

# Investigating snow cover and ground temperature variability at the Pinware River Hills research basin, NunatuKavut, southern Labrador.



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# Introduction



# Northern Environmental Geoscience Laboratory





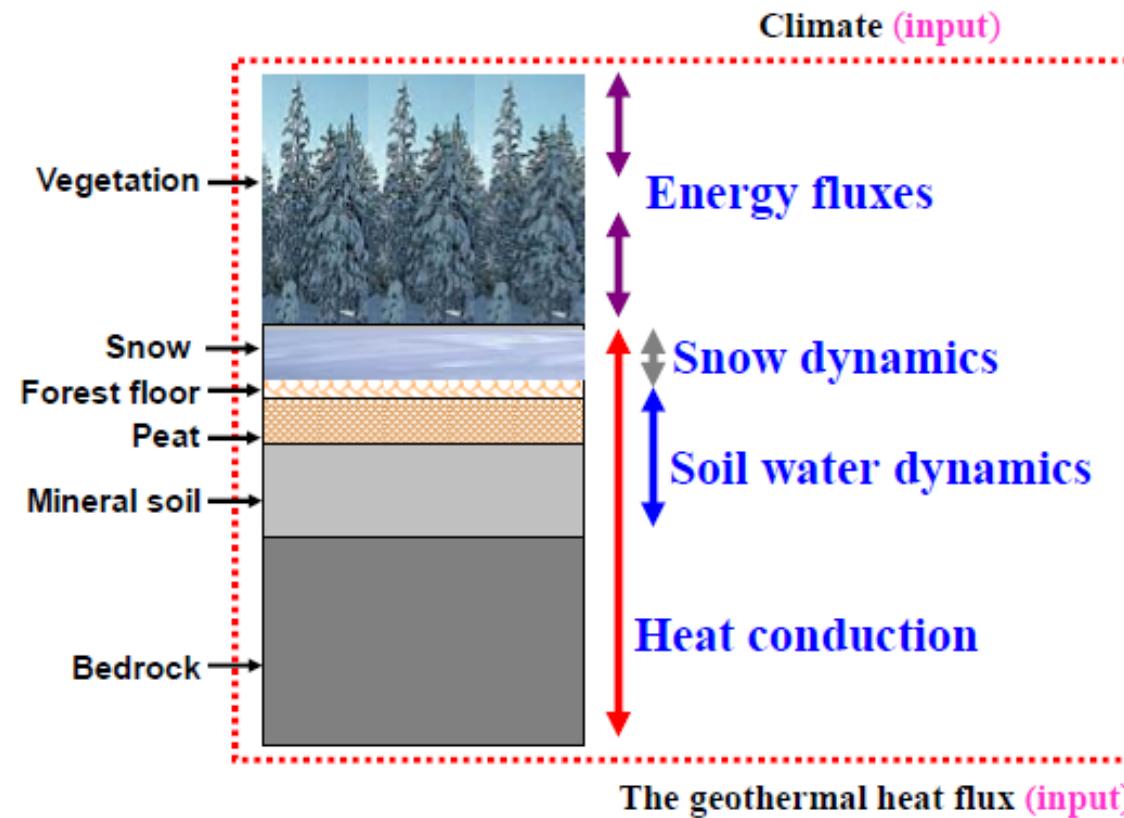
# Method Overview

- Obtain snow cover information from ground surface temperature (GST) loggers
- Determine a comparable method within and between sites
- Typical methods use an approximate cut-off point that can vary
- Machine learning method

# NEST model

Northern Ecosystem Soil Temperature Model

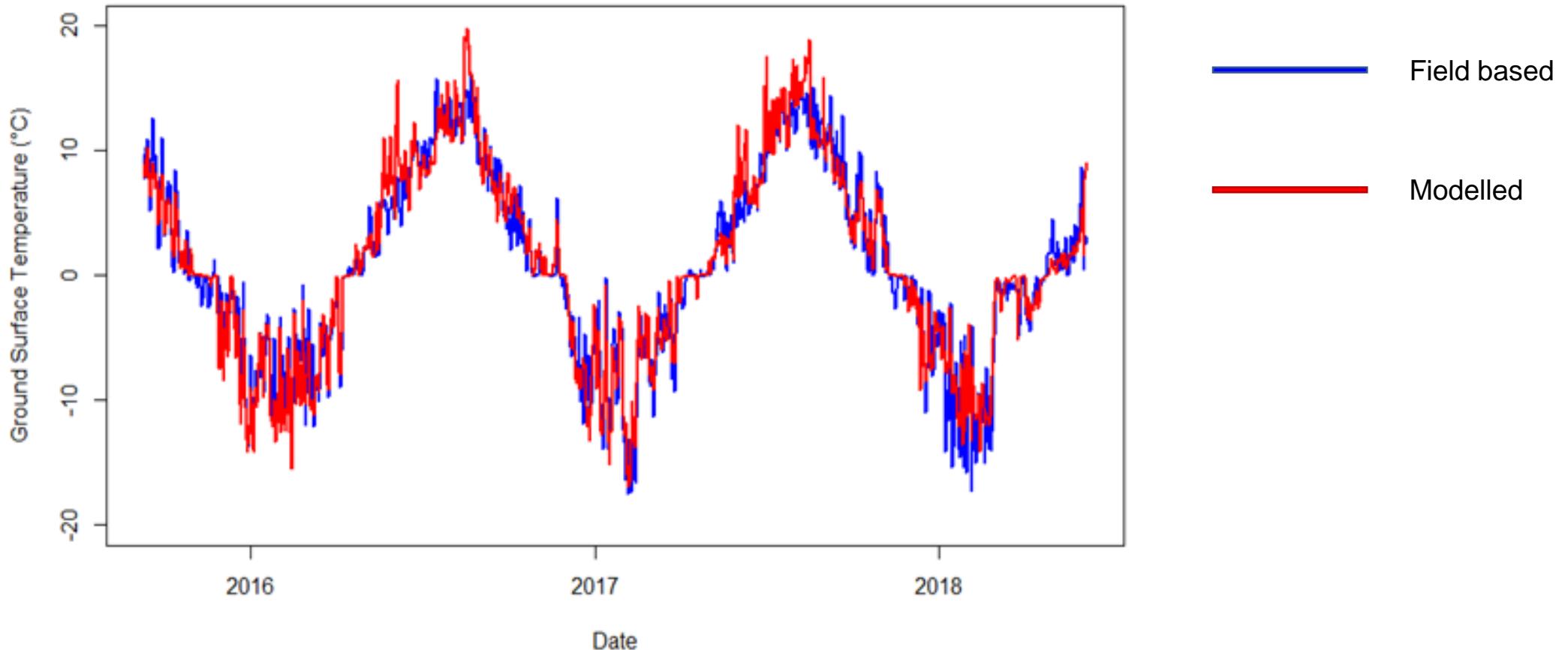
## A model for Northern Ecosystem Soil Temperature (NEST)



