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CMFD PROJECT – CORE SCIENCE TEAM, REMOTE SENSING (OPTIONAL MEETING)

DATE: March 26, 2021

TIME: 2:00-3:30pm MST

LOCATION: Microsoft Team Meeting

ATTENDEES: Matt Mavko, Tom Moore, Klaus Scott, Farren Herron-Thorpe, Andrew Kirsch, Mark Fitch, Lyndsey Boyle, Amber Soja

	AGENDA ITEMS	PRESENTER	TIME ALLOTTED
1	Welcome, introductions, agenda overview	Tom Moore	5 Minutes
2	Review slides diagramming current draft of Conceptual Model, emphasis on remote sensing inputs	Matt Mavko	20 Minutes
3	Invited expert discussion (Amber Soja, National Institute of Aerospace, Resident at NASA)	Tom Moore (facilitator)	40 Minutes
4	Next Steps and Meetings	Tom Moore	5 Minutes

Meeting Notes

Review of Conceptual Model Draft – Matt Mavko

- The Core Science Team is working to create a conceptual model to create a WRAP region fire emission inventory on an annual basis
- We are working together to identify which datasets are available and can be used to create the best emission inventory for fire emissions
- We have identified tools already available and organized them by frequency in which they are updated, quality, and types of data they include
- We are starting to sift through the available tools and data available – what would make sense for these annual WRAP inventories?
    - What is the most efficient and provides the best input data? What takes advantage of the best existing technology?
- We want to get our activity data into WFEIS and leverage their existing tools
    - How do we get the best activity data in the most efficient way?
    - Getting a comprehensive dataset can be challenging, especially when trying to cover the entire WRAP region

- We need other information to fill in the pieces of missing data
- Activity data:
    1. Remote sensing base data source: HMS as a stand in; using GOES and satellites
    2. Combine with perimeter data; Andy Kirsch has been helping with this data; the federal gov is almost done making a fire perimeter database NIFC
    3. We are discussing building a geographic layer that classifies the areas into when the prescribed burn seasons start, when ag burns occur, when the wildfire season is; to assign metadata to
- Wrangling small fires, example case study:
    - We had a lot of information on a small 2-day pile burn
    - Used information from literature to convert kg/MJ to ton/MJ to estimate emissions using the FRP values
    - FRP-estimated Fire Detects at an hourly scale and then integrated to get the total FRP would have been (FRP from VIIRS)
    - Consumption profile: Estimate of the arc of a typical 1-2 day burn
    - Blue Sky has empirical curve for what fire consumption by hour looks like depending on the length of the burn
    - That gives you % of total fuel consumed by hour
    - You can take the FRP value at any point and scale it by using the consumption curve
- Took the same technique and applied it to prescribed burn data from Oregon for 2017 for test cases
    - Grabbed VIIRS and MODIS detections for 2017 and randomly selected burns in OR from the Fall
    - Took the FRP, applied it to the profiles, and calculated tons derived
    - Results were not too far off, but would like to get more test cases (we have 5 so far)
    - There is potential for the reported data to have errors
- CalFire's Joe Restaino (former PW-FERA staffer) has been working with UC Davis and USFS-R5 Hugh Safford to detailed measure fuels pre and post burn. More work scheduled this Spring by UC Berkeley's Scott Stephens and John Battles at Blodgett Experimental Forest; joe.restaino@fire.ca.gov
- Scott Stevens has been doing a long-term study on fire fuels and surrogates for details on prescribed burns
    - We may be able to snag some collocated satellite
- Broadcast-type burning – lots of literature on this
- If we could get days and locations from the studies, we may be able to compare pile sizes

