Monitoring Atmospheric Mixing Heights Post-Wildfire Through the Use of NASA Earth Observations

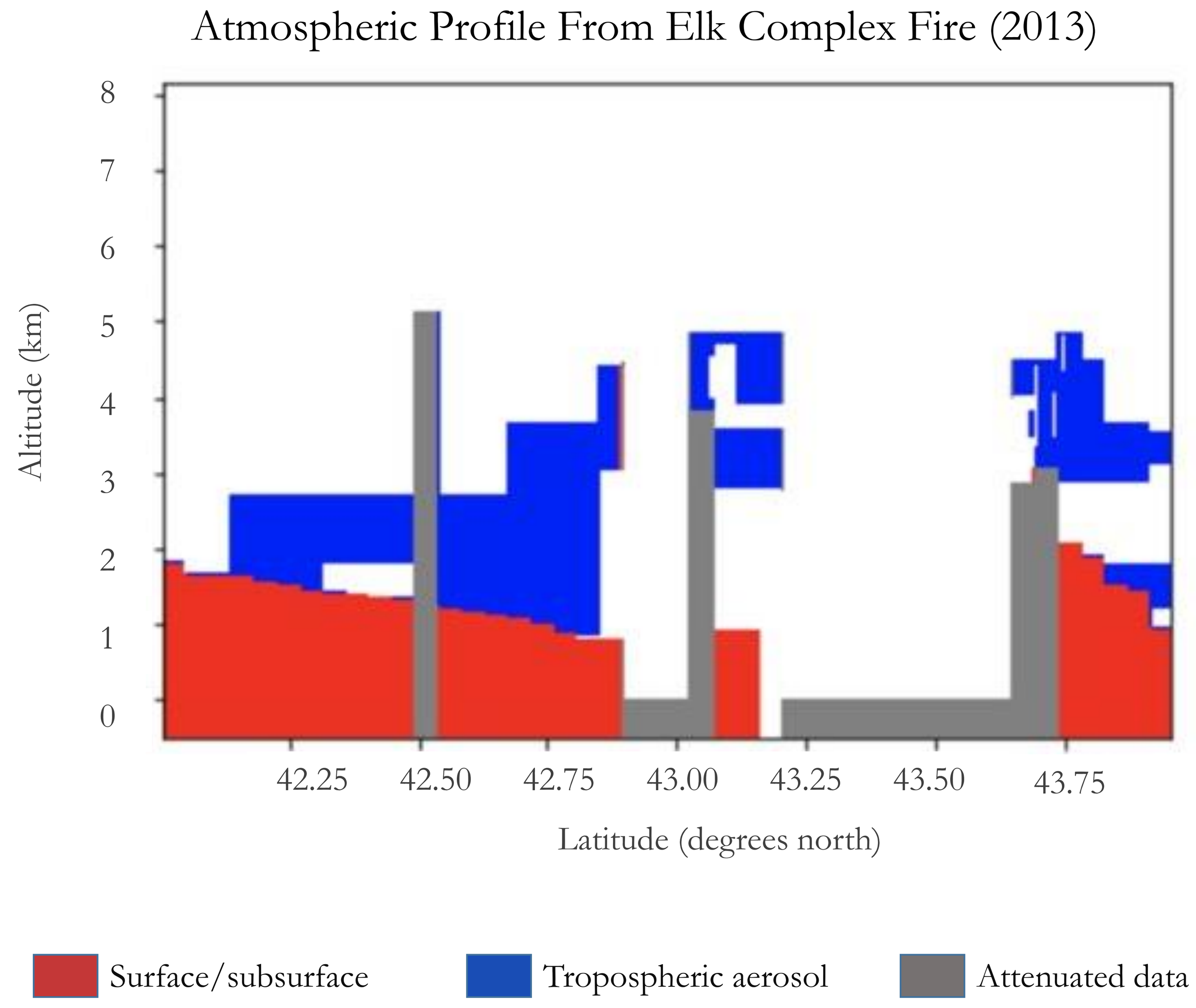
Abstract

Satellite imagery provides continuous and accurate coverage of mixing heights, which describes the maximum altitude to which a smoke plume rise,. The team developed a software tool that processes and extracts mixing height observations from Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) Vertical Feature Mask granules. The team then compared these observations to back-calculated mixing height estimations using four different methods based on model-derived atmospheric temperature profiles (soundings). The resulting comparisons provide insight about the accuracy and systematic bias of each mixing height prediction method to agencies to make better predictions about smoke pollution dispersal and subsequent management and public health decisions.

