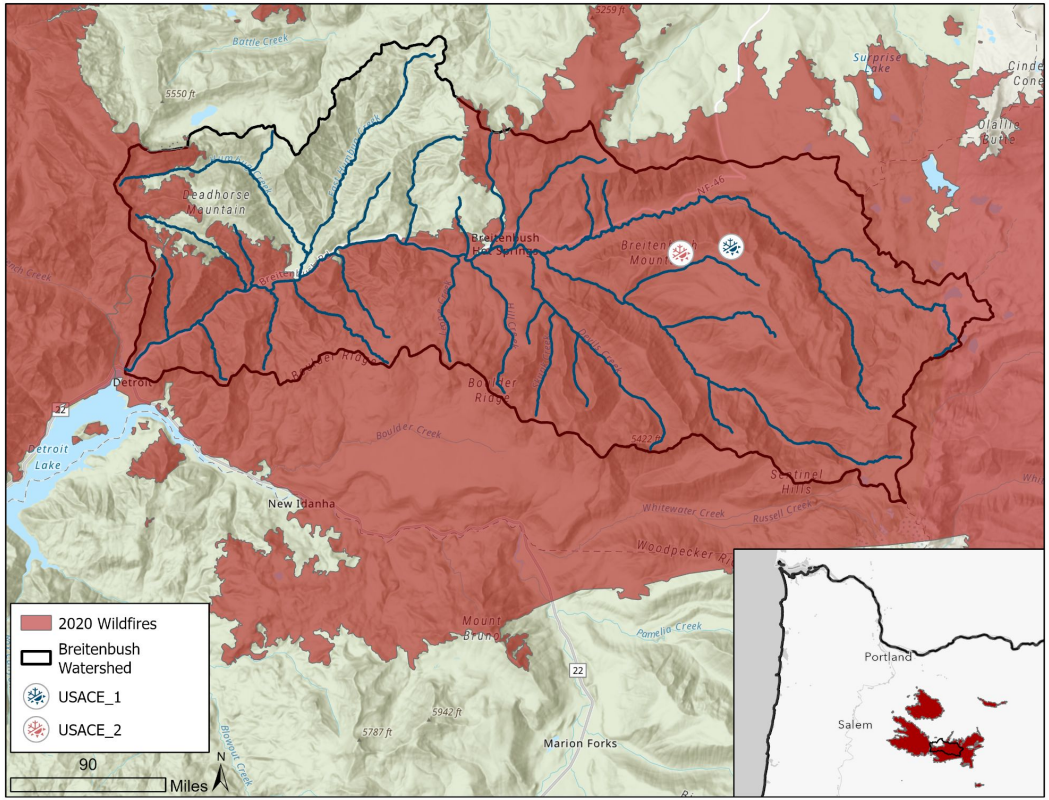
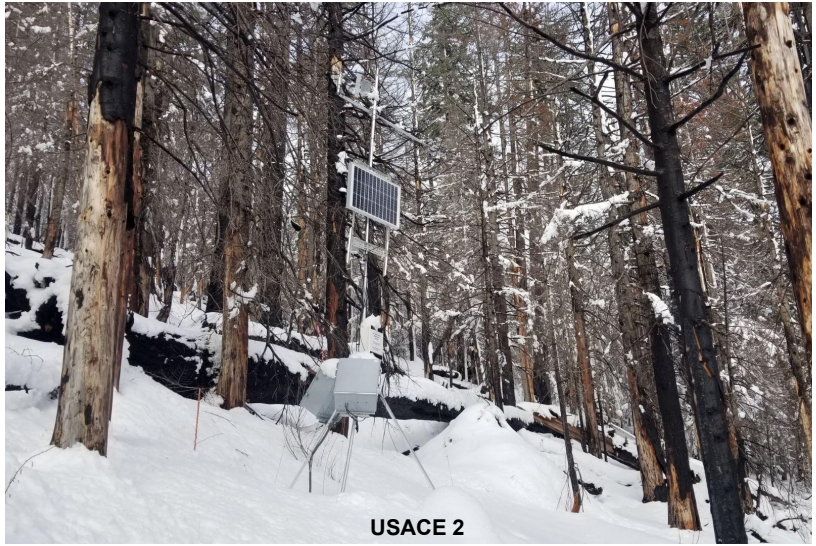
ESM 566 - Data Analysis

