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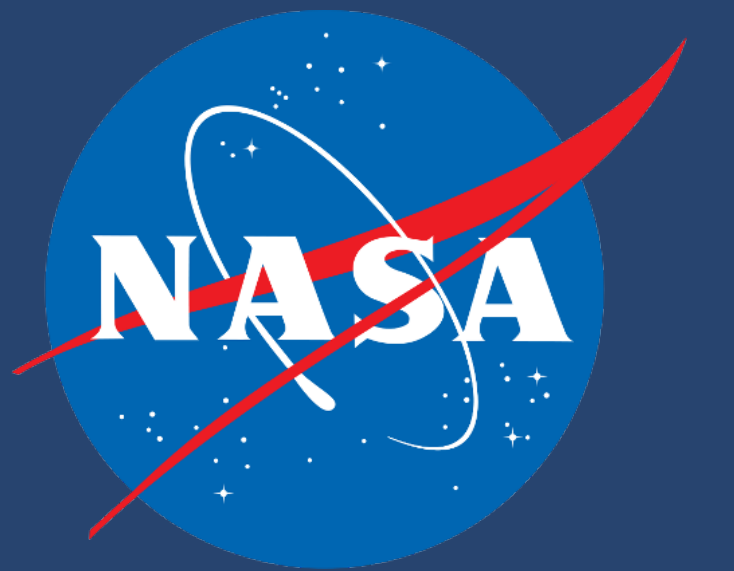


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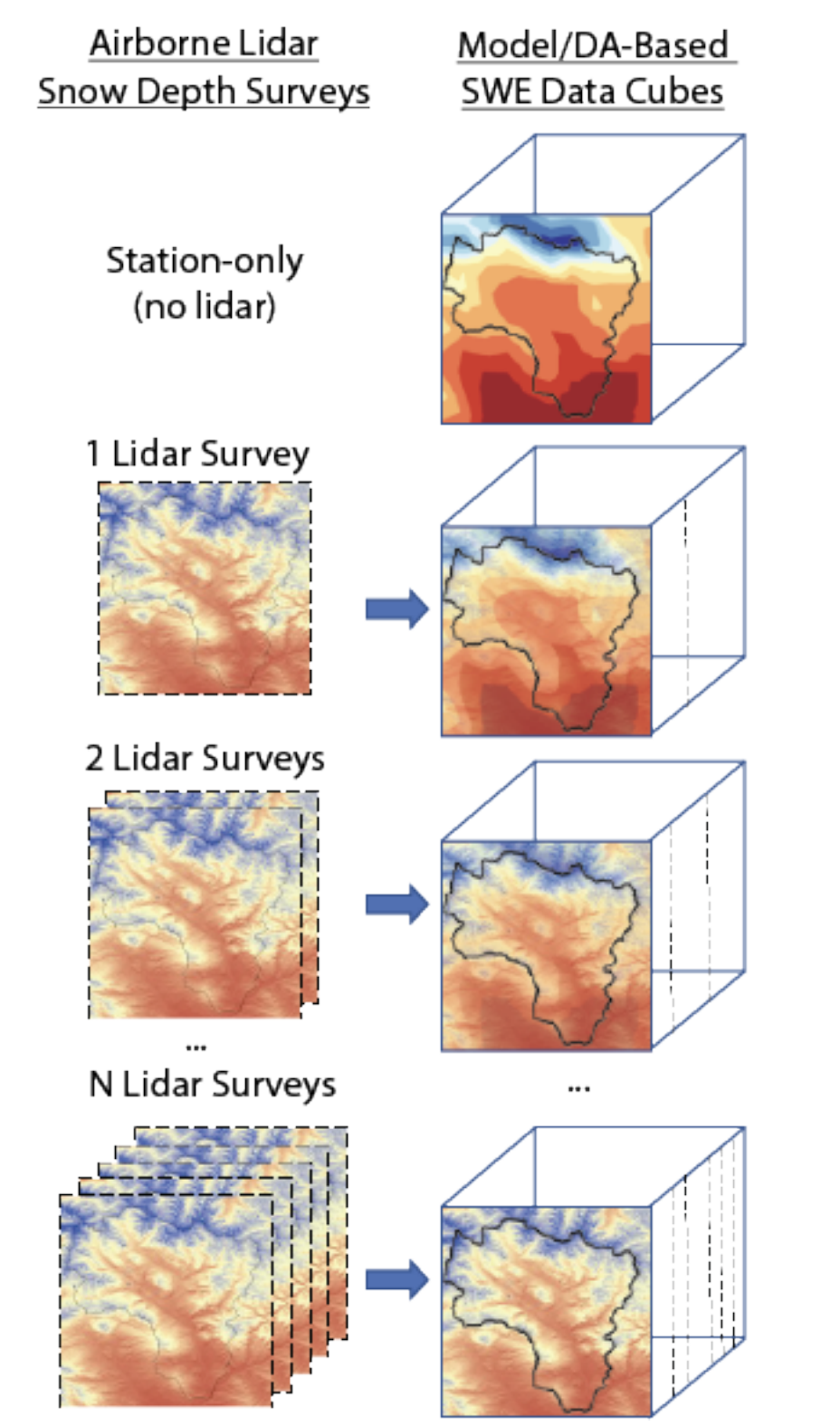
Fusing airborne lidar snow depth snapshots with a gridded SWE dataset to generate spatially and temporally detailed SWE estimates through time