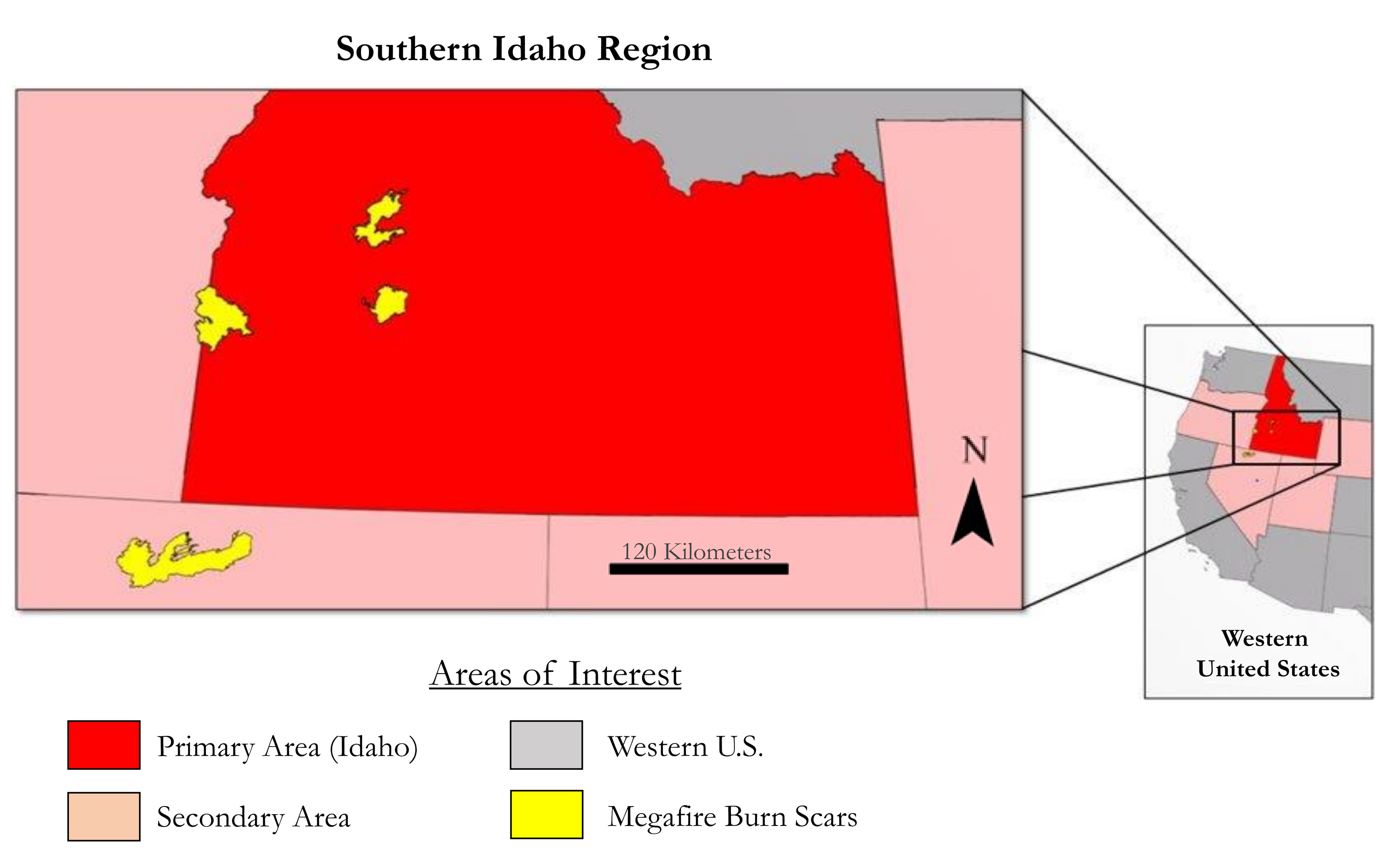
Methodology

The team gathered data in two parts: One for the validation and the other for estimations. For validations, the team used NASA worldview to identify fires and CALIPSO passes and then downloaded the data on from NASA Earthdata. The team developed a script which found the mixing height within the data. For the estimations, the team used SHARPpy to identify where model soundings were calculated and then ran the data through a script which estimated the mixing height.

