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*Sub-pixel analysis of flaming and
smoldering combustion*

By: Chris Elvidge, Colorado School of Mines

About Me



Chris Elvidge led the Earth Observation Group at NOAA from 1994-2019. He is now the director of the Earth Observation Group at the Payne Institute for Public Policy, Colorado School of Mines.



Elvidge pioneered the development of global nighttime lights data products in the mid-1990's. In 2012 he developed the VIIRS nightfire (VNF) data product, which uses spectral bands ranging from the near infrared to longwave infrared. The new algorithm, VNF+, performs subpixel analysis of flaming and smoldering combustion.



Team member: Dr. Mikhail Zhizhin, Earth Observation Group.

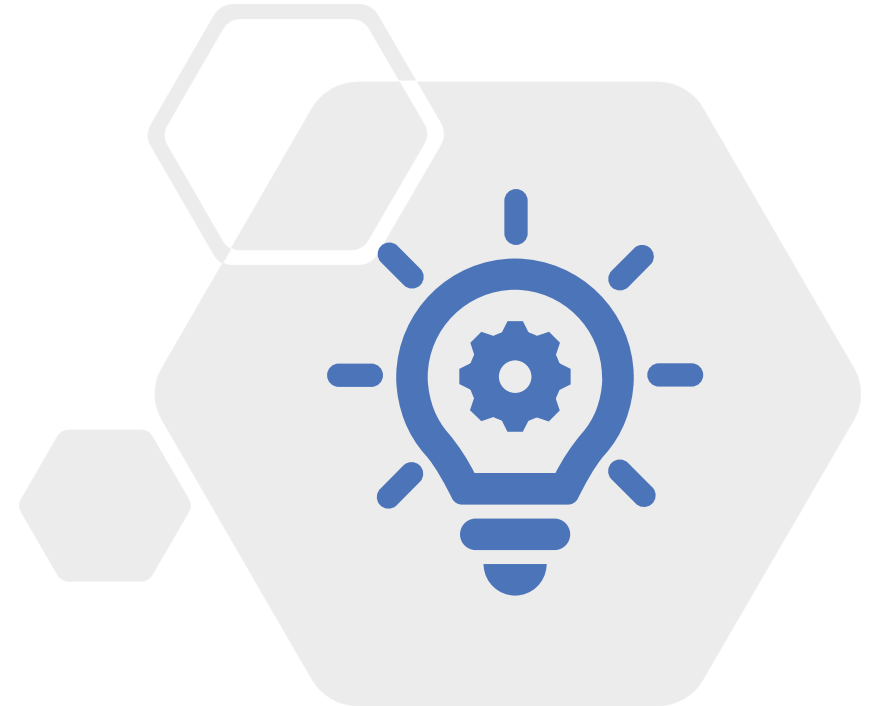
The Idea



- **Sub-pixel analysis of flaming and smoldering combustion**
- **Scope of Idea: Global - in near-real time**

