Global Fire Prediction on Daily and Seasonal Timescales

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April 24, 2018

NOAA
MAPP Webinar
Fire: Modeling and Prediction Issues
Fires are declining worldwide

We have lost nearly a quarter of global burned area over two decades.

Andela et al. (2017) Science
Relative rate of burned area change

Andela et al. (2017) Science
Landsat8 image from the Brazilian Cerrado (Morton, NASA)

Andela et al. (2017) *Science*
Andela et al. (2017) Science

(a) Population density
Decadal prediction of fires remains challenging

Andela et al. (2017) Science
El Niño exerts a strong influence on the global pattern of fire emissions

An El Niño cascade may improve global fire prediction

Chen et al. (2017) Nature Climate Change
Chen et al. (2017) Nature Climate Change
Improving emissions estimates for smoke forecasts

- Emissions prediction can be separated into a part associated with new ignitions and the spread of existing fires:
  \[ A_s(x, y, t+k) = A_i(x, y, t+k) + A_E(x, y, t+k) \]
- Emissions from new ignitions likely dominant in savanna and agricultural ecosystems.
- Emissions from existing fires likely a dominant term in western and boreal North American ecosystems.
Smoke forecasting methodology
– Existing fires

1. Assign active fires on day $t$ to existing and new clusters
2. Extract climate information from analysis and forecasts at each cluster centroid
3. Predict active fires on day $t + k$ in the future using the number of active fires at day $t$, and weather information
4. Use active fires to estimate emissions
5. Use emissions to estimate atmospheric composition at the next forecasting time step
Example Fire Cluster:
Current fire detections – red
Past active fires – blue
Other fire clusters – yellow a green

Climate Extraction:
NOAA Global Forecasting System
Analysis product
- Surface Air Temperature
- Relative Humidity
- Precipitation
- Wind speed

\[
\log( E[y_{t+k}^i] ) = B_0 + B_y \log(y_t^i + 1) + \sum_w B_w x_{t+k,w}^i
\]

Graff et al. (in prep.)
Active fire model prediction improves with use of climate data

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\]

Graff et al. (in prep.)
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