

AQRP Monthly Technical Report

PROJECT TITLE	Using Satellite Observations to Quantify Surface PM_{2.5} Impacts from Biomass Burning Smoke	PROJECT #	20-005
PROJECT PARTICIPANTS	Matthew Alvarado, Archana Dayalu	DATE SUBMITTED	06/08/2021
REPORTING PERIOD	From: 05/01/2021 To: 05/31/2021	REPORT #	10

A Financial Status Report (FSR) and Invoice will be submitted separately from each of the Project Participants reflecting charges for this Reporting Period. I understand that the FSR and Invoice are due to the AQRP by the 15th of the month following the reporting period shown above.

Detailed Accomplishments by Task for reporting period

We began drafting the Final Report and finalizing associated deliverables. We also began work on Task 3, where we examine how well the surface PM_{2.5} impacts of smoke in Texas can be constrained using current remote sensing products. For reference, Figure 1 displays the 2020 annual average of PM_{2.5} using daily PM_{2.5} data from EPA’s AirNow portal (<https://www.epa.gov/outdoor-air-quality-data/download-daily-data>). Daily measurements from the EPA AirNow portal will be used in conjunction with the data subset from Tasks 1 and 2 to derive PM_{2.5}-AOD relationships at each station. The derived relation will then be applied to the data subset as a whole (i.e., where GOES AOD measurements are available). We will compare

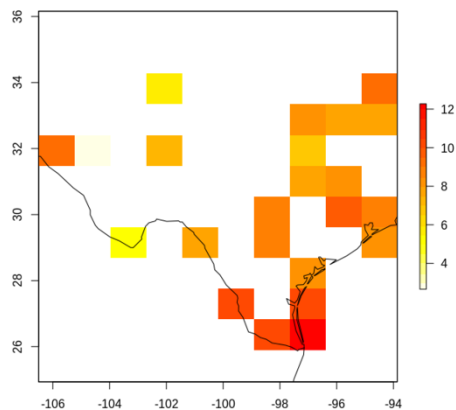


Figure 1: 2020 Annual Average PM_{2.5} derived from daily measurements at TCEQ/EPA Air Now monitoring stations. Units are µg/m³.

our findings with a recent paper by Zhang and Kondragunta (2021), which demonstrates a proof-of-concept for a near-real-time NOAA algorithm for surface PM_{2.5} estimates over CONUS. Zhang and Kondragunta (2021) emphasize the importance of dynamic PM_{2.5}-AOD relationships in realistic air quality assessments rather than using traditional algorithms that rely on simplistic climatological PM_{2.5}-AOD regression relationships. Figure 2 displays PM_{2.5} for an example study date (17 April 2020) along with relevant data from Tasks 1 and 2. Of note, observations indicate high PM_{2.5} air quality advisory in Southern Texas. Matching this up with our data

analysis for the same day, we can see that our Smoke Confidence Index is “Low” for this region. However, while the three smoke products (HMS, GOES, UVAI) do not overlap in time at the southern Texas location (leading to the Low SCI), they all consistently suggest smoke presence at various times in the day. In other words, there is spatial correlation rather than temporal correlation suggesting that future versions of the SCI could be updated to reflect spatial *and/or* temporal overlap rather than simply spatial *and* temporal overlap

