Evaluation of the characterization of smoke plumes within the AIRPACT model

Kenneth Christian[1], Fok-Yan Leung[2], Joseph Vaughan[2]

1. Department of Geography, University of Idaho

2. Laboratory for Atmospheric Research, Dept. of Civil & Environmental Engineering, Washington State University

Introduction

Wildfires are a major source of air pollution during the fire season in the Western US, yet are not well characterized within air quality forecasting models. It is increasingly important to improve modeling of smoke plumes with climate change expected to lead to an increased occurrence of wildfires. As fires emit significant amounts of particulate matter during the fire season, it is important to correctly characterize smoke plumes within air quality models for local governments to make informed decisions and report to the public accurate information. In this project, we compared satellite data observed by the MISR (Multi-angle Imaging SpectroRadiometer) tool aboard the Terra satellite and plumes modeled in AIRPACT (Air Indicator Report for Public Awareness and Community Tracking).

Objectives

- Find matching plumes between MISR plume observations and plumes modeled in AIRPACT
- Determine the accuracy of the model at each matching plume
- Determine what physical factors affect accuracy of modeled plume rise

Methods

- Use ArcGIS to find matches between plumes observed by MINX and reported fire locations.
- Get slope, aspect, and vegetation information from the Forest Service's Landfire database
- Get elevation data from Google Earth
- Analyze plume and attribute data within Excel to evaluate accuracy.

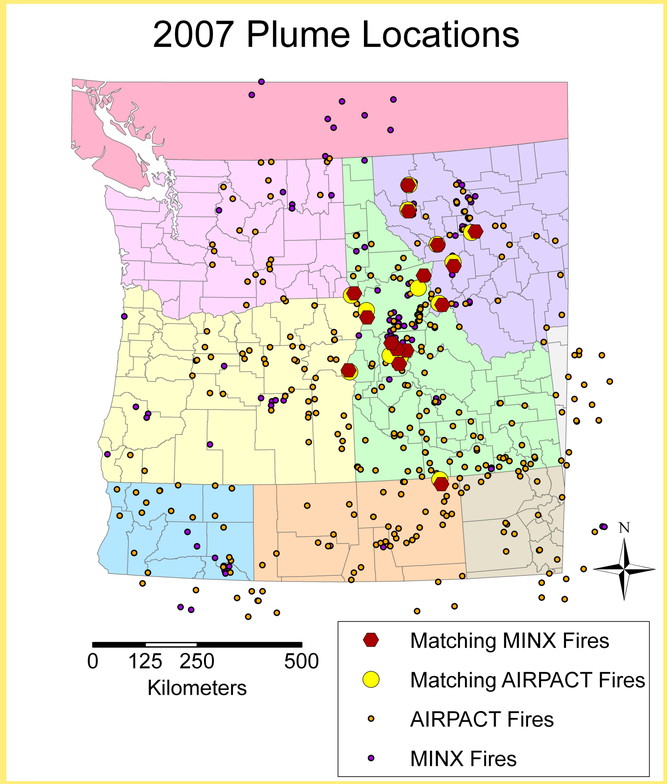

Figure 1: Plume Locations Studied

Results

- Accuracy of model was not significantly affected by land cover or aspect angle
- Depending on points used, elevation had ranging effect on accuracy
- Slope and fire power had the greatest and most consistent effects on accuracy (see Figs. 2 & 3).

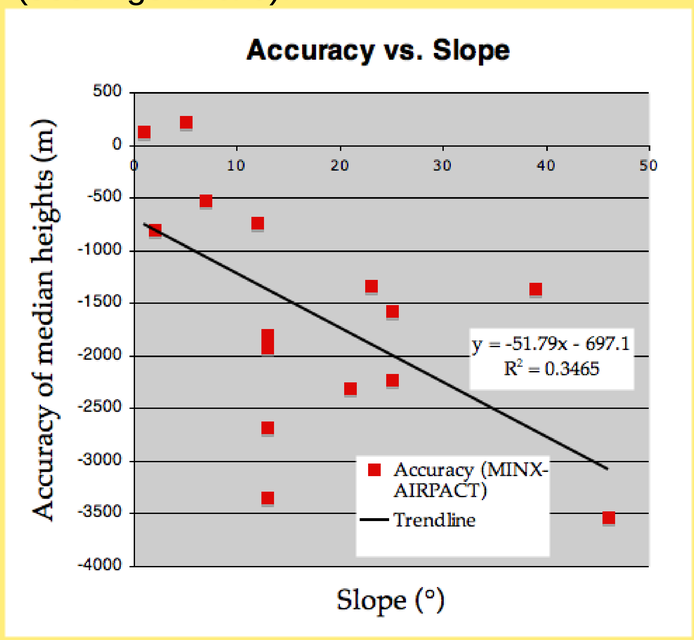

Figure 2: Plot of Accuracy of Model vs. Slope

As slope increases, accuracy decreases

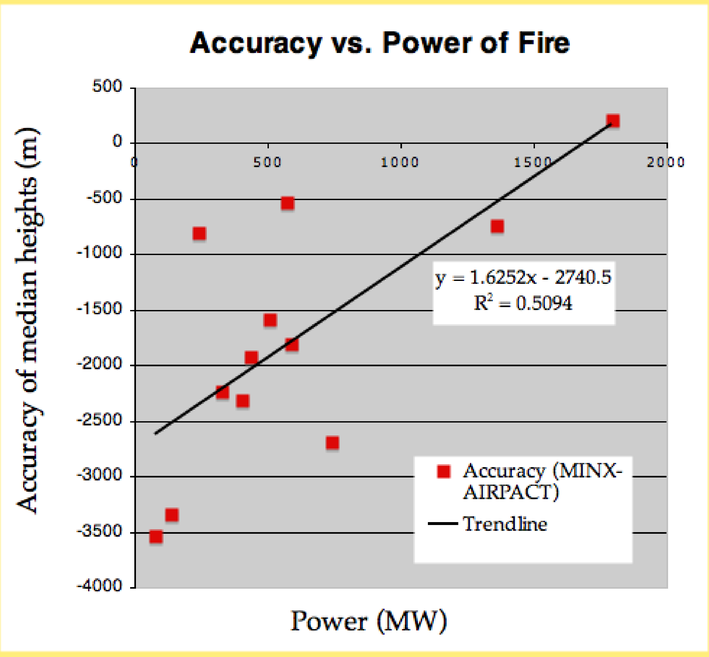

Figure 3: Plot of Accuracy vs. Power

As power increases, accuracy increases

Conclusions

There is quite a bit of uncertainty in the data, especially with a small sample size of fifteen matching plumes. For example, in mountainous terrain, small deviations in location can result in different topographical conditions. Despite these uncertainties, the preliminary correlations between model accuracy and slope and accuracy and power are noteworthy. The effect of slope may be a result of the model not including slope and the effect of power could be a result of small fires being affected by localized conditions not included in the model.

Further Research

- Sample other years to increase number of matching plumes
- Increase accuracy of the model by including new physical factors into plume rise model

Acknowledgements

I would like to thank Tara Strand of the USFS and Daniel Pryden of Sonoma Tech for their help with the BlueSky framework. This work was supported by the NSF's REU program grant number 0754990.