Persistent Snow in a Taconic Mountains "Ice Cave"

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1. Introduction

Despite being an integral part of history of the Taconic Mountain region in Upstate New York, the famous snow inundated "ice cave", the Snow Hole, remains a mystery. This location supports snow cover roughly 9 months of the year. The reasonable distance from SUNY Oneonta, and its location on public property facilitates easy fieldwork at the site. Information gathered in this study can expand the knowledge of regional climatology in the Taconic Mountains and enhance the scientific knowledge about this location of historical significance.

Goal: Determine whether current conditions found at the site can support relict permafrost, and if the geology of the Snow Hole has any impact on the cool temperatures found in the "cave" year-round.

2. Objectives

A. Gather in situ, and regional temperature measurements, and use them to develop multivariate regression models to predict temperature at the Snow Hole
B. Determine whether relict permafrost is possible at this elevation, and whether it causes the persistent snow found deep within the Snow Hole

3. Study Site Description

Latitude: 42.45 **Longitude:** 73.16
Elevation: 2340 ft
Town: Petersburgh, NY 12138

Geology/Geomorphology:

Primarily made up of Greenschist and Phyllite and formed from the Taconic Orogeny. Not technically a "cave" due to the low levels of carbonate

4. Methods

A. Visited the field site to obtain data from the HOBOLink sensors previously placed inside and above the Snow Hole. Rock and soil samples were also taken to identify the geological makeup of the site
B. Excel used to enter and manipulate temperature data at the Snow Hole, and selected locations near the site
C. SPSS was utilized to analyze and compare the temp data gathered. A statistical significance, confidence interval, and standard error were found for multiple scenarios comparing the Snow Hole to the nearby locations

Date	SH2_Min	BEN_Min	N.AD_Min	ALB_Min	SVN_Min	SH2_Max	BEN_Max	N.AD_Max	ALB_Max	SVN_Max
9/28/2018	45	46	49	52	48.80	52.54	61.00	61.00	62.00	58.70
9/29/2018	49	42	42	47	41.20	54.70	66.00	64.00	68.00	62.80
9/30/2018	42	38	41	43	37.10	55.01	63.00	63.00	66.00	61.40
10/1/2018	50	52	51	52	48.20	53.08	56.00	59.00	59.00	62.00
10/2/2018	49	53	55	52	53.60	58.71	64.00	59.00	66.00	59.70
10/3/2018	53	50	51	50	49.10	58.56	63.00	63.00	65.00	62.70
10/4/2018	51	48	53	50	47.90	70.53	74.00	74.00	72.00	70.70
10/5/2018	40	41	44	46	41.50	53.69	61.00	64.00	61.00	61.10
10/6/2018	48	48	50	47	47.90	56.78	66.00	62.00	65.00	61.80
10/7/2018	57	52	54	52	56.10	62.42	69.00	73.00	72.00	73.80

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	2.917	.469		6.222	<.001
	BEN_Min	-.188	.081	-.194	-2.311	.021
	N.AD_Min	.207	.073	.210	2.842	.005
	ALB_Min	.610	.051	.634	11.949	<.001
	SVN_Min	.284	.074	.295	3.845	<.001

a. Dependent Variable: SH2_Min

SH2 VS. SVN/ALB/N.AD/BEN (5D MIN)

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	SVN_Min, ALB_Min, N. AD_Min, BEN_Min[b]	.	Enter

a. Dependent Variable: SH2_Min
b. All requested variables entered.

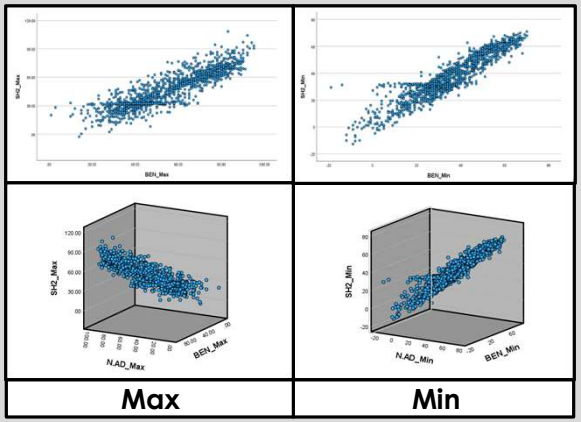
Model Summary

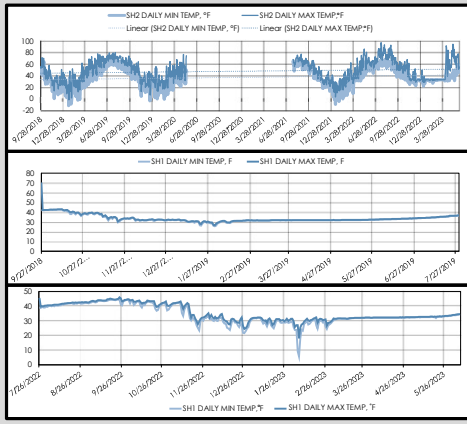
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.940[a]	.884	.883	5.612

a. Predictors: (Constant), SVN_Min, ALB_Min, N.AD_Min, BEN_Min

5. Discussion

Graphs **(B)** and **(C)** illustrate approximate fill and melt dates of snow. A more linear line indicates that the sensor has been covered and is measuring a consistent temperature (~31-32˚F). A variability indicates melt. After SPSS analysis of the data from the top of the Snow Hole, a statistical significance <.001 was found for both the max and min temperature datasets. In conjunction with a confidence of .940 for the min and .895 for the max, temperatures at the top of the Snow Hole can be predicted with relative accuracy. The equation, **SH = -0.188 (BEN) + 0.207 (N.AD) + 0.610 (ALB) + 0.284 (SVN)**, is used to find the Snow Hole Min Temp, and the equation **SH = 0.283 (BEN) -0.246 (N.AD) + 0.707 (ALB) + 0.145 (SVT)** for the Snow Hole Max Temp. Further work is necessary to determine if prior temperatures meet the condition of "permafrost", averaging less than 32F over a period of two or more years.





A) Snow Hole Top: Min and Max Temperature from 9/2018 - 6/2023

B) Snow Hole Bottom: Min and Max Temperature from 7/2018 - 7/2019

C) Snow Hole Bottom: Min and Max Temperature from 7/2022 - 6/2023

6. Going Forward

A. Using XRD device to analyze mineralogy of rocks and soil
B. Determine thermal conductivity and diffusivity
C. Potentially add more locations
D. Analyze additional variables, including precipitation, snow depth, snow fall

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