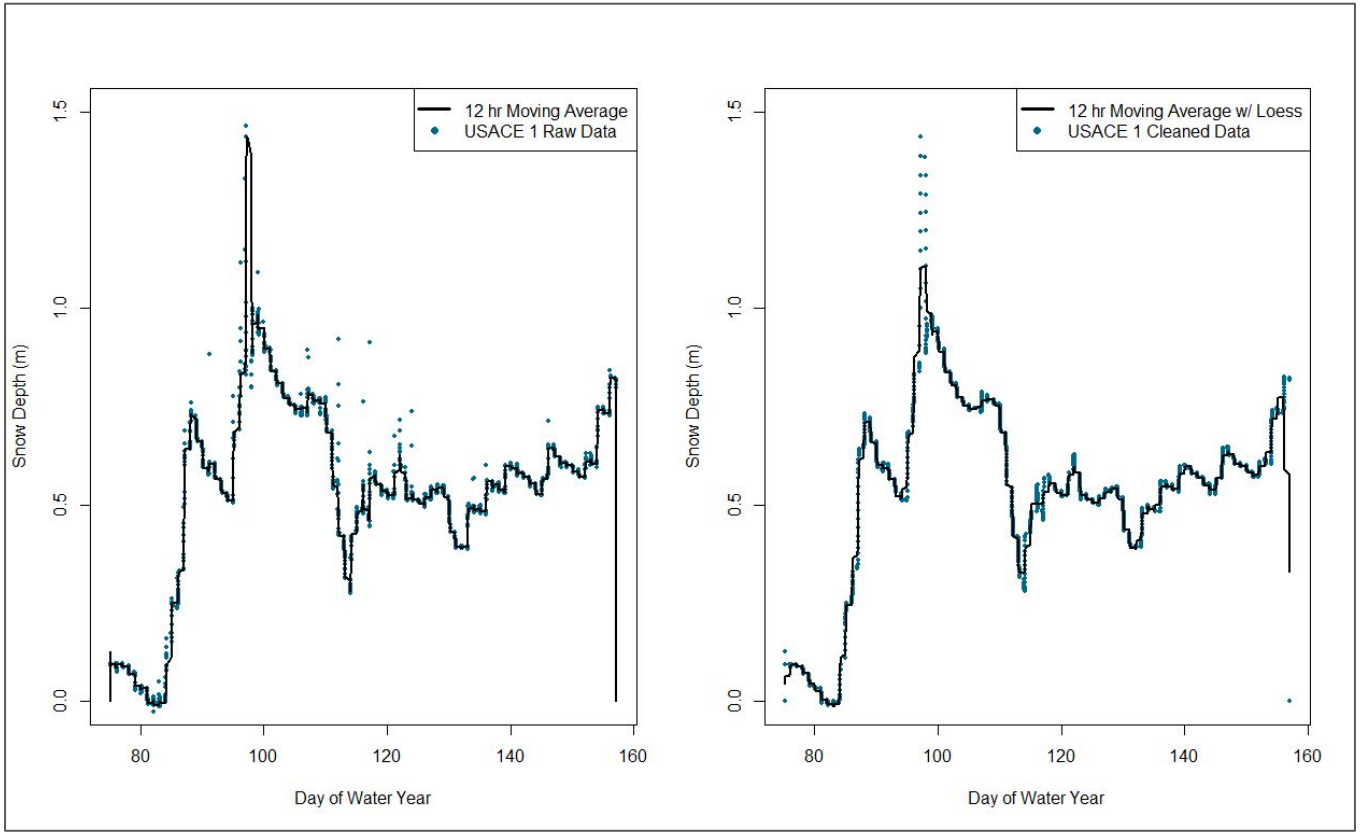
Introduction



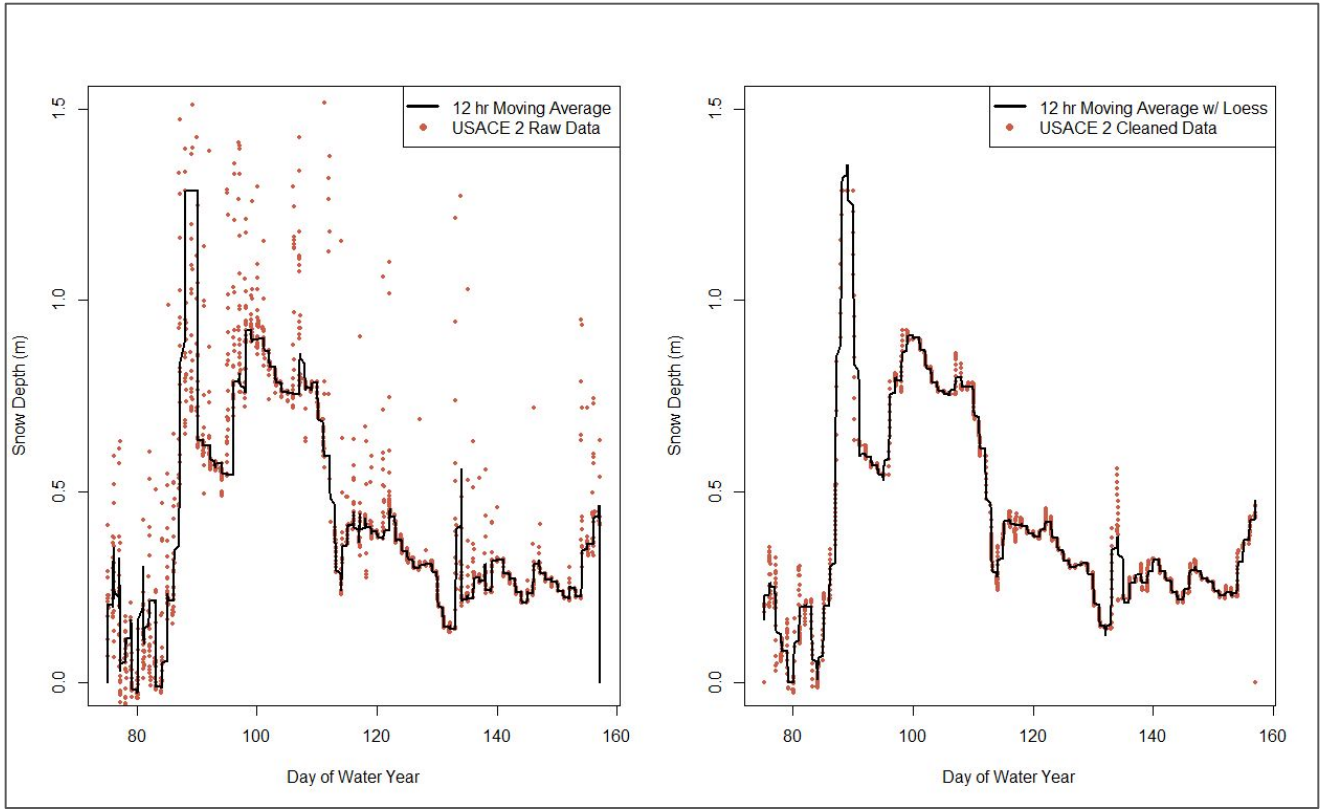
Study Area



Methods: Data processing



Methods: Data processing



Methods: Statistical modeling

- Method 1: Multiple linear regression using binned data.
- Method 2: Multiple linear regression using 12 hour rolling average data.
- Method 3: Correlation and Regression Tree (CART) Model.

Results

Method 1: Multiple linear regression using binned data

Table 2: Key metrics from reduced linear model for USACE_1 site

Coefficient estimate for relative humidity (%)	-0.0003169
Coefficient estimate for wind speed (m/s)	-0.2914
Adjusted R-squared	0.2213
Standard error of predicted hourly change in snow depth (m)	0.08

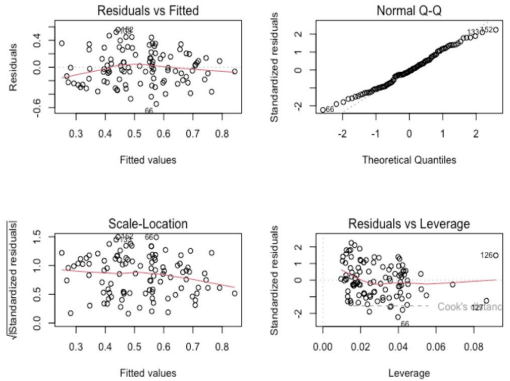


Figure 4: Residual plots of USACE_1 reduced model. The plots indicated and tests confirmed the residuals' normality (Shapiro-Wilks test) and homoscedasticity (F-test between the variances of two halves of the residuals).