Schematic of the variables included in NEST modelling. Credit: Zhang et al. (2003).

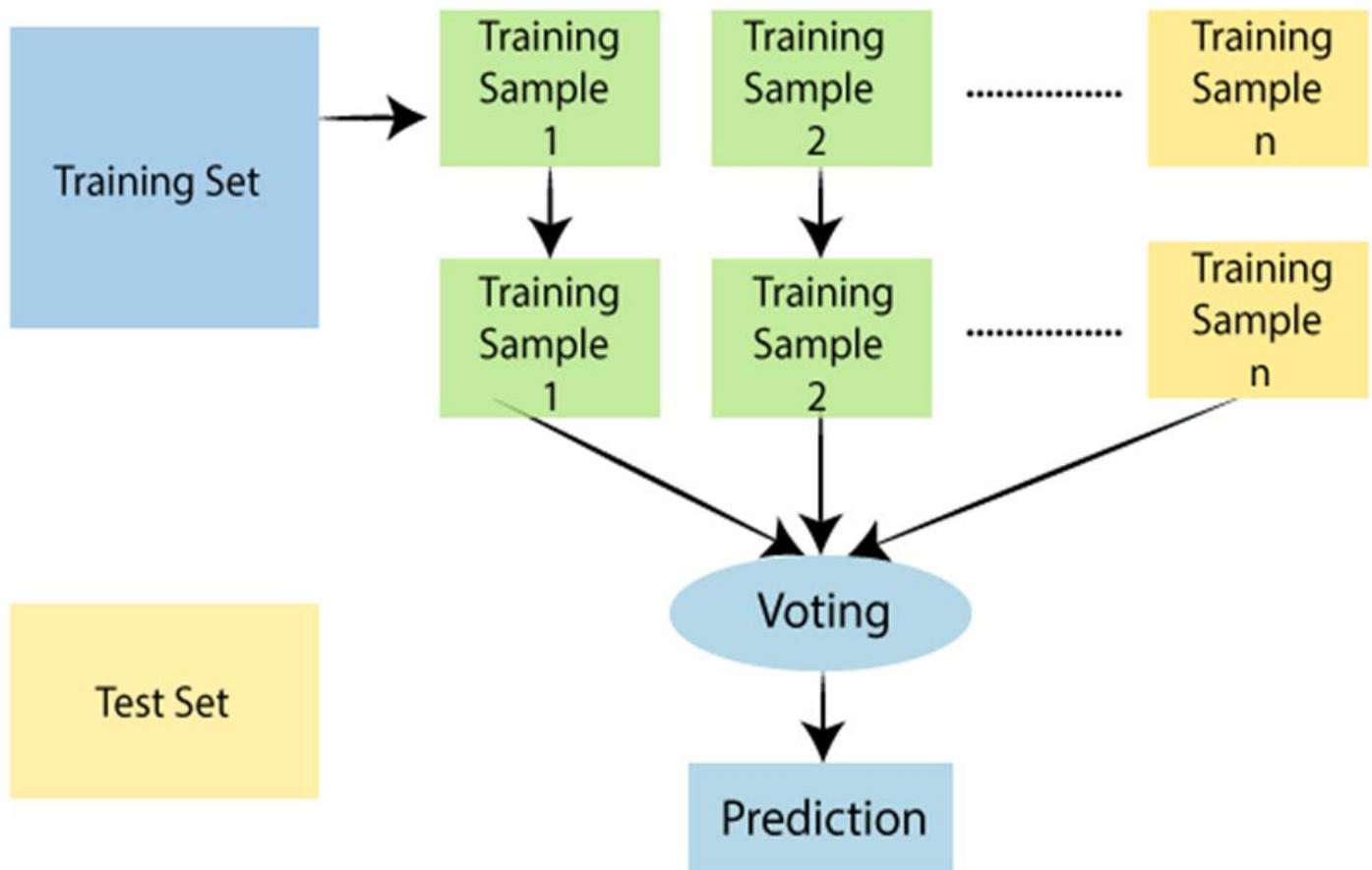
# NEST Comparison

## Validation with calibrated data