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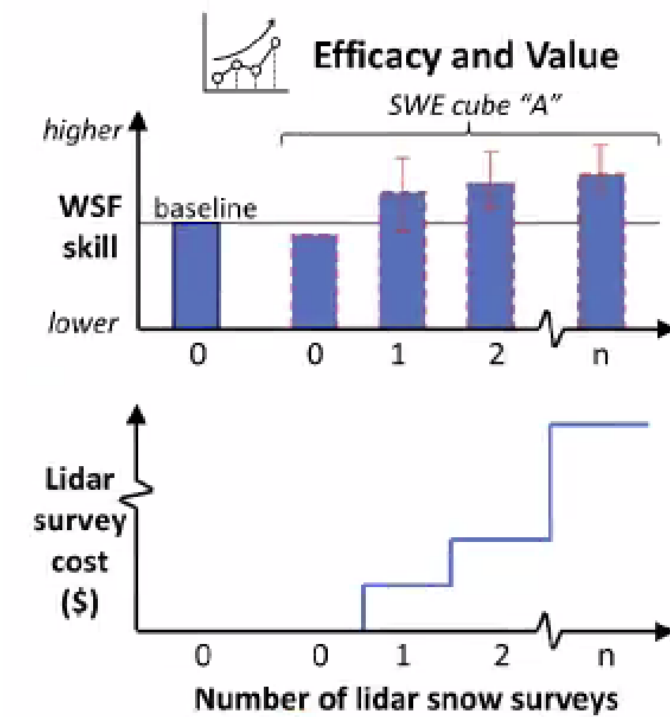