- EPA was involved in a study similar – Allen Goldstein has been deploying all kinds of samplers at these sites and flying drones in the plumes
- Get after some well characterized burns to do some more testing
    - You could improve on this methodology per ecosystem
    - Anything that its in the background of VIIRS you may be able to help
    - Start tweaking the algorithm by ecosystem to see if you can improve on your original equation
- Andy can provide more information on using pre and post LIDAR data
- Might be helpful to get more test case data, pile burn data
    - The Forest Resiliency Burning Pilot Project may be helpful in getting more test data
- More examples of diurnal profiles, need diverse ecosystem examples, need broadcast burns examples, need more standard candles to compare reported and derived
- This technique we are talking about will only be applied to burns that are isolated and short durations
- Consider testing this methodology with cropland burns
- Using it for pile burns and ag burns makes sense, but how would we translate for smoldering or when fuels are moist?
- We would not need acres burned; instead, we go straight to tons consumed
    - Sometimes we need to include a proxy for acres (Farren)
- Maybe the geographical layer can have information on probability
    - Could have different profile shapes based on where we are at
    - This is more likely to be a broadcast burn, so that would have a different profile
- Large, multi-day fires
    - Similar to SMARTFIRE2: Try to apportion daily acres burned using HMS detects
    - The HMS detections that occurred over the burn are very useful, but it can over/under estimate, so WRAP has reassessed the total acreage using the perimeter at the end
    - Instead of using the detect data to estimate the daily acres burned, we can use the total acres burned and create an adjusted daily acres burned by applying what was observed daily using the HMS detects using the median acres burned
        - This helps to eliminate the zero values days on days when there are no HMS detects
- For a burn that is under 12,000 acres, GOES becomes less reliable (perhaps this is not entirely true given the current time and scale resolution)
- What to do when fire detects are not available for multi-day fires?
    - Can apply a logistic function using the duration of fire
- GOES is capturing fires that are about a square kilometer

- Fire Geography: WA Example
    - Different air agencies in the state; they may be separately setting burn bans at different times
    - We could start with a default breakdown, but could customize it by year to include actual known dates of different burn bans for different regions within the state (based on jurisdiction)
    - Potentially a big undertaking to do the entire WRAP region but may be necessary to create a rule set that would categorize burn type by location
- The final model would then be a rule set /flow chart that could be applied with different
- We would come up with technical rule sets that would be a memorandum every time datasets are coming together so that the steps are laid out very clearly
- Example: VIIRS
    - You may have a cluster of VIIRS detects over a couple of days
    - Those get associated as a single fire
    - Then those are applied to the consumption curve
- What is missing in the way the EPA does it now? What does WRAP need from the emissions?
    - Need comprehensive fire inventory on an annual basis
    - Transparency; there is nothing hidden about the methods
        - Overtime EPA has not met their needs in transparency around the data
    - EPA data is not detailed enough for states to use the data at a more local level
    - The west coast is dominated by wildfires which are not well characterized by the EPA NEI
    - Ready to use, for planning or exceptional events
    - Quality control and the ability to QA data ourselves
- GRIDMET is an alternative to WFAS.NET
- The FRP route could side-step the perimeters-fuels-consumption-emissions pathway, but CARB is also involved in natural resource issues because CARB is in the GHGs/natural & working lands carbon budgets business (Klaus)
- Ag and Prescribed fire should be on a diff. track from Wildfire track. FLMs, state-tribal-private foresters, state and tribal air agencies are all interactively managing activity and resulting smoke, some of the natural resource issues Klaus mentions.

FIREFAQ Presentation, Amber Soja (National Institute of Aerospace)

- Depending on the fire weather and the fuels type; you get much different results for consumption
- Fire radiative power is a powerful measurement; fuel matters and how hot its burning is key

- GOES detected 69-76% of the fires, more than any other satellite
    - Because of the temporal scale
- The DC-8 Flight track is done by a plane with AQ monitoring equipment flies over the plume to see where the thickest part of the smoke is and then does horizontal transects of the plume
- Continuation of these datasets and tools: everything that is currently being collected will continue and NASA will continue exploring verticals (LIDAR data, spectrometers, etc.)
- FIREX-AQ is a good resource to check out
- Consider how vegetation types and fires burn by ecosystem (e.g. boreal, temperate, tropical)

References Mentioned

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