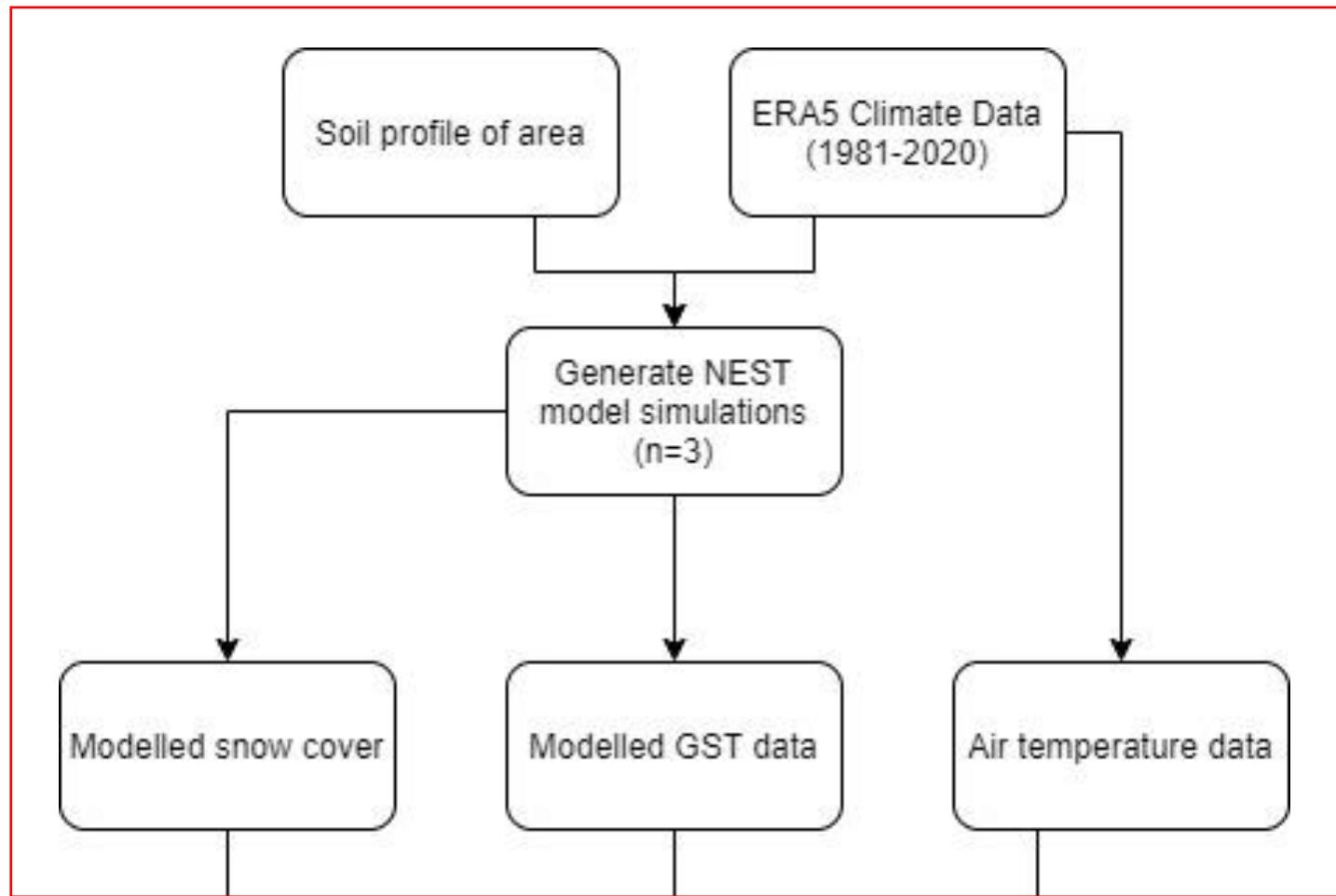
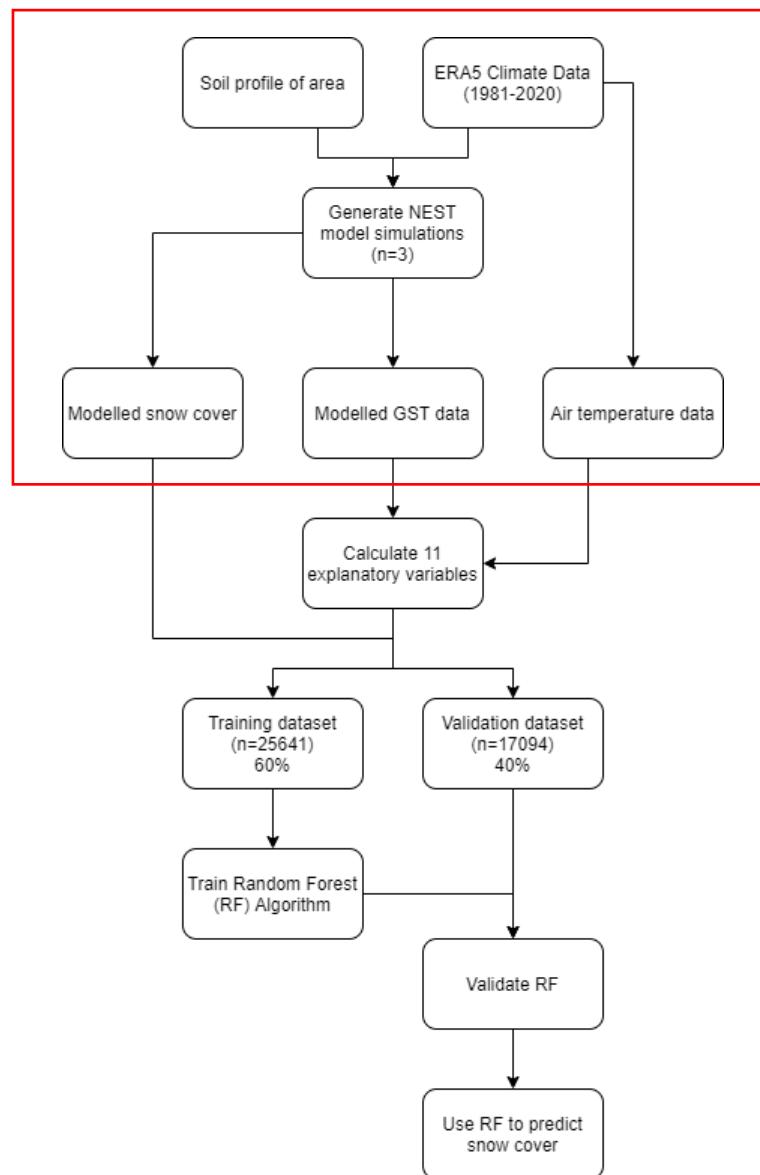
Comparison of measured and modelled NEST ground surface temperature in the Blanc-Sablon region. Credit: Yifeng Wang (2021)