Overview



Motivations

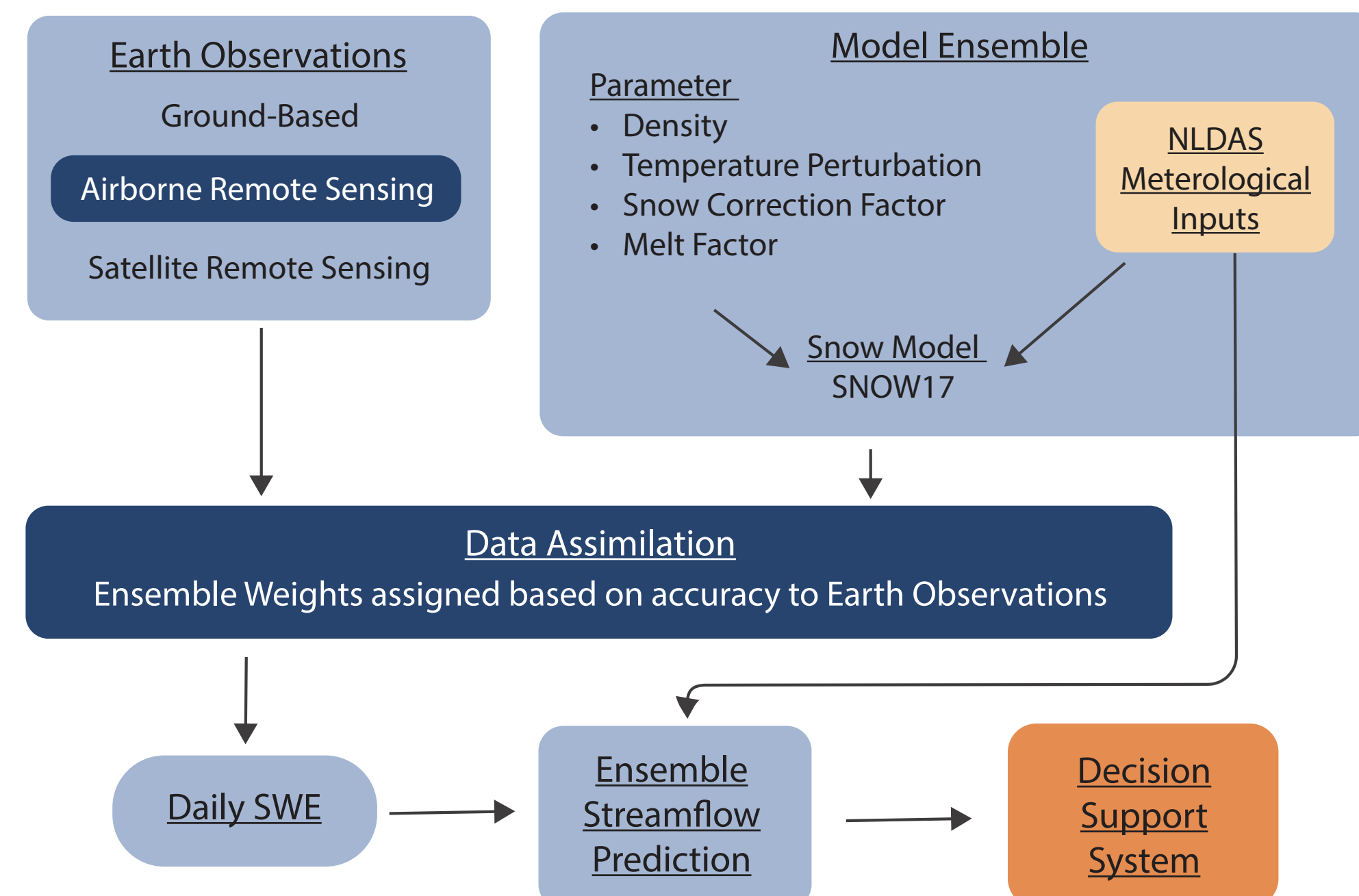
- Airborne Snow Observations provides spatially extensive and detailed but infrequent snapshots of snow depths across a basin.
- How many lidar snow surveys are needed to guide model simulations?
- How transferrable are the weights based on lidar flights from one year/season on another year/season?



Here, we describe a data assimilation approach to combine spatially-extensive snow depth data from lidar flights with snowpack models (SNOW17)

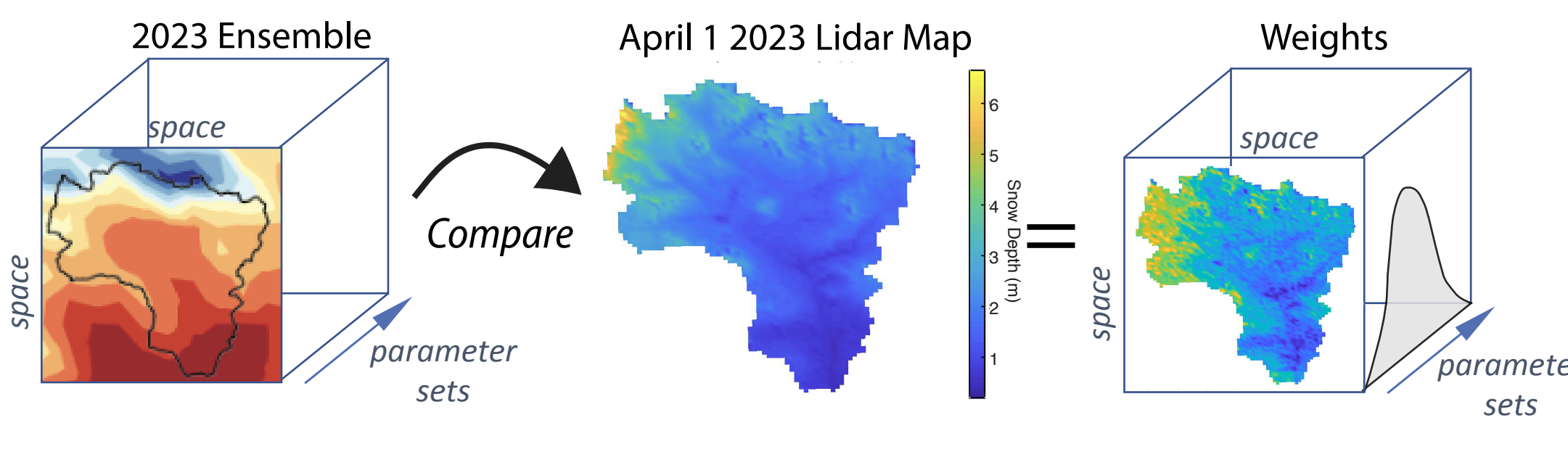
- Define weights for model parameter sets based on accuracy to lidar data
- Apply weights to other years extending the model through time yielding a lidar-informed SWE and snowdepth data cube
- Evaluate the model performance of different combinations of lidar flights

