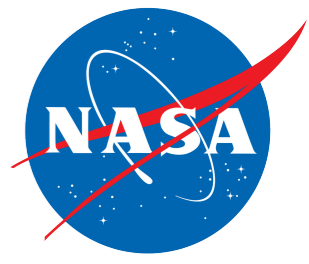


# Integrating snow station and lidar data with machine learning: A daily, spatially representative snow validation dataset

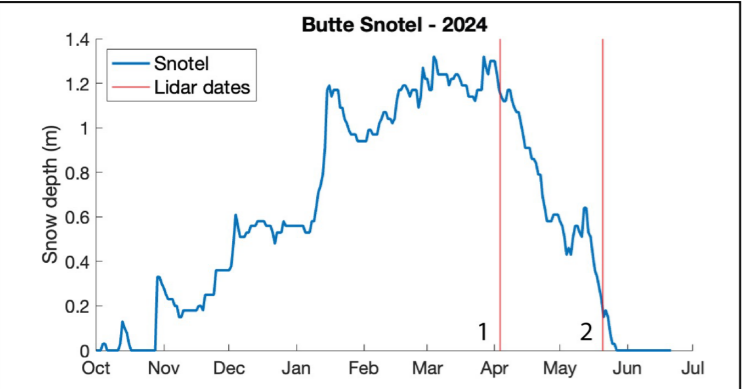


Jordan N. Herbert<sup>1</sup>, Mark S. Raleigh<sup>2</sup>, Eric E. Small<sup>1</sup>

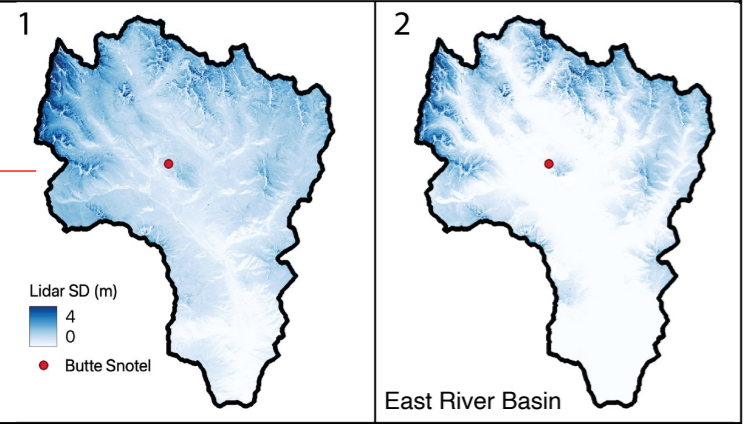
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**We combine Snotel and lidar information using machine learning to create a daily snow depth validation dataset that has a larger spatial footprint than Snotel alone**

