**Lightning Occurrence Prediction Model for Alberta**

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### Introduction:

Wildland fires burn an average of 2.5M ha of Canada’s forested area [1] with direct suppression costs ranging from CAD $500 million to $1 billion per year [2]. Although fire is a natural and necessary feature of our landscape, human development and valued resources inhibit our ability to allow fire to roam freely. Although human and lightning ignitions are near equal in number, lightning caused fire starts are responsible for ~80% of area burned in Canada [1]. Lightning fires are responsible for such a vast area burned due to two main factors:

1. **Location**: lightning can occur in remote areas making detection and response difficult thus increasing the chance of the fire escaping initial attack [3] (Photo courtesy of Stephanie Koroscil).

2. **Concentration**: lightning has a tendency to occur simultaneously in multiple locations and in large concentrations [3] (photo courtesy of NOAA www.nws.noaa.gov).

### Methods:

21 variables are used to generate possible prediction algorithms via random forest (multiple decision trees).

- Temperature, dew point, winds, sea level pressure, geopotential height, etc.
- Atmospheric instability indicators (Showalter index, Lifted index, K Index, etc.)
- Digital elevation model Location (latitude)

### Preliminary Results:

The greatest number of cloud-to-ground lightning strikes in Alberta occur in June, July and August. On average, there are ~326,000 strikes per fire season with ~149,000 occurring in the month of July alone.

A diurnal trend in lightning occurrence is shown with the peak number of cloud-to-ground lightning strikes occurring between 3pm and 9pm local time. This anticipated trend corresponds with typical peak temperature and atmospheric instability.

### Looking Forward:

- Determine key atmospheric indicators for predicting lightning location and frequency in Alberta.
- Forecast lightning location and frequency in Alberta out to 4 days.
- Possible adaption of model for other regions.
- Potential prediction of lightning variations (positive vs. negative strikes, dry lightning and long continuous current).

An accurate, medium range lightning prediction model could greatly aid the effort to responsibly manage Alberta’s forests, improve allocation of resources and increase preparedness of fire managers and communities alike. The incorporation of this lightning occurrence prediction model with the Fire Weather Index and a Vegetation Index could produce extended lightning ignition risk forecast maps.

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### References: