Updates of Satellite Applications in National Air Quality Forecasting

Patrick C. Campbell$^{1,2,3}$, Daniel Tong$^{1,2,3}$ (PI), Youhua Tang$^{1,2,3}$, Barry Baker$^{1,3}$ and Pius Lee$^2$

1. George Mason University, Fairfax, VA
2. NOAA Air Resources Lab, College Park, MD
3. University of Maryland, College Park, MD

Father’s Day heat wave and dangerous ozone
Eastern U.S. June 16-18, 2018

2018 California wildfires and fine particle
Camp Fire of Butte, CA November 8-27, 2018
Volcanic SO$_2$ Forecasting with OMPS SO$_2$

Mt. Kilauea Eruption
May-August
2018

Lava, ash, and gases

(REUTERS/Terray Sylvester)
Fire Emissions

The Blended Global Biomass Burning Emissions Product (GBBEPx V2)

GBBEPX 0.1x0.1 Emission testing in a real-time PM$_{2.5}$ forecast

- Speciated wildfire emissions
- Diurnal variation/daily ratio
- Duration when forest fraction $> 0.4$
- Inline plume rise using Briggs
- Heat flux derived from FRP
- Burn area is 10% of gridded area

Some improvement over HMS-Bluesky
Satellite-aided Dust Forecasting

Goal:

Novel method to improve dust forecasting nationally and globally.

Satellite Products:

- MODIS/VIIRS Albedo;
- MODIS/VIIRS BRDF;
- MODIS/VIIRS AOD;

Global Dust Forecasting

time = 2019-06-10, level = nan

MODIS AOD

time = 2019-06-10, level = nan
Emission data assimilation (EDA) algorithms are being developed at HAQAST to improve emission modeling;

Initial applications to real-time air quality forecasting show promising results;

Working with National Weather Service for further evaluation and transition to operational forecasts.
Year 3 Progress Update, PI Daniel Tong

Emission data assimilation, air quality forecasting and reanalysis

- Air quality forecasting:
  - Advancing air quality forecasting to protect human health [Tong and Tang, 2018];
  - The particle dry deposition component of total deposition from air quality models: right, wrong or uncertain? [Saylor et al., 2019]

- Fire emissions:
  - Retrospective simulations of the 2018 Camp Fire in California (Oct 5-25, 2018);
  - Real-time ensemble forecasting for FIREX-AQ;
  - Evaluating a fire smoke simulation algorithm in the National Air Quality Forecast Capability (NAQFC) using SENEX [Pan et al., 2019];

- Outreach: Six presentations; Twelve stakeholder meetings;

Tiger Team Participation

- TT O’Neal & Diao: CA Fire
  - Testing different satellite-based fire emission products with NAQFC;
  - Conducting a national scale simulation of the 2018 Camp Fire.

- TT Fiore: Regional Haze.
  - Worked with TCEQ to study dust contribution to haze in Texas.

- TT Anenberg.

Two papers published;
Two accepted;
Two under review.