Motivation: validation datasets are flawed

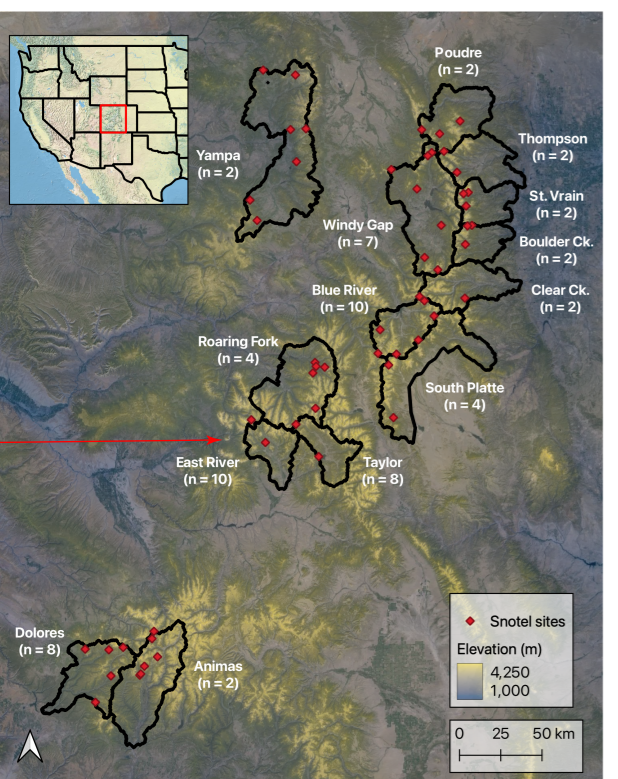


← Snotel  
Temporally continuous  
Spatially limited



← Lidar  
High resolution  
Watershed scale  
Temporally limited

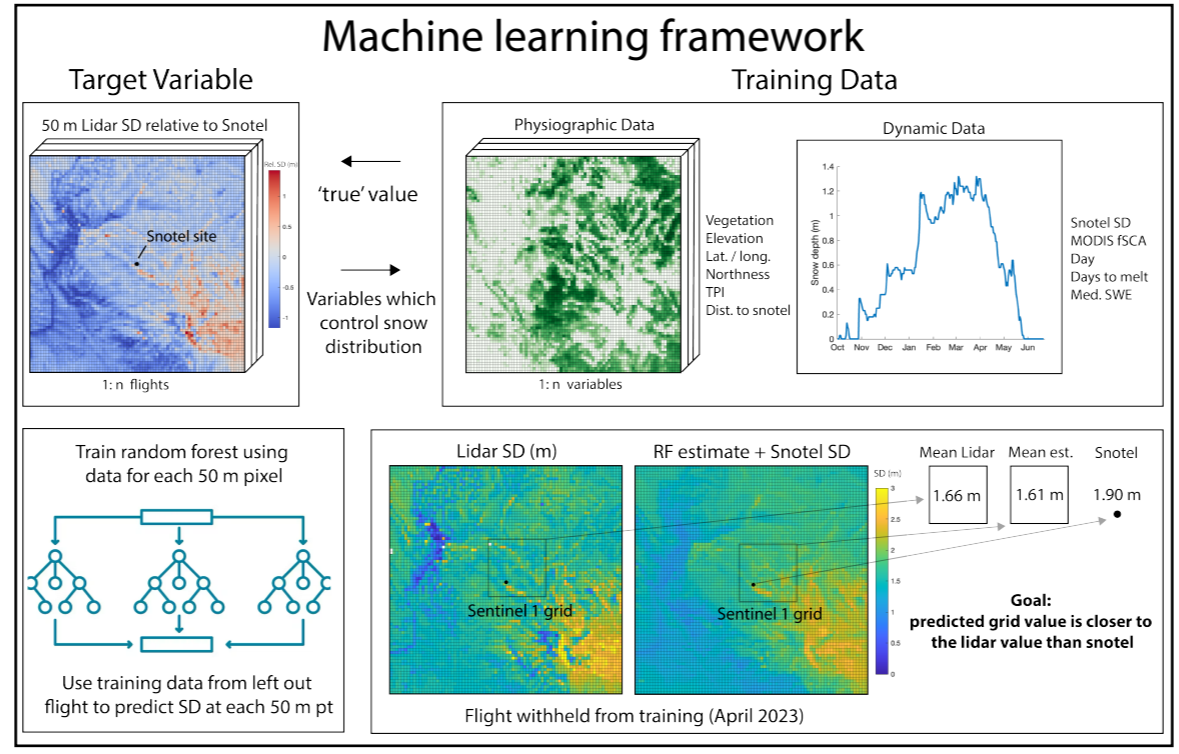
**Goal: estimate daily snow depth at 50 m resolution surrounding Snotel sites using a random forest model. The output data can be re-gridded to match any target grid**



- Sites and data:
- Colorado 2018-2024
  - 14 watersheds
  - 68 ASO lidar surveys
  - 48 Snotel stations
  - 197 coincident lidar-Snotel points