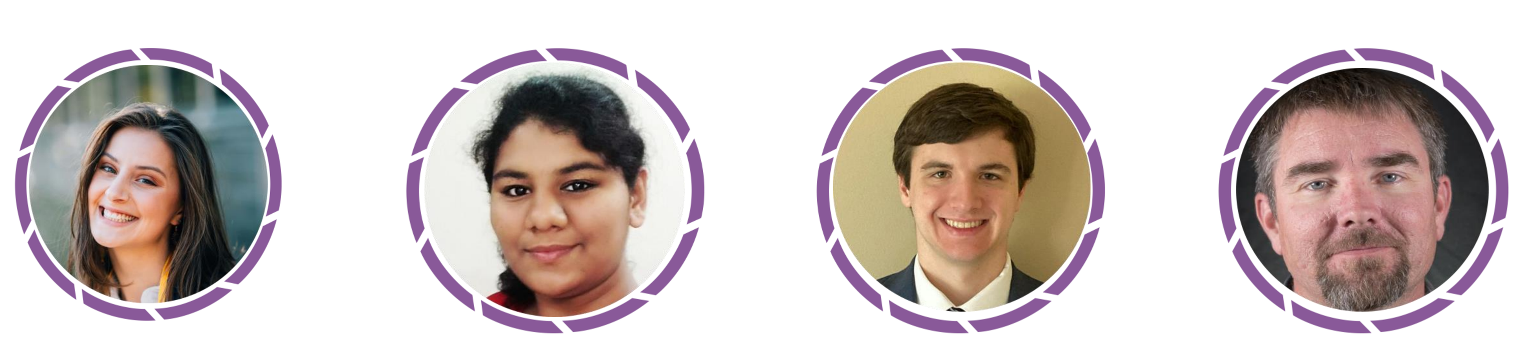
Atmospheric Profile From Elk Complex Fire (2013)



Study Area



Team Members



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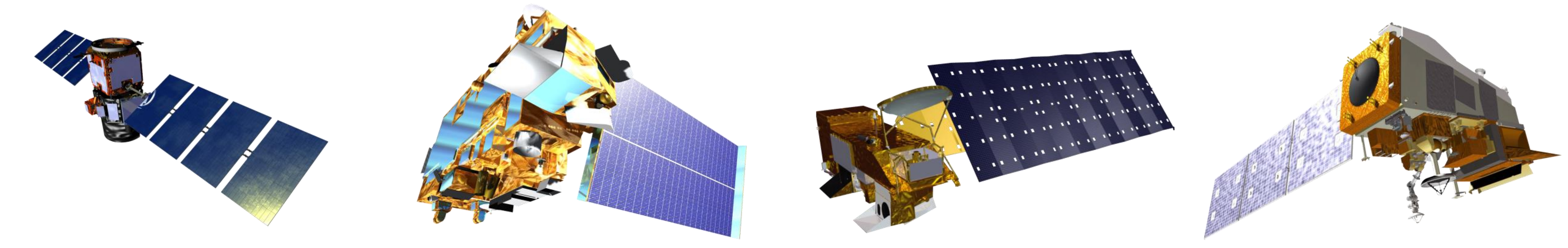
Objectives

- **Calculate** observed mixing heights of historic wildfires using CALIPSO Lidar data
- **Compare** observed data with mixing height estimation from different prediction methods
- **Provide** project partners with a script that automated the process of finding the mixing height from any CALIPSO data import