Workflow

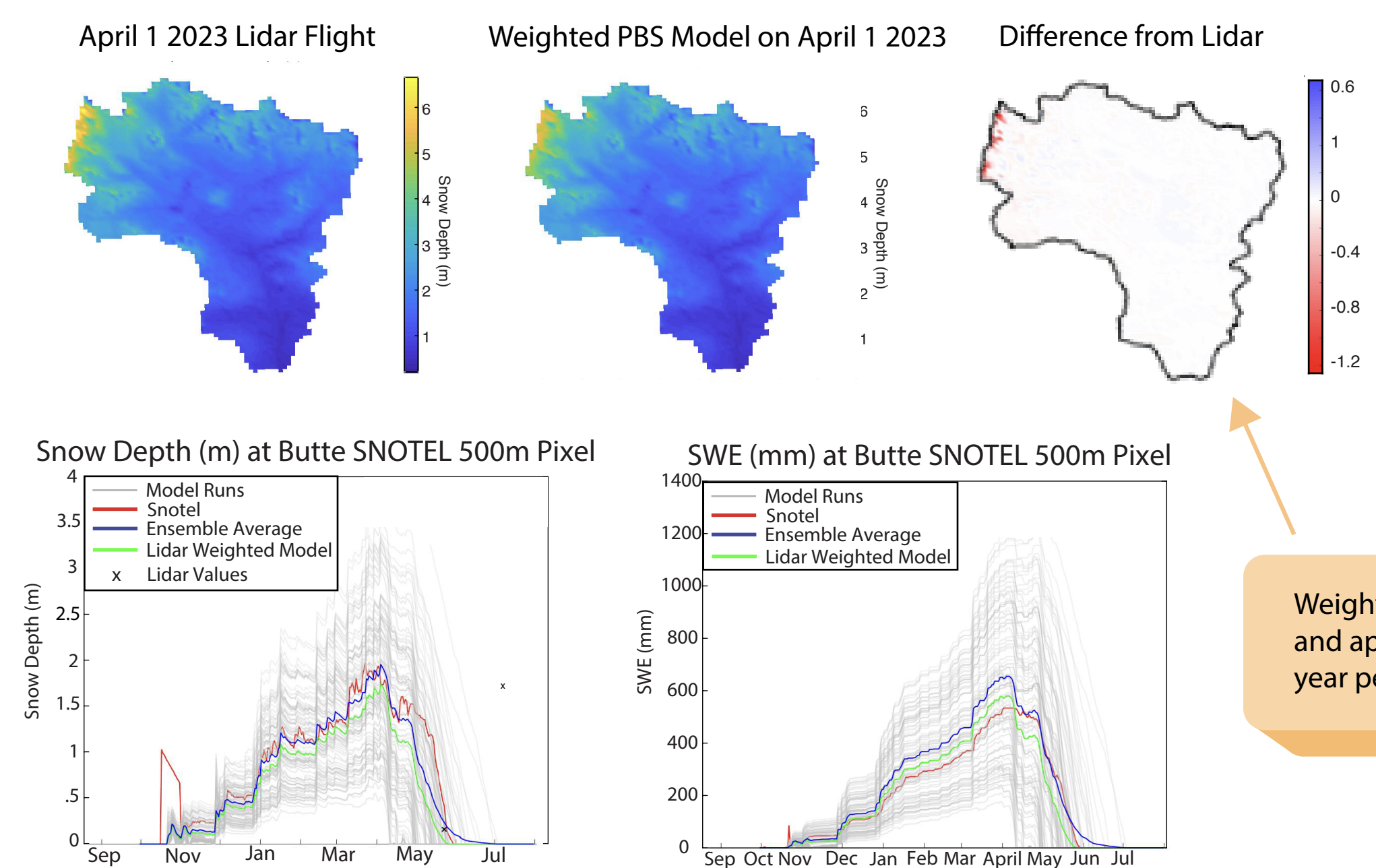


Test Case: East River Basin

Calculate Particle Batch Smoother Weights