# Random Forest

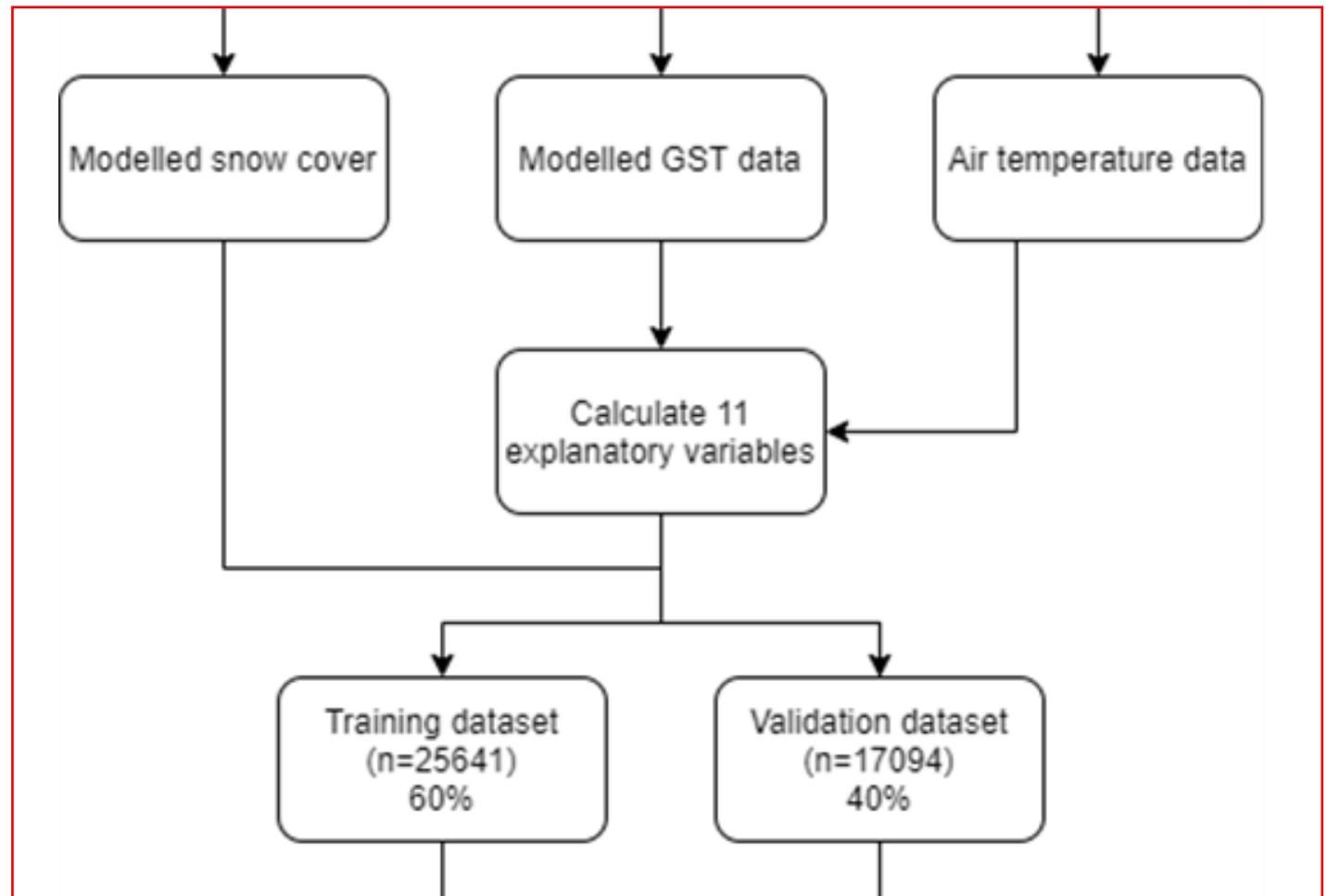
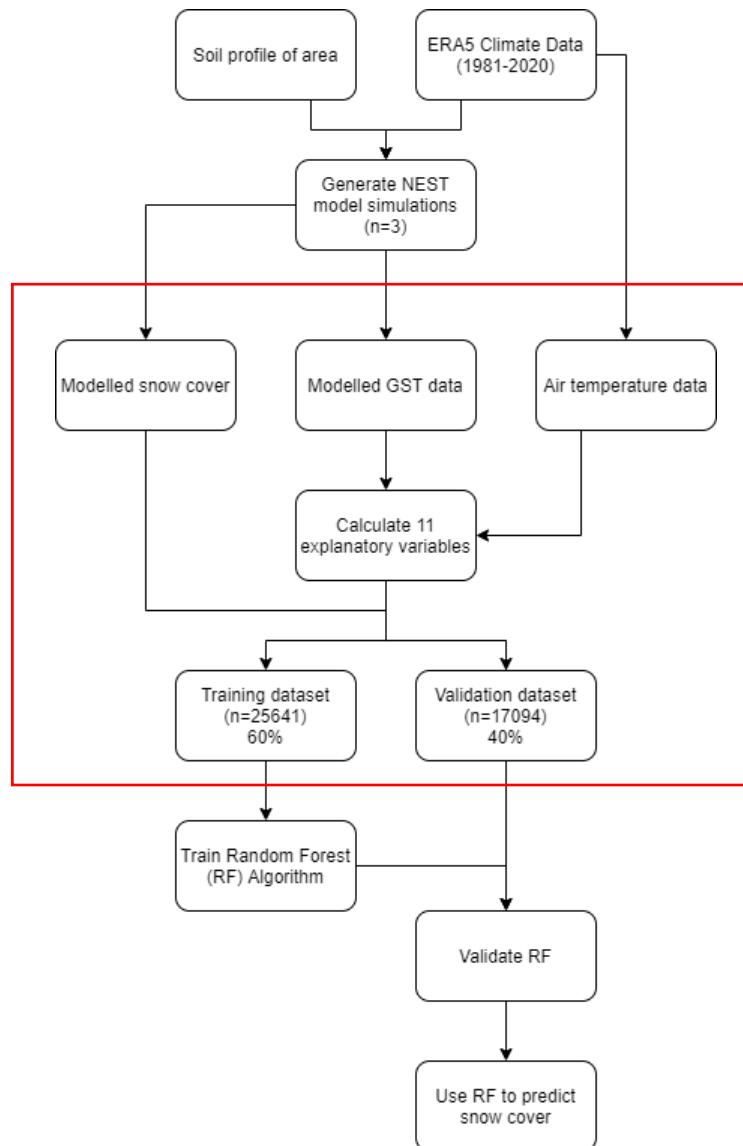