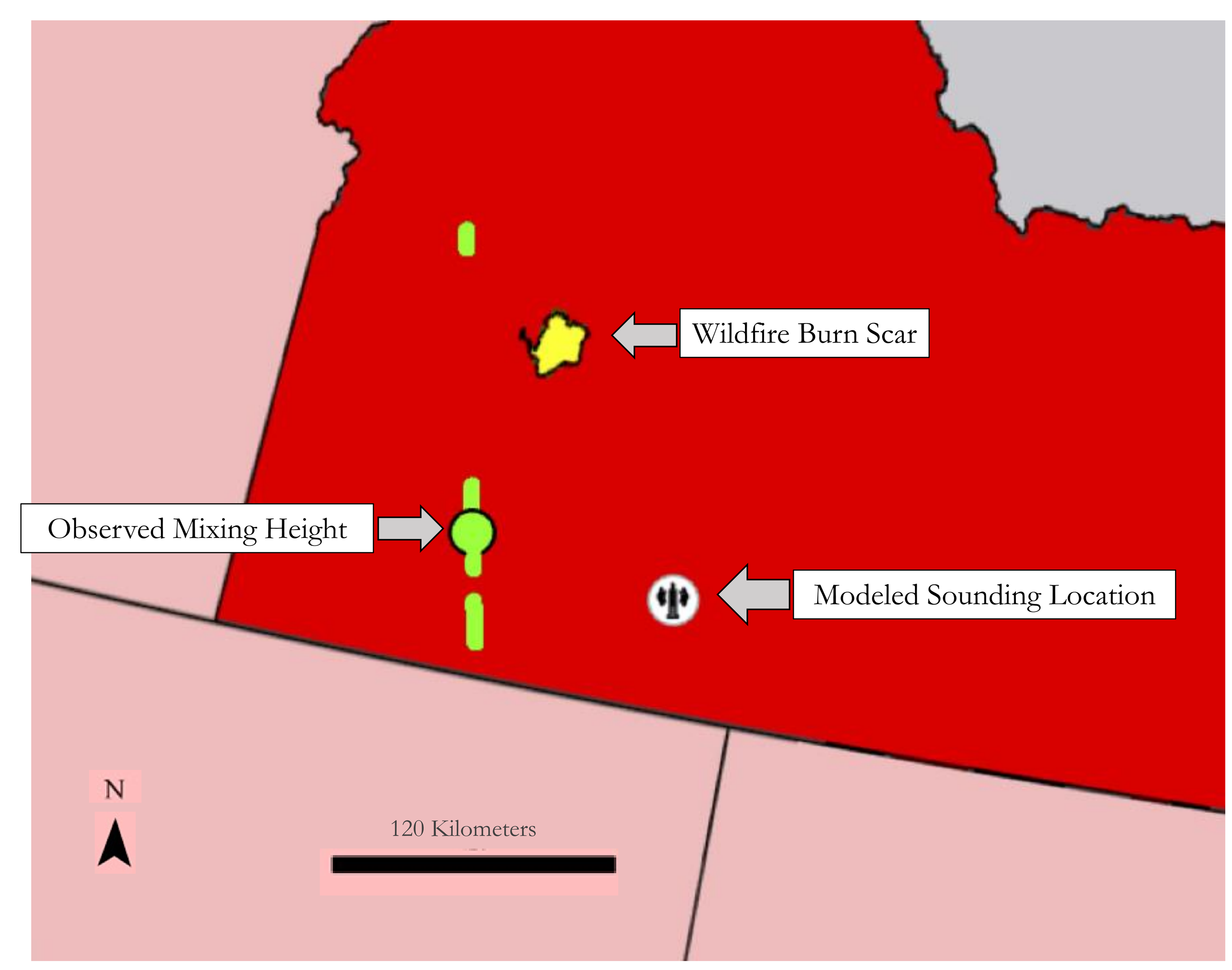
Earth Observations

CALIOP CALIPSO | Terra MODIS | Aqua MODIS | Suomi NPP VIIRS



Results

- CALIPSO LiDAR Vertical Feature Mask data can extract mixing height observations successfully.
- The mixing layer observation calculated from CALIPSO data does not align spatially or temporally with model-based soundings.



Conclusions

- The current models for mixing height estimation have limited validation.
- Stull and Holzworth methods frequently underestimate mixing heights.
- Holzworth estimates are accurate when the atmosphere is exceptionally dry.
- CALIPSO LiDAR data can be used to validate the accuracy of mixing height models.

Project Partners

NOAA's National Weather Service Fire Weather Program

Bureau of Land Management Interagency Fire Center

National Parks Service

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- **Project Partners**
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