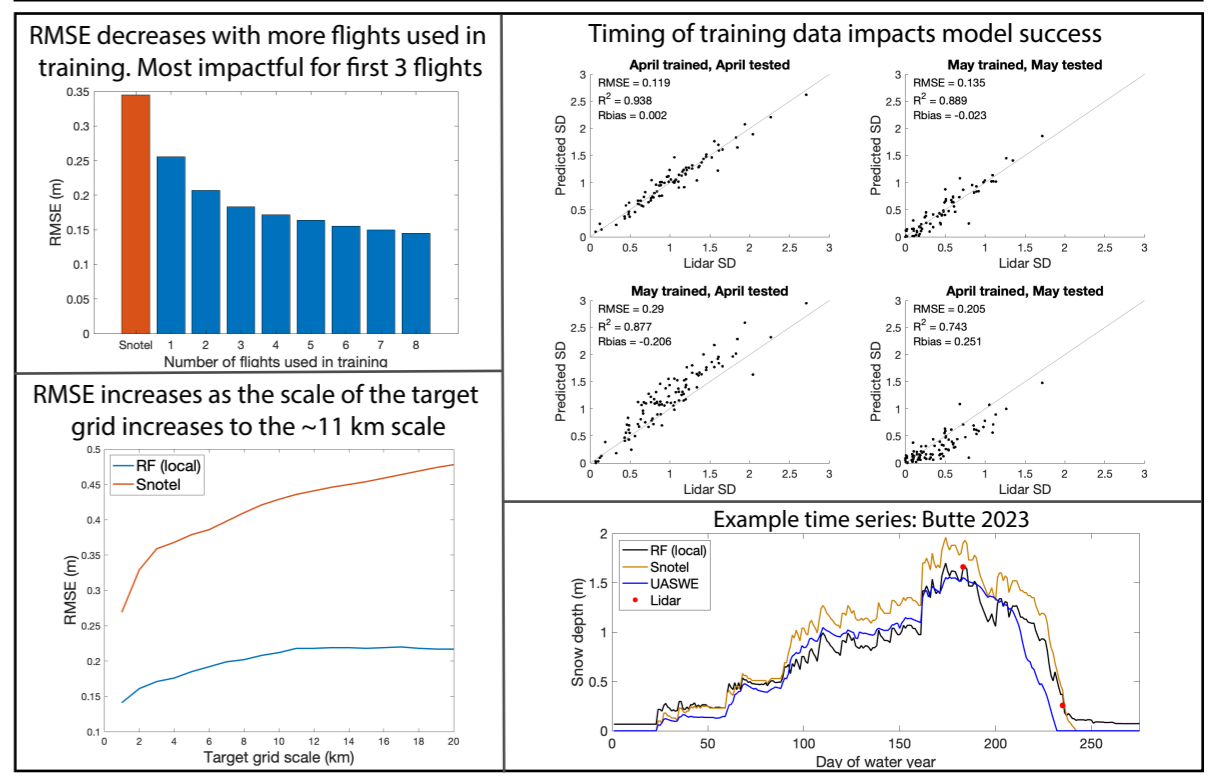
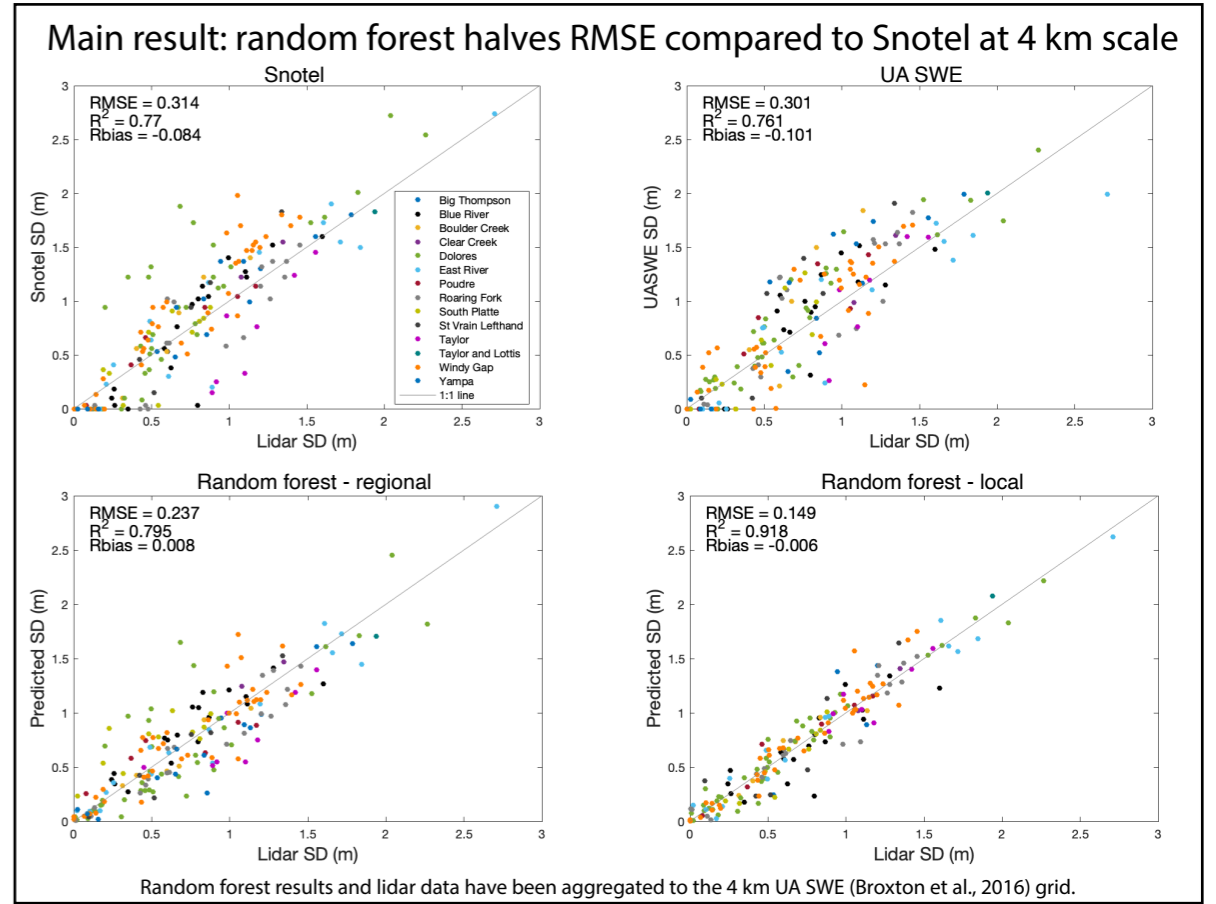
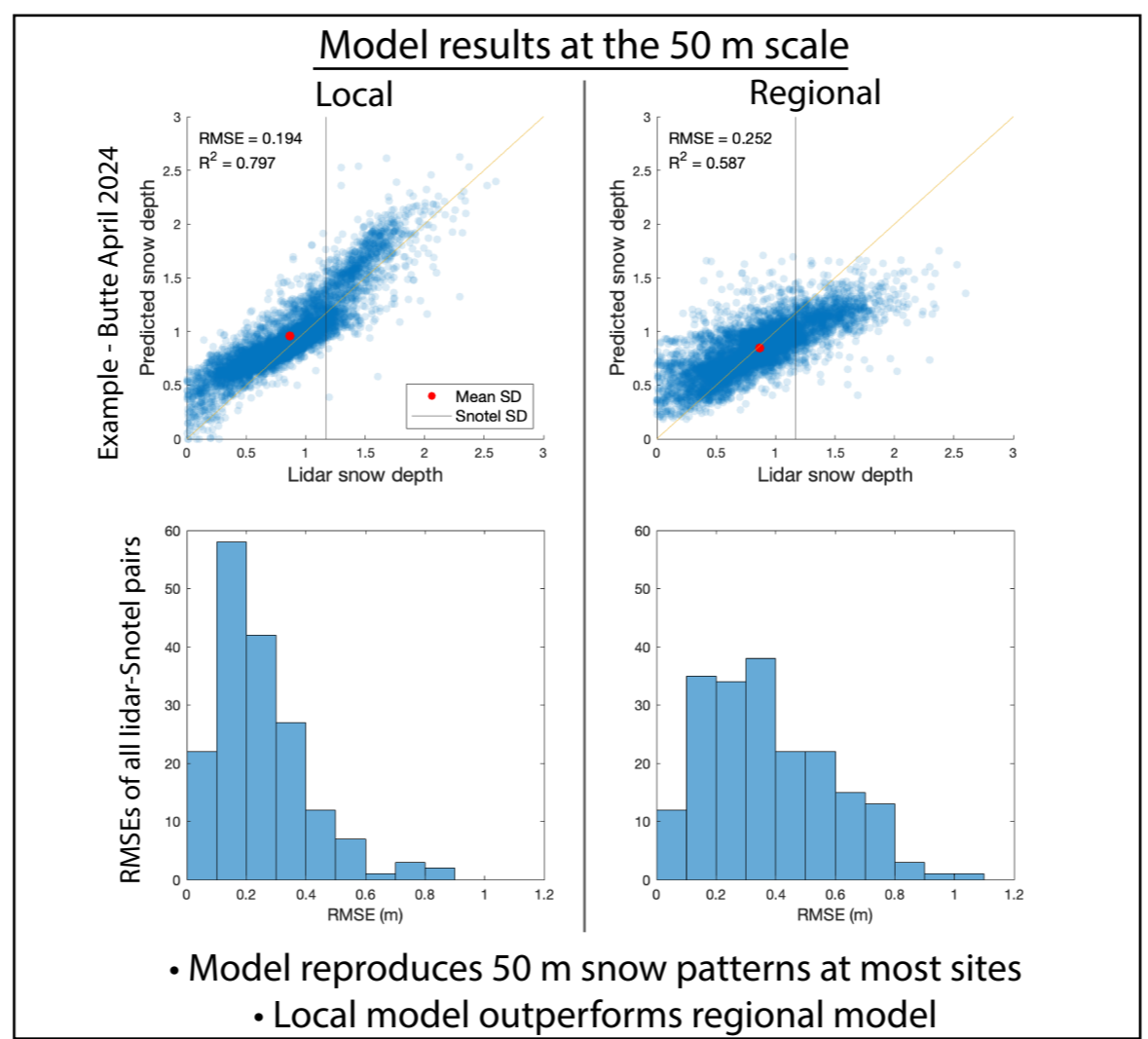
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**Local model**  
Trained and tested on data from one Snotel site (one flight withheld for validation)  
Tests the importance of local lidar information on model success

**Regional model**  
Trained on all coincident Snotel-lidar data except for data from the test site



**Takeaways:**

- Our framework is an improvement over validation with Snotel or UA SWE
- Local lidar information increases model performance relative to a regionally trained model
- Model performance improves with more lidar data (mostly from 1-3 flights)
- Model performance slightly deteriorates with spatial scale

**Acknowledgements**

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