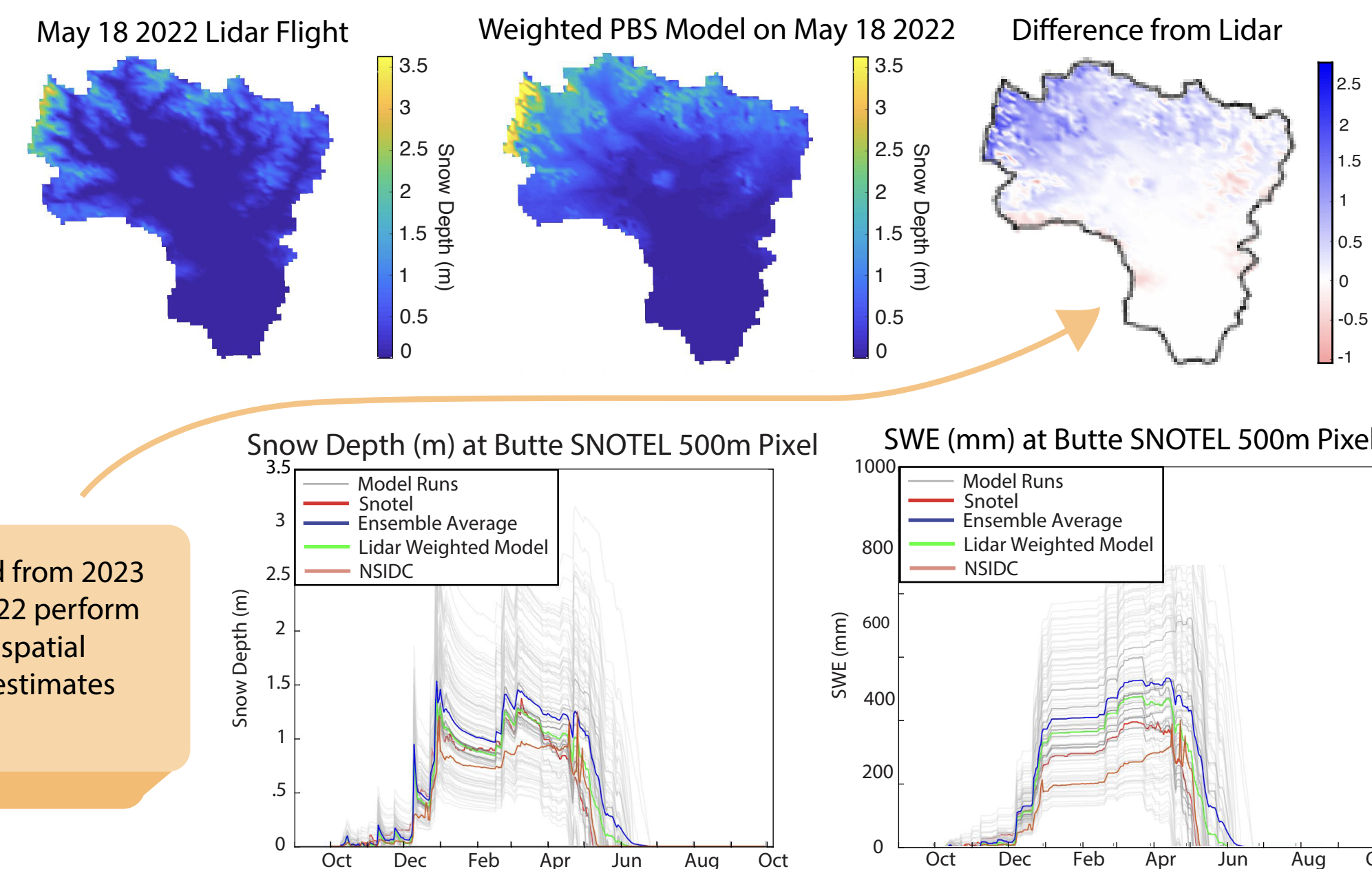


How does PBS perform when the weights are applied to the same year? 2023 Weights Applied to 2023