Table 3: Key metrics from reduced linear model for USACE_2 site

Coefficient estimate for wind speed (m/s)	-0.1542
Adjusted R-squared	0.2452
Standard error of predicted hourly change in snow depth (m)	N/A (training set failed model assumptions)

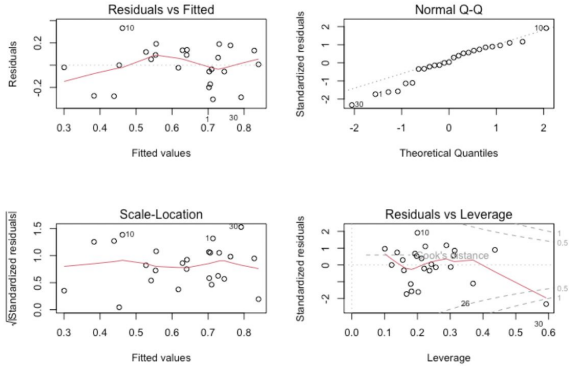


Figure 5: Residual plots of USACE_2 reduced model. The plots indicated and tests confirmed the residuals' normality (Shapiro-Wilks test) and homoscedasticity (F-test between the variances of two halves of the residuals).

Results

Method 2: Multiple linear regression using 12 hour rolling average data

- Models failed the Shapiro-Wilks test for normality of residuals:

  USACE_1 ($P < 0.001$), USACE_2 ($P < 0.001$)

- Inadequate!

Results

Method 3: Correlation and Regression Tree (CART) Model, USACE 1

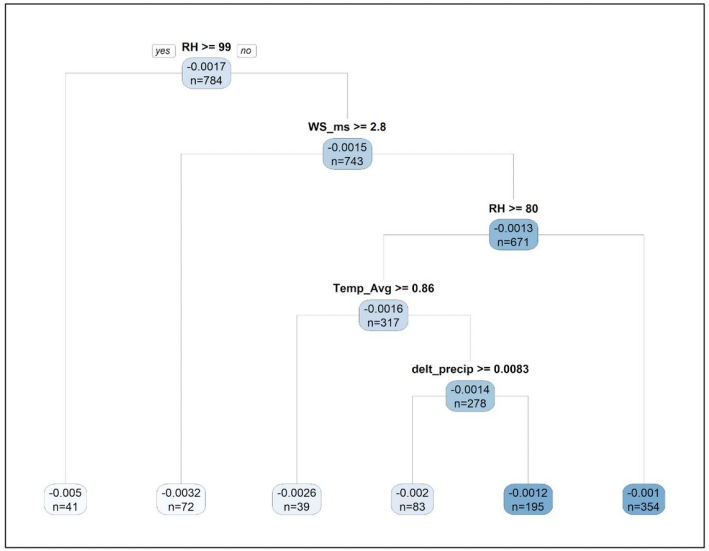


Figure 6: CART model of meteorological drivers at the USACE_1 study site. (Total Cp= 0.19, Pseudo R^2 = 0.35)

