



CALIFORNIA STATE SCIENCE FAIR 2016 PROJECT SUMMARY

Name(s) Albert J. Zhai	Project Number S1112
Project Title A Web-based Global Plant Productivity Information System	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objectives of this project are to: Deliver near-real-time global plant productivity information from NASA's OCO-2 satellite to average farmers and researchers. Assist farmers in spotting early signs of plant stress and improving agricultural efficiency. Improve understanding of plant productivity responses to weather and climate variabilities.</p> <p>Methods/Materials Solar-induced-fluorescence (SIF) is the near-infrared light re-emitted by plants during the process of photosynthesis. It has been found to represent the total productivity of a plant more accurately than the commonly used measure of the amount of chlorophyll present. The NASA OCO-2 satellite mission, launched in July 2014, provides global CO₂ and SIF measurements. However, the SIF measurements are not easily accessible to ordinary people and their interpretation requires prior knowledge. I wrote Python scripts to process 18 months of OCO-2 SIF data from September 2014 to February 2016 into gridded arrays. Then, I assembled them into a web-based data portal that I built myself via Python (for the handling routine) and JavaScript (for the user interface). A virtual globe was implemented to allow users to conveniently obtain the SIF values on any date and at any location on the Earth. In addition, the abnormality of SIF compared to historical means and its temporal variation are also displayed in the webpage.</p> <p>Results The data portal I created enables ordinary people to efficiently examine plant productivity trends around the world. Using my portal, I found that there are large plant activity differences between an El Niño year and a normal year in multiple areas. Also, they match the precipitation responses to the El Niño in those areas.</p> <p>Conclusions/Discussion This web-based GPPIS is useful for informing farmers about crop health, guiding water and nutrient use, improving regional farming practice and enhancing agricultural productivity. In addition, it is useful for scientists to understand the factors that influence global plant productivity. It is a direct application of NASA satellite data and has immediate benefits for drought monitor and water resource management.</p>	
Summary Statement I built a web-based data service to allow general users to monitor plant productivity all around the globe.	
Help Received Professor Christian Frankenberg clarified some questions I had about the raw satellite data. JPL scientist Quoc Vu introduced me to the JavaScript package I implemented for the globe interface.	