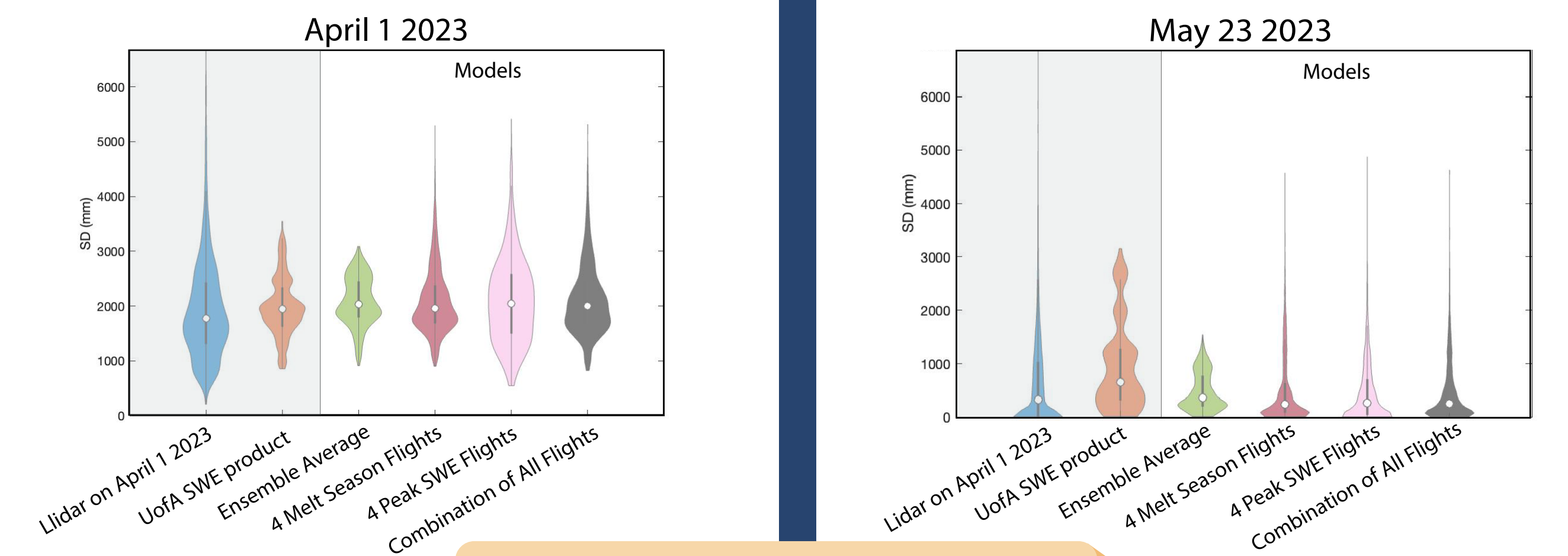
Weights calculated from and applied on the same year performs well

How does PBS perform when the weights are applied to a different year? 2023 Weights Applied to 2022