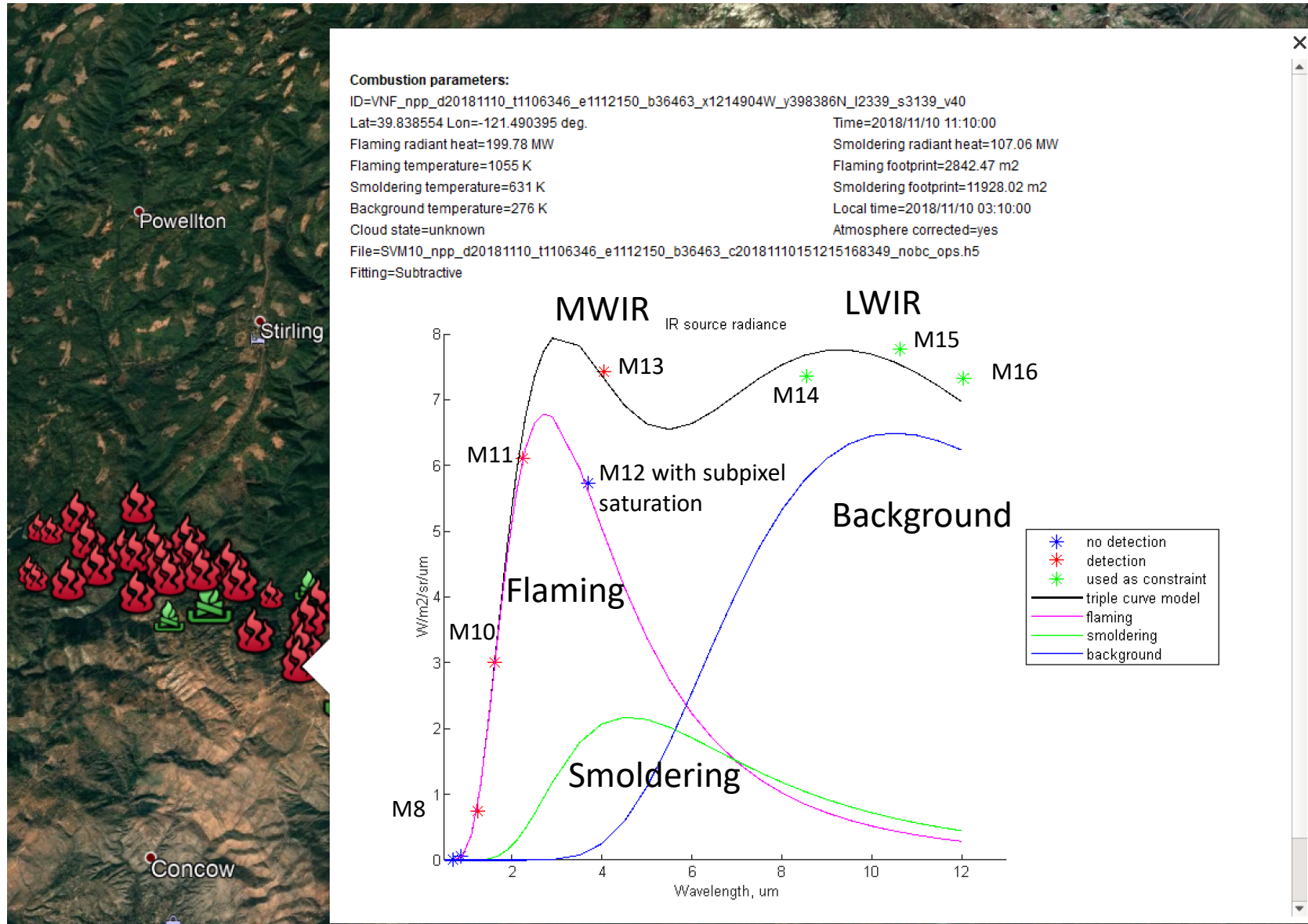
The Idea

There are two widely recognized combustion phases: flaming and smoldering. Flaming is hotter and produces more complete combustion. Smoldering is cooler and produces more smoke and partially oxidized trace gases. The flaming radiant emissions are shifted to shorter wavelengths (Wein's Displacement Law). Our approach is to model the flaming phase Planck curve with near infrared and shortwave infrared radiances. The flaming phase radiances are then modeled for the remaining VIIRS bands and subtracted from the observed radiances. The smoldering versus background Planck curves are then derived from the residual radiances.



Mega-fire pixel from California Camp Fire November 10, 2018

Flaming is typically in the 800 to 1100 K range. Smoldering in the 600-700 K range, typical of glowing embers.



Issue(s) being addressed

- Smoke production
- Suppression strategies
- Wildfire impacts
- Carbon emissions and flux

The Idea

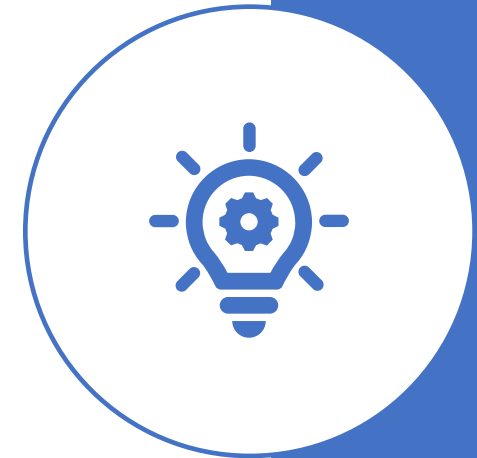


Issues Addressed

What EO data does your idea utilize?

- Nighttime Landsat
- Nighttime VIIRS

The Idea



The Idea – Outcomes / Societal Benefits



- EOG has one more year of funding for this development from the JPSS Proving Ground program.
- We plan to begin near-real time VNF+ production later this year.
- We are looking for opportunities to validate results.
- We anticipate that the USFS could find the additional information content useful for fire and smoke management.



Thank You!