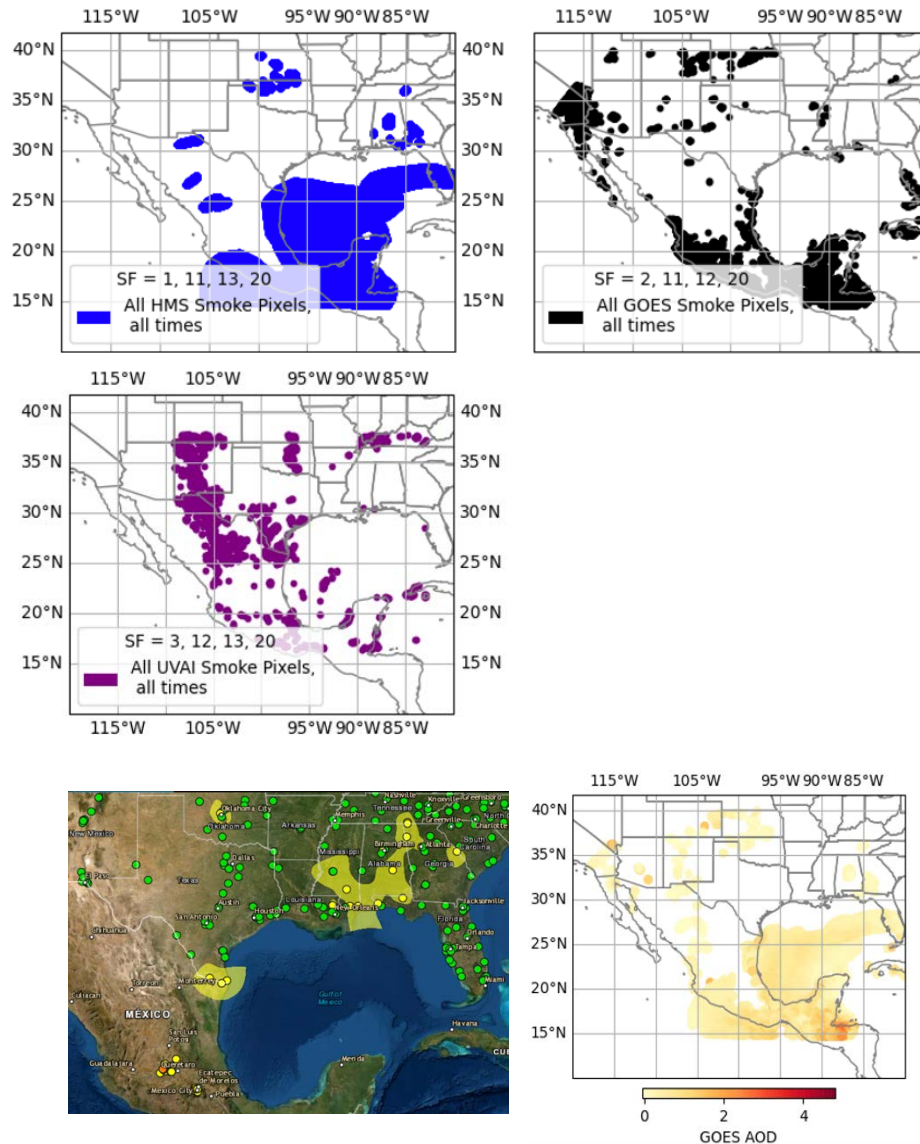


Figure 2. Synthesis of findings thus far using 17 April 2020 as an example date. Rows 1 and 2 provide smoke data from HMS, GOES, and TROPOMI UVAI along with the Smoke Confidence Index of spatiotemporal overlap. The last row (first column) displays PM_{2.5} Air Quality from the EPA AirNow interactive map; yellow indicates Moderate PM_{2.5} Air Quality advisories. The last row (second column) displays available GOES AOD measurements.

Data Collected

Daily PM_{2.5} data for the study period was downloaded from the EPA AirNow portal (<https://www.epa.gov/outdoor-air-quality-data/download-daily-data>).

Identify Any Problems or Issues Encountered and Proposed Solutions or Adjustments

None

Goals and Anticipated Issues for the Succeeding Reporting Period

In the next reporting period, we will provide preliminary PM_{2.5}-AOD regression results at EPA AirNow surface stations. We will include a comparison with findings from Zhang and Kondragunta (2021). The regression results will then be used to derive a PM_{2.5} variable associated with AOD measurements reported in the Task 1 and 2 data subset.

Detailed Analysis of the Progress of the Task Order to Date

We have selected 93 dates between January and July 2020 with suspected smoke intrusions in the Texas area. For these dates:

- We have merged all the Task 1 and 2 components thus far and placed them on a common grid.
- We have performed aggregate, seasonal, and daily analysis of the 93-day smoke data set, incorporating multiple auxiliary products (NH₃, CO, OMI BrC, AOD, PH) where relevant.
- We have developed a Smoke Confidence Index within a standalone data set that enables a user to perform multiple calculations including FMS, PH, etc.
- We have calculated PH from AOD bins based on Cheeseman et al. (2020) MAIAC PH/AOD relation.
- We have performed FMS analyses, aggregated over all times as well as broken down by day and measurement hour.
- We have developed a python-based GUI to visualize daily results from a user-selected date.
- We have subset relevant data for HYSPLIT Plume Analysis and Surface PM_{2.5} estimates (Task 2.2, Task 3)
- We have daily PM_{2.5} data from TCEQ (via EPA AirNow) surface stations.

Do you have any publications related to this project currently under development? If so, please provide a working title, and the journals you plan to submit to.

Yes **No**

Working title: Identification and evaluation of biomass burning events: a data assimilation approach over Texas

Journal: Journal of the Air and Waste Management Association

A draft of this manuscript will be provided to AQRP prior to submission.

Do you have any publications related to this project currently under review by a journal? If so, what is the working title and the journal name? Have you sent a copy of the article to your AQRP Project Manager and your TCEQ Liaison?

Yes **No**

Do you have any bibliographic publications (ie: publications that cite the project) related to this project that have been published? If so, please list the reference information. List all items for the lifetime of the project.

Yes No

Do you have any presentations related to this project currently under development? If so, please provide working title, and the conference you plan to present it (this does not include presentations for the AQRP Workshop).

Yes No

Do you have any presentations related to this project that have been published? If so, please list reference information. List all items for the lifetime of the project.

Yes No

Identifying Smoke-Impacted Regions using the Optical Properties of Brown Carbon Aerosol, oral presentation at the CMAS Fall Meeting

Identifying Smoke-Impacted Regions using the Optical Properties of Brown Carbon Aerosol, poster at AGU Fall Meeting

From OMI to TEMPO: Opportunities for enhanced identification of biomass burning using the optical properties of Brown Carbon aerosol, poster presented at TEMPO June 2021 Science Team Meeting

Have any personnel changes occurred that were not listed in the original proposal? If so, please include a detailed description of the personnel change(s) below.

Yes No

Qiang Sun resigned from AER at the beginning of February.

Are any delays expected in the progress of the research? If so, please include a detailed description of the potential delay below.

Yes No

Describe any possible concerns/issues (technical or non-technical) that AQRP should be made aware of.

None

Are you anticipating using all the available funds allocated to this project by the end date? If not, why and approximately what is the amount to be returned?

Yes No

Submitted to AQRP by
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