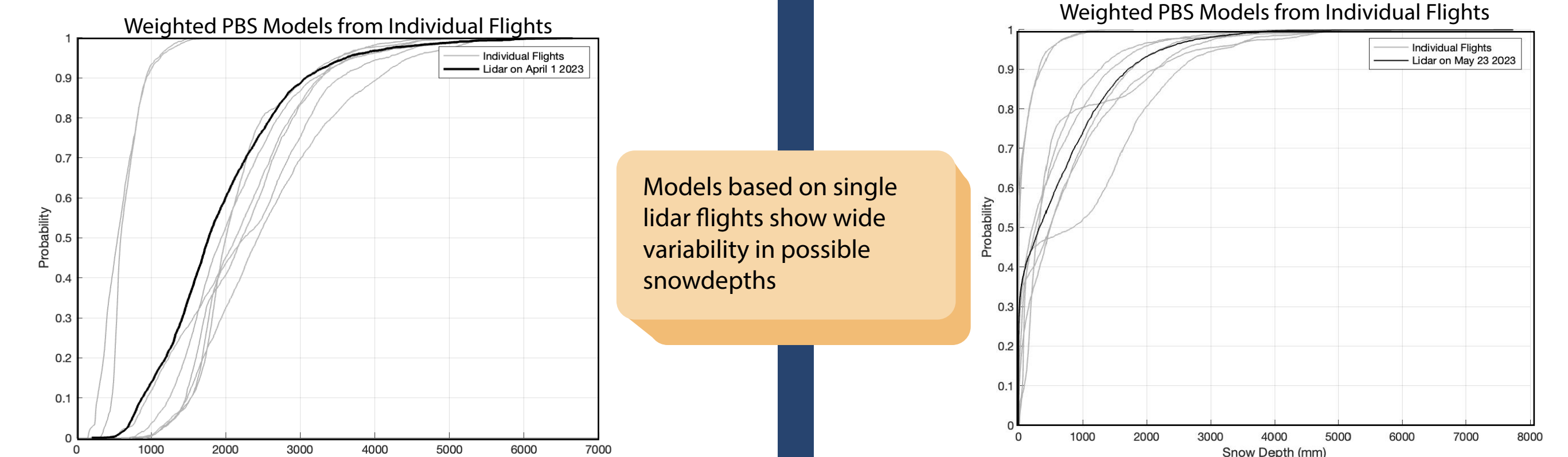


Weights calculated from 2023 and applied on 2022 perform well and recreate spatial patterns, but overestimates snowdepth

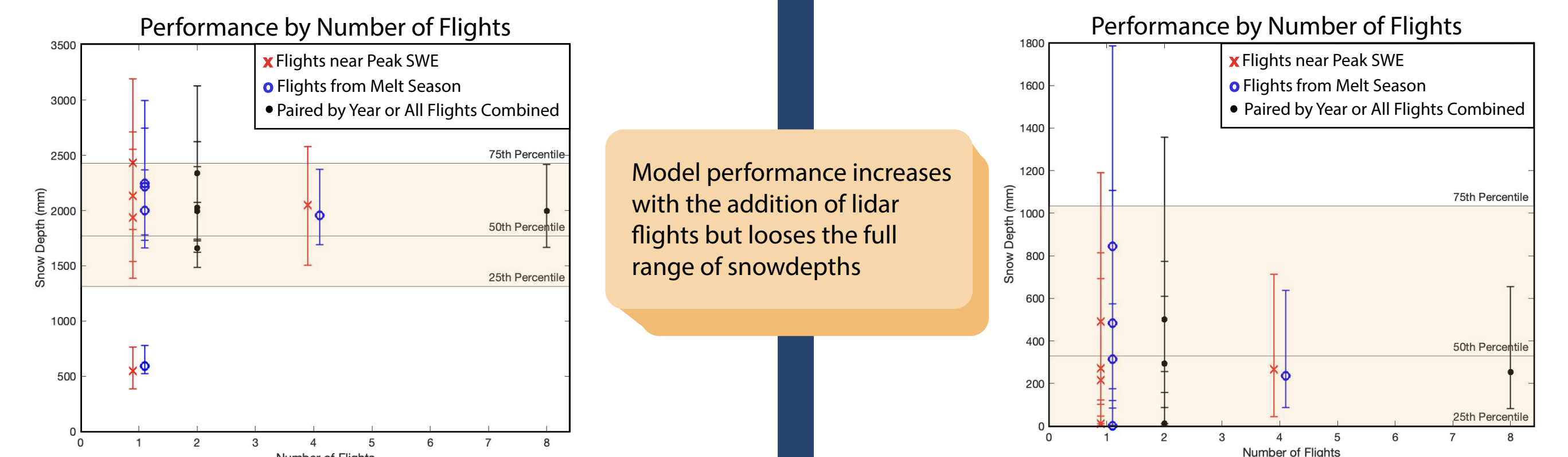
Model Performance: Combinations of Lidar Flights



Models using the combination of 4 flights near peak SWE best recreate the distribution of snowdepth near the time of Peak SWE compared to 4 melt season flights or when using all 8 available flights



Models based on single lidar flights show wide variability in possible snowdepths



Model performance increases with the addition of lidar flights but loses the full range of snowdepths

Summary

We describe an approach to combine spatially-extensive snow depth data from lidar with snowpack models (SNOW17)

- Parameter set weights defined by comparing lidar snow depth with output from model ensembles (SNOW 17)
- Using the weighted parameter sets, we apply the model to other years and seasons
- Model performances based on different combinations of lidar flights were evaluated
- Models based on peak or melt season flights are best at predicting corresponding season flights

Future work includes further exploring all combinations of flights and performance at all other lidar flight (not just 2023). As well as combining lidar weights with weights based on UoFA SWE to explore performance with the inclusion of SNOTEL data.

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