NASA DIRECT READOUT CONFERENCE (NDRC) WEBINAR

July 1, 2020

MINUTES

Purpose/Objectives of the NDRC Webinar Series

At 11:00 a.m. Mr. Brad Quayle (USDA FS GTAC) convened the NASA Direct Readout Conference (NDRC) Webinar. He reviewed the purpose of the NDRC, activities to date, and objectives going forward. This webinar featured Ms. Natasha Stavros (NASA/JPL) and Mr. Alireza Farahmand's (NASA/JPL) presentation, "Fire Danger from Earth Observations (FDEO): Use of Satellite Observations to Forecast Wildfire Risk."

Mr. Quayle's presentation, including webinar wrap-up slides, is available here: https://directreadout.sci.gsfc.nasa.gov/links/rsd_eosdb/PDF/NDRC_Webinar_Series_20200701 - Quayle.pptx

Fire Danger from Earth Observations (FDEO): Use of Satellite Observations to Forecast Wildfire Risk

Wildfire danger assessment is essential for operational allocation of fire management resources; with longer lead prediction, the more efficiently resources can be allocated regionally. Traditional studies focus on meteorological forecasts and fire danger index models [e.g., National Fire Danger Rating System (NFDRS)] for predicting fire danger. Meteorological forecasts, however, lose accuracy beyond ~10 days; as such, there is no quantifiable method for predicting fire danger beyond 10 days. While some recent studies have statistically related hydrologic parameters and past wildfire area burned or occurrence to fire, no study has used these parameters to develop a monthly spatially distributed predictive model in the contiguous United States. Thus, the objective of this presentation is to introduce Fire Danger from Earth Observations (FDEO), which uses satellite data over the contiguous United States (CONUS) to enable two-month lead time prediction of wildfire danger, a sufficient lead time for planning purposes and relocating resources. In this study, we use satellite observations of land cover type, vapor pressure deficit, surface soil moisture, and the enhanced vegetation index, together with the United States Forest Service (USFS) verified and validated fire database (FPA) to develop spatially gridded probabilistic predictions of fire danger, defined as expected area burned as a deviation from "normal." The results show that the model predicts spatial patterns of fire danger with 52% overall accuracy over the 2004 – 2013 record, and up to 75% overall accuracy during the fire season. Overall accuracy is defined as number of pixels with correctly predicted fire probability classes divided by the total number of the studied pixels. This overall accuracy is the first quantified result of two-month lead prediction of fire danger and demonstrates the potential utility of using diverse observational data sets for use in operational fire management resource allocation in the CONUS.

Question and Answer Session with Ms. Stavros and Mr. Farahmand

Q: You explained that you take every vegetation type and find the input that best correlates to each type. Have you explored combining Soil Moisture (SM), Enhanced Vegetation Index (EVI) and Vapor Pressure Deficit (VPD) to predict the burned area for any vegetation type (not taking into account only the most closely correlated input)?
A: Thanks, this is a great suggestion. We did not try the different combinations. We kept it simple at the beginning and used only the input that had the best relationship. We do anticipate a better relationship though when combining these variables. Next steps for the

future must look at including the combinations of different variables. It is also worth noting that we only showed three land-cover types in the presentation, but we also included grasslands and wetlands for a total of five. An important objective of the FDEO model is operational decision support. One of the requirements for our algorithm design was that the decision-makers did not want to have a black box. We did not want to use too many variables because it becomes harder to interpret the results provided by FDEO.

Q: To follow up on the previous question, what are the data you are using in the model?
A: If you want to use different variables, you can still use same approach as we did in our model. Using our data-driven model we examined the fire occurrence/frequency relative to the target variables discussed. I would be happy to provide more information about the model and how it works.

Q: Please go back to the slide (refer to slide 19) with the three-panel comparison for US Burned Area in August 2013. I am not sure I understand what this is saying. Are you saying that the National Interagency Fire Center (NIFC) Categorical Prediction on the right looks very different than the other two models (Categorical Observation on the left and FDEO Categorical Prediction at center)? Is it due to the differences in the data used for NIFC predictions? This was a fantastic talk, and think it is great that you are using larger-scale data to provide more information.
A: NIFC interprets several sources of information/data (past fire frequency, drought, meteorological data, etc.) and it is a subjective process. The take-away here is that the categorical observations map matches with the FDEO map, but the NIFC map does not match very well. Ultimately we hope to look at different months and years to see how our predictions compare to NIFC's predictions. The main reason we picked August 2013 is because it was a month for which NIFC indicated that their map had been wrong. August 2013 could be an interesting case to see if NIFC might have used FDEO input to have improved their predictions.

Q: I think I missed what VPD means? What is the significance of that variable compared to temperature and humidity in terms of fire behavior?
A: VPD is Vapor Pressure Deficit. VPD combines information from relative humidity and temperature. We know that relative humidity and temperature are highly correlated with fire burned area occurrence and fire danger.

Q: Are there opportunities for international collaboration, specifically in South Africa? In South Africa we have a national fire danger rating service. Something like FDEO would be valuable to incorporate for decision support.
A: Yes, we are open to international collaboration and looking for funding opportunities so that we can implement our model globally. This algorithm was not designed to be fine-scale like lots of other fire danger systems aimed at a seven-day forecast. Our model is looking one or two months out, but it would be complementary and really powerful to combine with the fire danger system.

Q: I see where you want to upgrade to using more recent sensors, but in your slides I only saw American missions. Why not integrate data from other international missions

like Sentinel?
A: We are open to using international sensors, and would look at the full suite of available sensors as we expand the use of FDEO globally. We focus on using free, public domain data. We will not work with any sensor that is proprietary.

Q: Did you aggregate hydrological variables (e.g., VPD, SM, EVI) before computing Standardized Index (SI) with Gringorten plotting (refer to slide 9)?
A: Yes, we aggregated the hydrological variables up to one-month temporal resolution and 0.25-degree spatial resolution. Ignition data were compared to hydrological variables from one month prior.

Q: Considering the end users of FDEO, is there reaction or direction from these end users? What feedback have they provided after using the system, and what features would they like to have in a future version?
A: At this stage, we have demonstrated the results of the algorithm, focused on particular test cases and received initial, informal feedback on the results. A more in-depth and comprehensive analysis is needed using NIFC data, including additional anecdotal feedback from Predictive Services and fire managers.

Q: Thanks, this was a great presentation and a great learning experience. Why are the predictions for three categories only, normal, above normal and below normal? Why not try assigning a probability value also, with respect to above normal and below normal?
A: This is a great comment and suggestion and we will definitely look at doing that in the future..

The presentation made by Ms. Stavros and Mr. Farahmand is available here:
https://directreadout.sci.gsfc.nasa.gov/links/rsd_eosdb/PDF/NDRC_Presentation.pdf

Meeting Wrap-up
Mr. Quayle thanked Ms. Stavros and Mr. Farahmand for their presentation, as well as Webinar participants for all of their great questions. Mr. Quayle also thanked the DRL for providing logistics support. Mr. Quayle stressed the value of participant feedback as we evaluate future software technologies and algorithms, and prioritize resources accordingly to meet the needs of the global user community. He invited participants to submit feedback and suggestions for future webinar topics via email to NDRC organizing committee members (refer to Mr. Quayle's presentation for addresses). Mr. Quayle adjourned the webinar at 12:25 p.m.

Next Webinar
The next webinar is planned for September 2, 2020. Additional details will be provided via the Direct Broadcast Users email alias.