Leveraging Satellite Remote Sensing to Enhance Understanding of Post-wildfire Streamflow Variability

Poster # 10

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INTRODUCTION

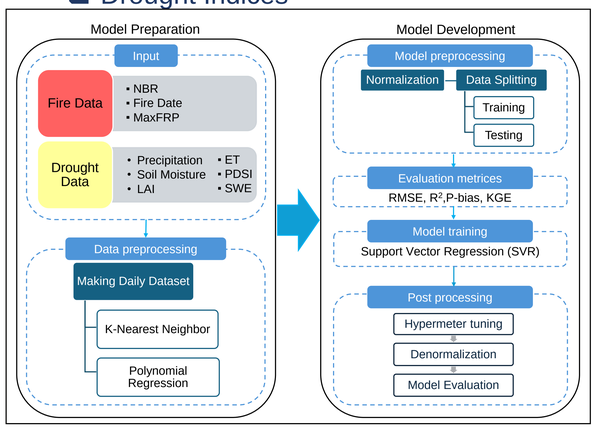
- Existing studies seek to address post-fire streamflow variability using run-of-the-mill hydrological datasets with statistical regression and conceptual simulation models. They consistently fall short in incorporating fire-related Earth data for post-fire streamflow predictions.
- We introduce an innovative Machine Learning framework to address this limitation, which seamlessly integrates fire-related Earth data and delivers promising results.

OBJECTIVE

- Integrate fire-related Earth data from multiple NASA satellites with vegetation and drought data.
- Develop a reproducible Machine Learning based model to understand the post-fire streamflow variability.

METHODS

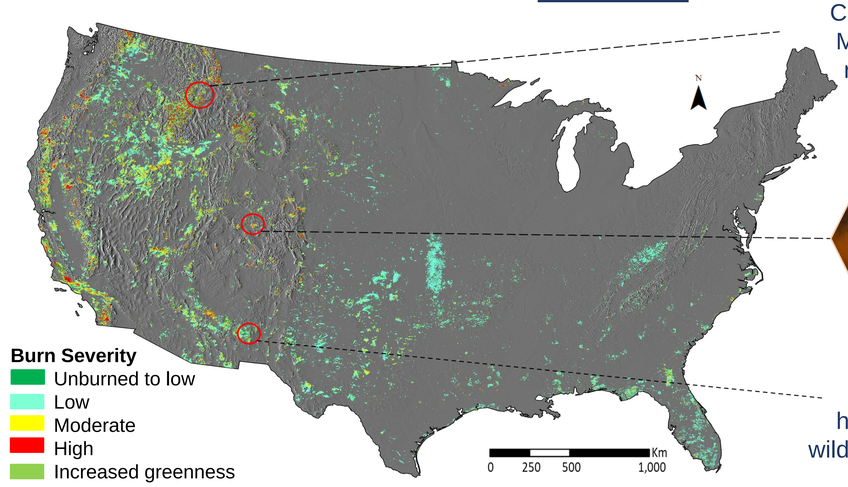
- Support Vector Machine (SVM) algorithm
  - USGS Streamflow Data
  - Earth Observation Fire Data
  - Drought Indices



** NBR – Normalized Burn Ratio; MaxFRP – Maximum Fire Radiative Power; LAI – Leaf Area Index

Fig. 1. A schematic showing the methodology applied for the work

RESULTS



Clark Fork basin in Montana is facing recurring fires in recent years

Upper Colorado basin faced the largest fire in 2020

A flash flood happened after a wildfire in New Mexico

Fig. 2. Map showing Burn Severity Across the CONUS (1984–2020). Model test beds were selected based on the spatial variations of burn severity.

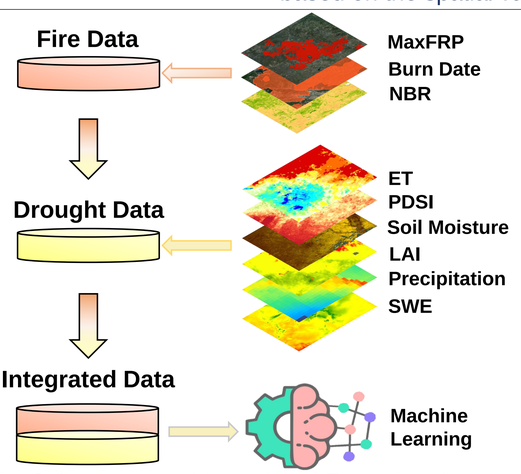


Fig. 3. Integration of fire-related Earth data from NASA satellites with run-of-the-mill drought data

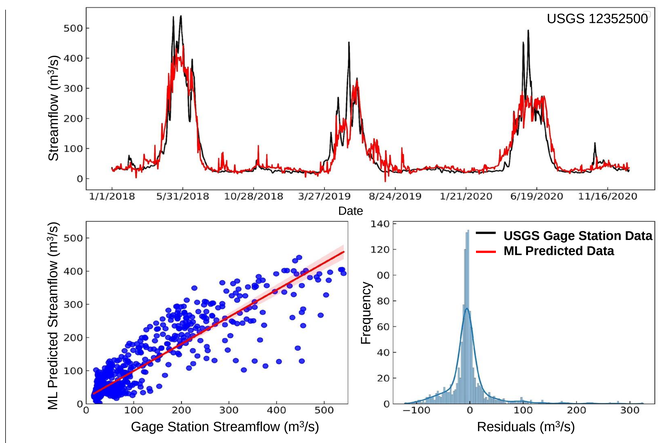


Fig.4. SVM ML model trained for Clark Fork Basin in Montana, United States

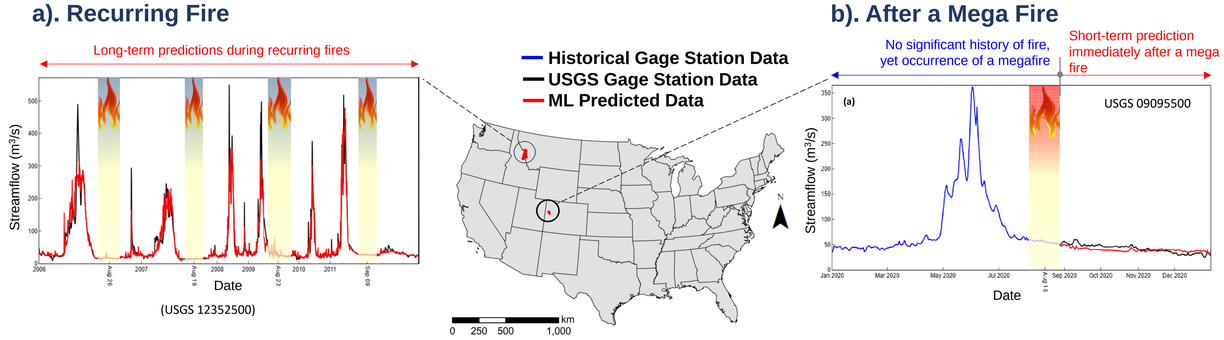


Fig. 5. Physical realism of the ML model in mimicking three real-life post-fire hydrologic conditions. (a) Long-term streamflow predictions during recurring fire events. (b) Streamflow immediately after a mega fire in a watershed with no significant history of fire. All data are at daily time-scale.

SUMMARY

- The preliminary findings indicate that integrating fire, vegetation, and drought data with machine learning offers a very efficient method for predicting post-fire streamflow.
- This new approach will help to fill a critical need in the hydrological community and the stakeholders against the increasing wild-fire events.

REFERENCES

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