- Machine learning algorithm
- Large number of decision trees
- Average over all the trees
- Avoids overfitting
- Cannot extrapolate

# Flowchart

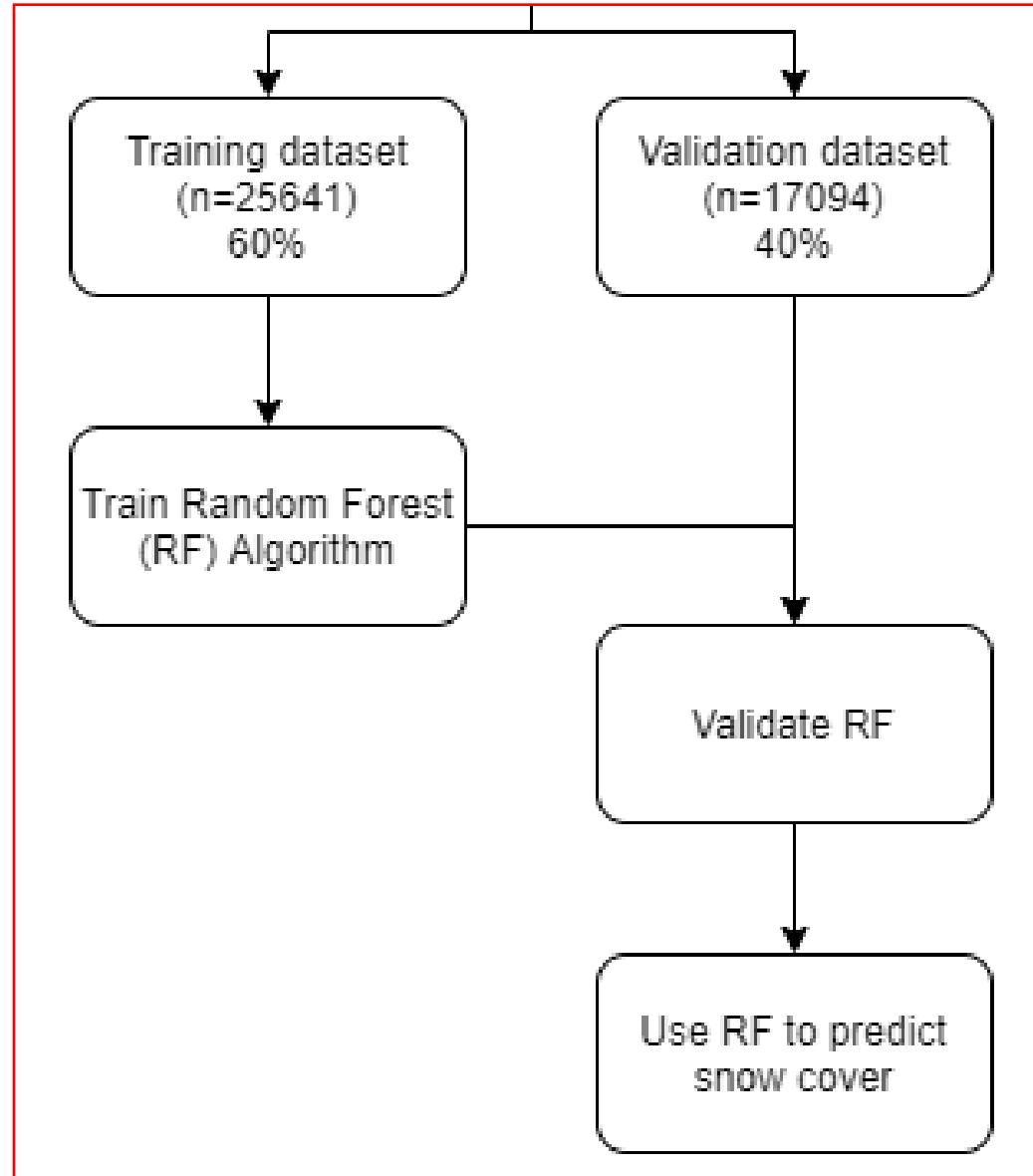
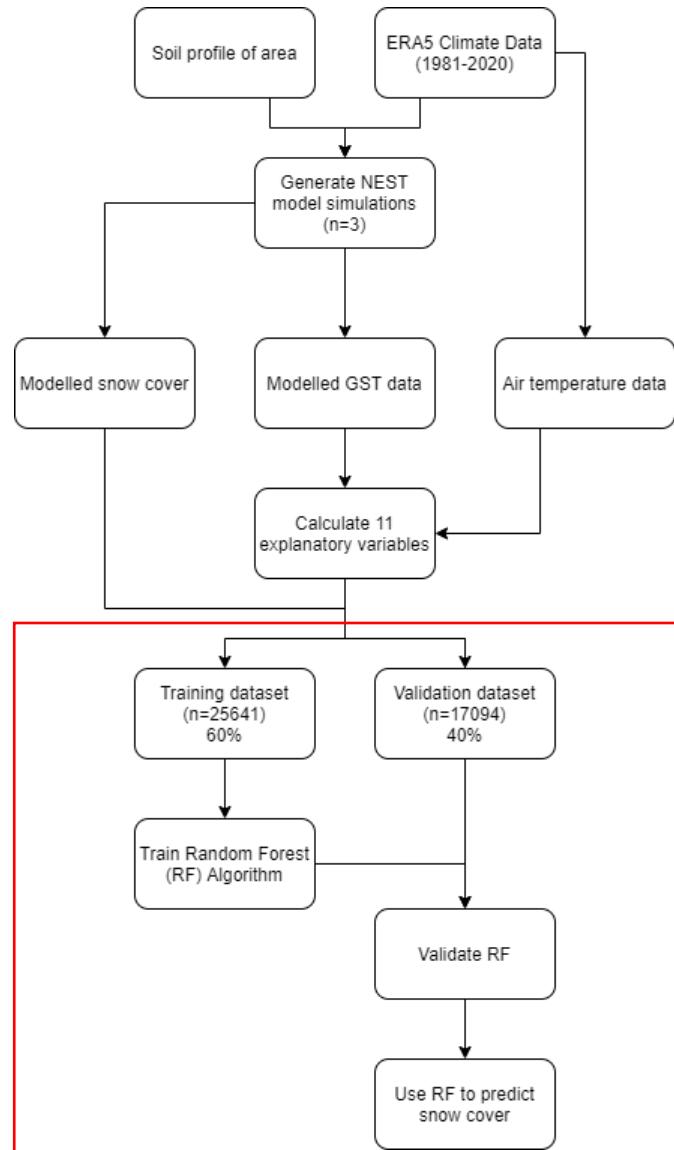