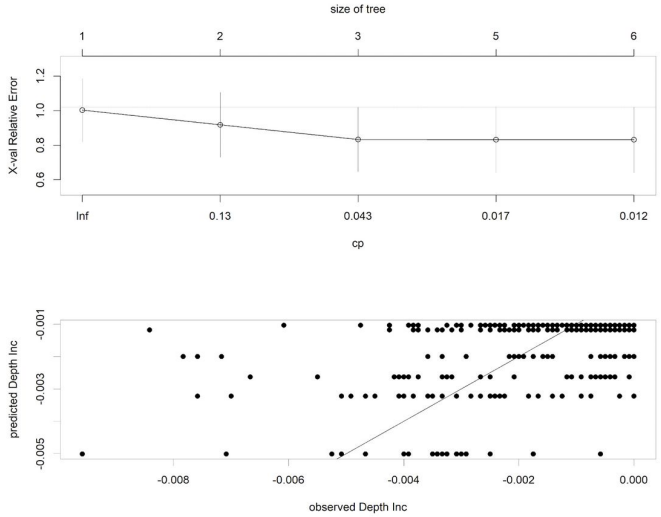


Figure 7: (Top) primary splits and cp values for USACE_1 CART model. (Bottom) Predicted change in depth (Depth Inc) values during melt periods vs predicted change in depth values. The model does not perform well as a predictive model, but can be used to describe the processes influencing melt during the period analyzed.

Results

Method 3: Correlation and Regression Tree (CART) Model, USACE 2

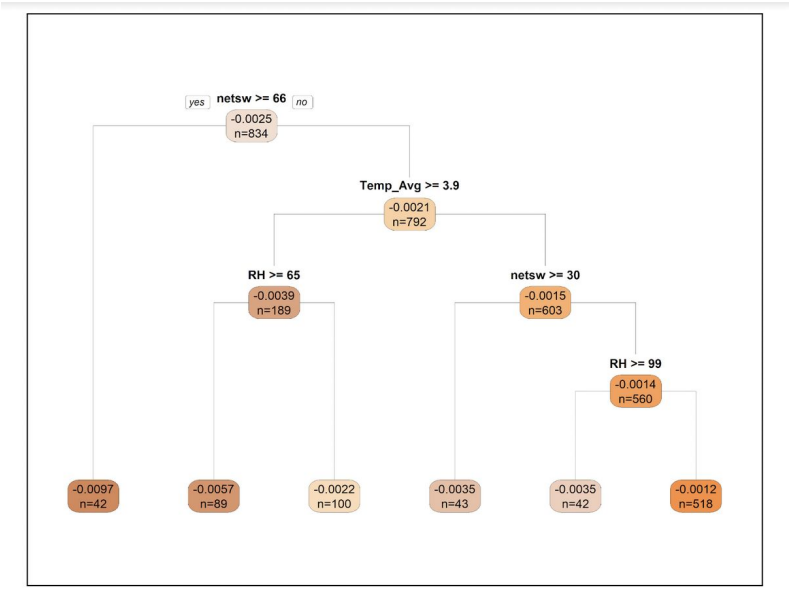


Figure 8: CART model of meteorological drivers at the USACE_2 study site. (Total Cp= 0.13, Pseudo R^2 = 0.32)

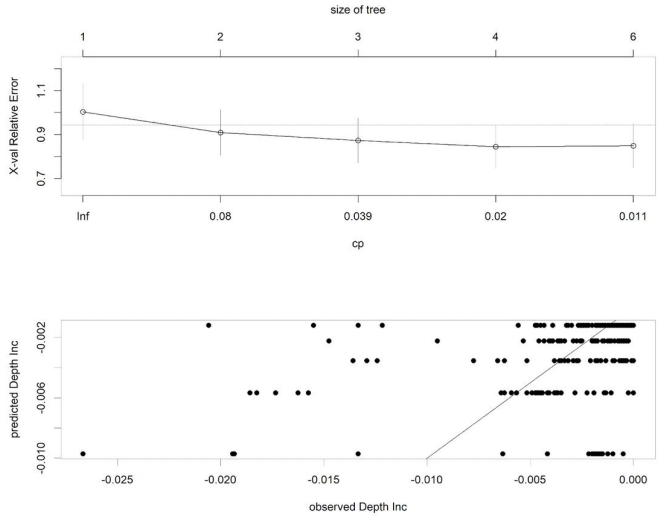


Figure 9: (Top) primary splits and cp values for USACE_2 CART model. (Bottom) Predicted change in depth (Depth Inc) values during melt periods vs predicted change in depth values. The model does not perform well as a predictive model, but can be used to describe the processes influencing melt during the period analyzed.

Discussion

- Reduced data sets: significant models with poor performance
- Full data: inadequate models
- CART model showed influential drivers
- Likely need more data for robust linear regression models
- Next steps: pre-specification of methods, time series analysis, mixed effects modeling, etc.