PyFDEO - a new Python tool for Fire Danger prediction from Earth Observations

Cibele Amaral[1,2], Luke Fanguna[3], Erick Verleye[1,2], Natasha Stavros[4], Matt Jolly[5], Alireza Farahmand[6]

[1] Earth Lab, Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder, CO 80303
[2] Environmental Data Science Innovation & Inclusion Lab (ESIIL), Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder, CO 80303
[3] California Polytechnic State University-San Luis Obispo, San Luis Obispo, CA 93407
[4] Ball Aerospace, Boulder, CO 80301, USA
[5] Missoula Fire Sciences Laboratory, Rocky Mountain Research Station, Forest Service, United States Department of Agriculture, Fort Collins, CO 80526
[6] California State University Los Angeles, Los Angeles, CA 90032

Here we present PyFDEO - a new Python tool for predicting fire danger from Earth observations. PyFDEO generates a forecasted fire danger map from automatic model feeding and prediction using near-real-time data. It is intended to help firefighters plan and optimize resource allocation across the Conterminous United States (CONUS).

The tool collects available remotely-sensed data on Vapor Pressure Deficit (VPD) from the Atmospheric Infrared Sounder (AIRS) (**A**), Surface Soil Moisture (SSM) from the Gravity Recovery and Climate Experiment (GRACE) (**B**), and Enhanced Vegetation Index (EVI) (**C**) from the Moderate Resolution Imaging Spectroradiometer (MODIS) to feed probabilistic models.
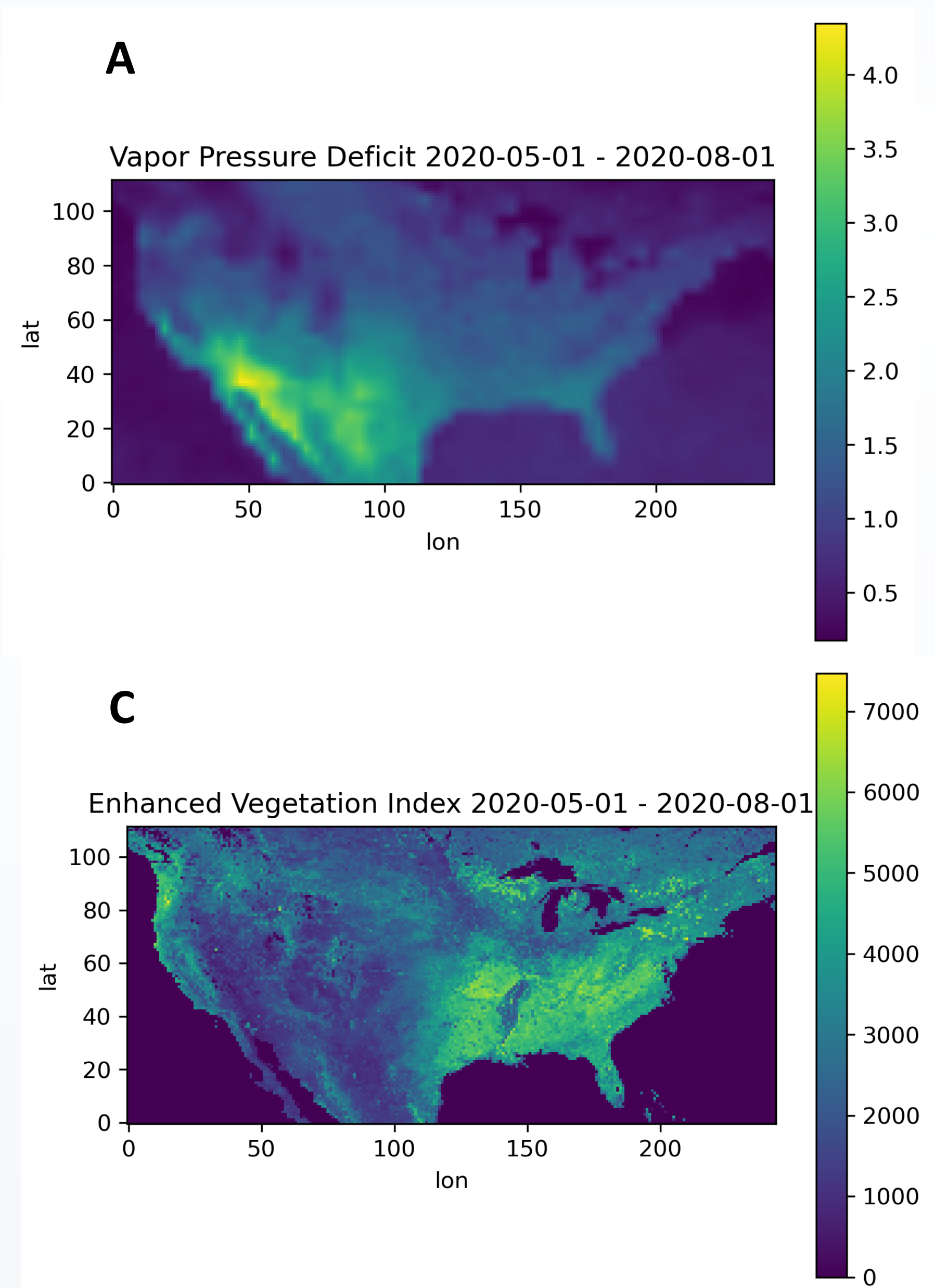
Models are land cover-specific and were developed for Deciduous Forests, Evergreen Forests, Shrublands, Herbaceous, and Wetlands using a 2003-2013 time series. They were trained and validated with the National Fire Program Analysis Fire-Occurrence Database (FPA FOD, Short et al. (2021)). The models predict spatial patterns of fire danger with up to 75% overall accuracy during the fire season (Farahmand et al. (2020).

The output of our tool is a CONUS-wide, 0.25-degree gridded cell map of two-to-three-month forecasted fire danger, i.e. whether it is expected to be below normal, normal, or above normal. This open-source tool can also be adapted for use in other countries and may help society respond to increasing wildfires under climate change.

You can find the PyFDEO tool at the Earth Lab GitHub at the following link:
https://github.com/earthlab/fdeo

References

Farahmand, A., Stavros, E. N., Reager, J. T., & Behrangi, A. (2020). Introducing spatially distributed fire danger from earth observations (FDEO) using satellite-based data in the contiguous United States. Remote Sensing, 12(8), 1252.
Short, Karen C. (2021). Spatial wildfire occurrence data for the United States, 1992-2018 [FPA_FOD_20210617]. 5th Edition. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2013-0009.5