# Flowchart

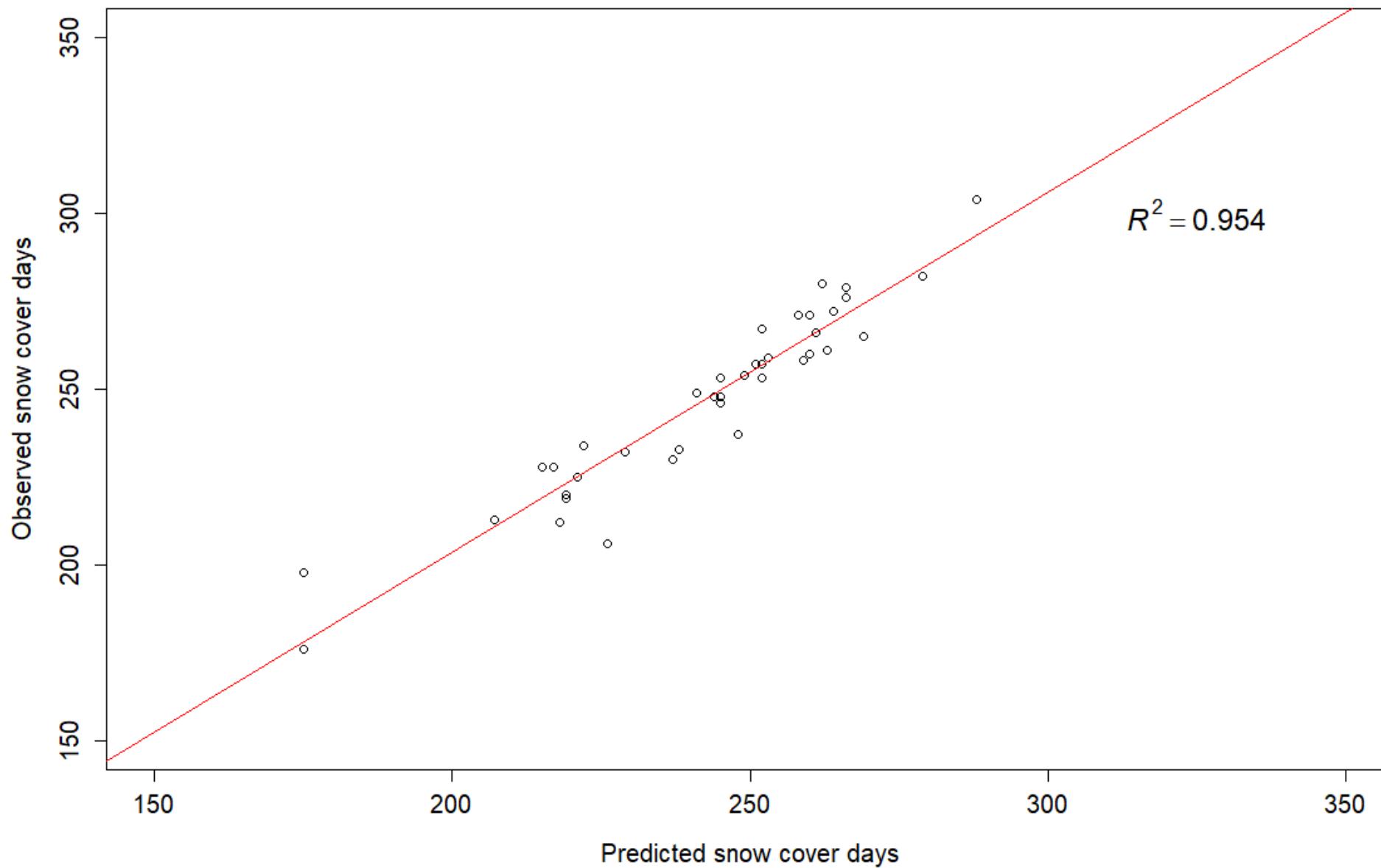


Explanatory variables: 1) hydrological date, 2) sd of GST, 3) mean GST, 4) max GST, 5) min GST, 6) range GST, 7) sd of air temperature, 8) mean air temperature, 9) max air temperature, 10) min air temperature, 11) range air temperature

# Flowchart



### Number of Snow Cover Days per Hydrological Year (n=39)



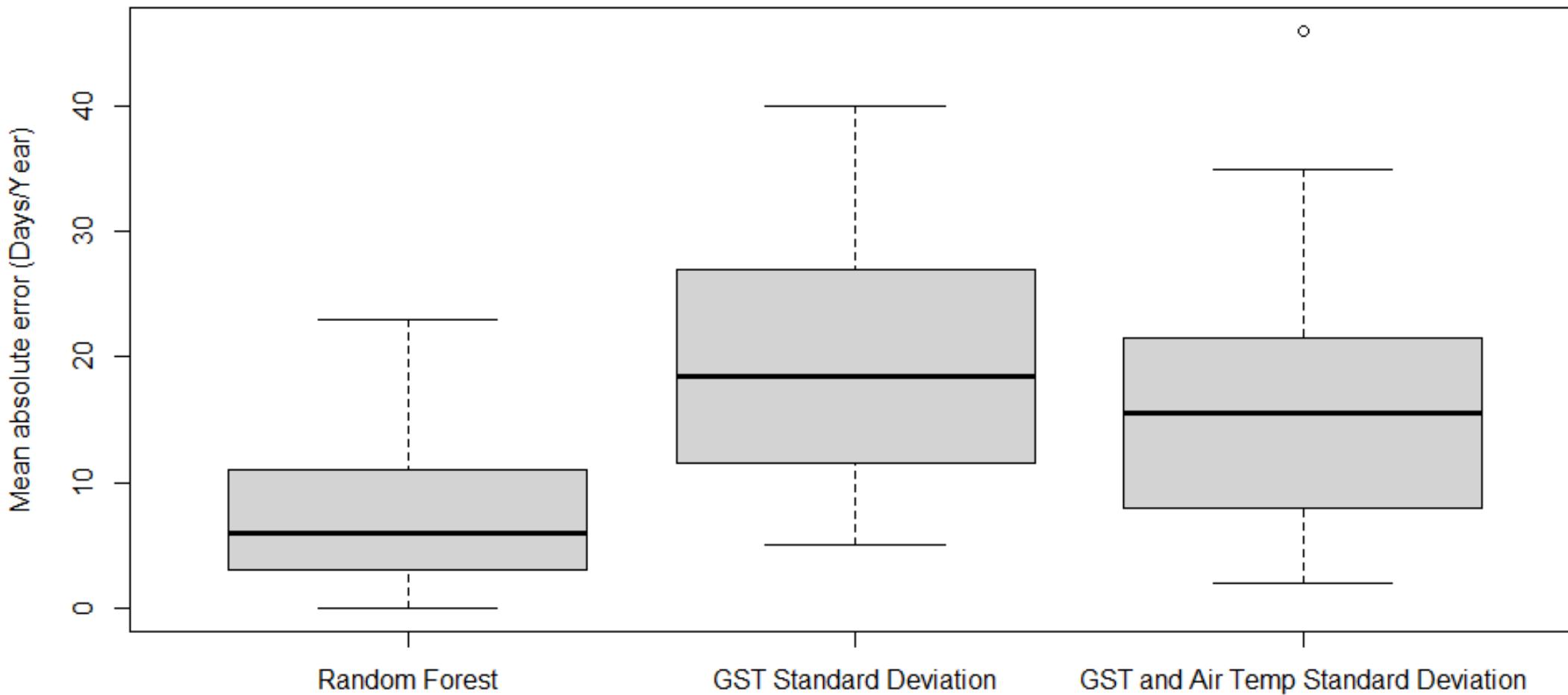
# Methods for Comparison

- Change in daily ground surface temperature standard deviation demonstrating snow insulation<sup>1</sup>
- Change in daily air temperature and if there is a decoupling with ground surface temperature<sup>2</sup>
- Maximum ground temperature to allow snow cover (zero curtain)

<sup>1</sup>Staub, B., and Delaloye, R. (2017) Using Near-Surface Ground Temperature Data to Derive Snow Insulation and Melt Indices for Mountain Permafrost Applications. *Permafrost and Periglac. Process.*, 28: 237– 248. doi: 10.1002/ppp.1890.

<sup>2</sup>Zhang, T. (2005), Influence of the seasonal snow cover on the ground thermal regime: An overview, *Rev. Geophys.*, 43, RG4002, doi:10.1029/2004RG000157.

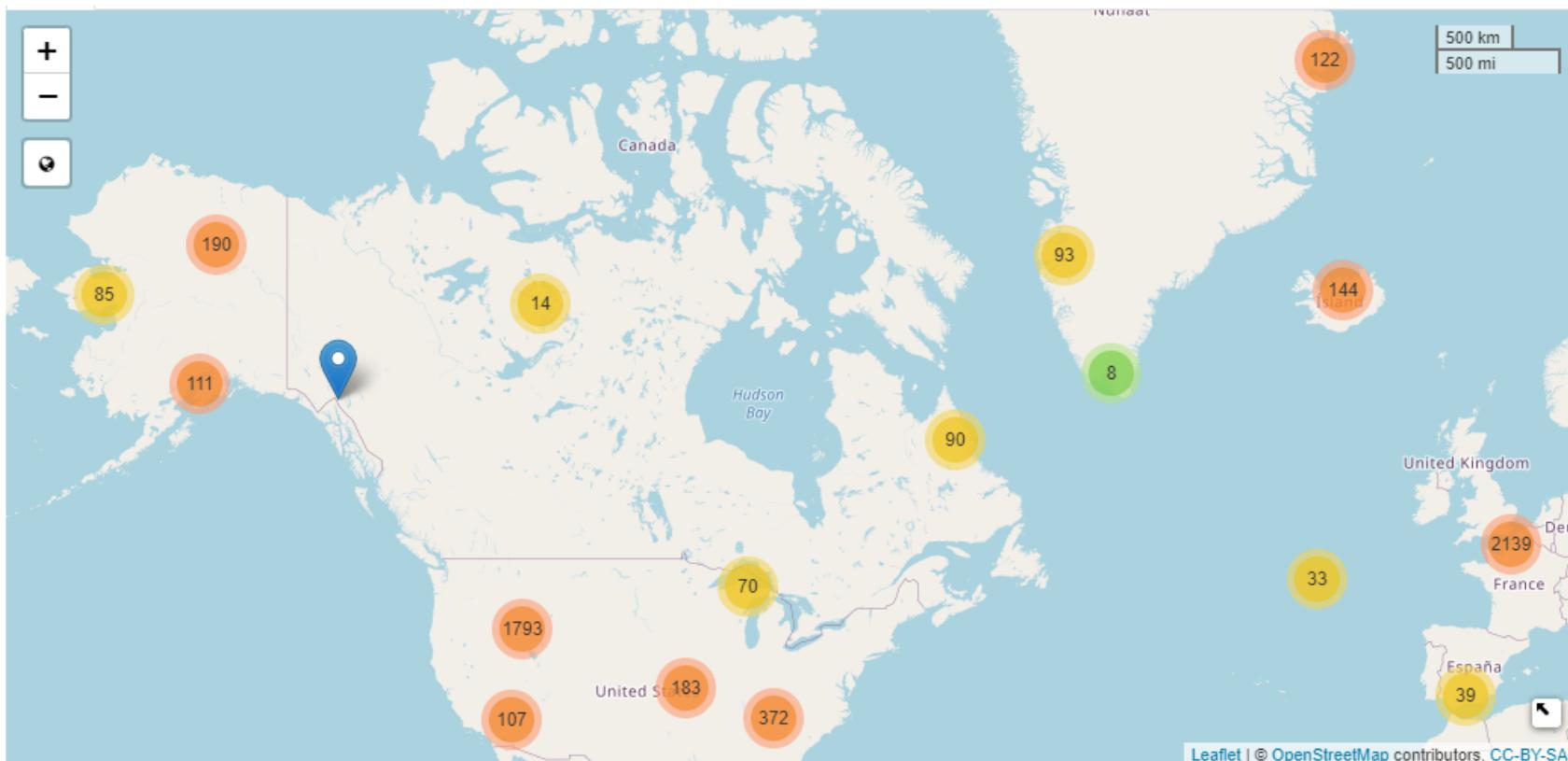
## Methods of Snow Cover Prediction



Boxplot displaying the mean absolute error days between the actual snow cover days and predicted snow cover days between the three methods using the validation dataset (n=39).

# Implications

- Ground surface temperature loggers are a commonly used method of collecting data for many different regions
- This method would allow for these regions to be accurately compared between each other
- Random forest could be used to obtain other types of data from ground surface temperatures



Sample of the current soil temperature monitoring locations <https://microclimate.shinyapps.io/loggerapp/>

# Thank you!

# Anika Forget

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