Awards and Recognition

Award for Cluster Integrity, Exception Resolution, and Reclustering Algorithm: Michael Peterson, a former CISESS researcher who now works at the Los Alamos National Lab, won the Gold at the R&D 100 Conference in the Special Recognition category for its Cluster Integrity, Exception Resolution, and Reclustering Algorithm (CIERRA). This algorithm was designed to provide the most comprehensive and accurate understanding of light data. The algorithm:

- Analyzes massive amounts of satellite-collected lightning data (including GOES-R GLM data);
- Provides accurate interpretation of dangerous lightning events;
- Creates visualizations to interpret storms and predict weather hazards;
- Posts notifications and visualizations in minutes; and
- Searches and documents extreme lightning megaflashes (including two record-breaking events recently confirmed by WMO).

This was a collaborative effort with CISESS at the University of Maryland. The R&D 100 Awards, established in 1963, recognizes new commercial products, technologies and materials from across the globe for their technological significance. PubMed gives users easy access to these lightning visualizations in three recent articles: https://pubmed.ncbi.nlm.nih.gov/32355365/. Twitter feed: https://twitter.com/RD100Awards/status/1311033514314346500.

(POC: Daile Zhang, dlzhang@umd.edu, Funding: Los Alamos Labs, GOES-R AWG & GOES-R PGRR)
Chengquan Huang wins Provost Award: Research Professor Chengquan Huang has been selected to receive a University of Maryland Provost's Excellence Award for Professional Track Faculty for the quality of his research with the Department of Geographical Sciences. That research includes a CISESS Task on S-NPP and JPSS Surface Type Environmental Data Records Algorithm and Product Development. These products are retrieved from the Visible/Infrared Imager Radiometer Suite (VIIRS). He works with Xiwu Zhan’s group at STAR/SMCD/EMB. The formal award ceremony will be held on October 19th.

(POC: Chengquan Huang, cqhuang@umd.edu, Funding: JSTAR)

Publications

Deep Learning Refines Aerosol Satellite Retrievals: CISESS Graduate Student Tianning Su and his advisor, Prof. Zhanqing Li, have collaborated with STAR scientists Istvan Lazlo and Satya Kalluri for the last two years on the innovative use of “Deep Learning,” an artificial intelligence method that goes beyond machine learning. For the past two decades, quantitative retrievals of aerosol optical depth (AOD) have been made from both geostationary and polar-orbiting satellites. Despite the progress made in improving the accuracy of AOD retrievals, there are still major challenges, especially over land. A notable one for the so-called Dark-Target (DT) algorithms is building the surface reflectance (SR) relationships (SRR) to derive SR in the visible channels from SR in the short-wave infrared (SWIR) channel, mainly because these relationships are strongly subjected to entangled factors (e.g., viewing geometry, surface type, and vegetation state).

In their newly published article, Su et al. (2020) examine the benefits of a new method for deriving the SRR using deep learning techniques. The SRR constructed by the deep neural network (DNN) considers multiple related inputs, such as the SWIR normalized difference vegetation index ($NDVI_{SWIR}$), viewing geometry, and seasonality, among others. The DNN-constrained SRR is then incorporated into a DT algorithm to retrieve AOD from Himawari-8. The revised DT algorithm with the deep learning technique (DTDL) demonstrates improved performance over the study region, as attested by significantly reduced random noise, especially for low $NDVI_{SWIR}$ and high surface albedo cases (Fig. 1). Robust independent tests indicate that this algorithm can be applied to untrained regions, not only to those used in training. The method directly benefits the algorithm development for Himawari-8 and can also be adopted for other geostationary or polar-orbiting satellites. It also illustrates how artificial intelligence could significantly improve AOD retrievals from multi-spectral satellite observations.
Figure 1. Absolute biases between AOD derived from ground measurements and retrieved from Himawari-8 in 2017 for different (a) $S_{R0.47}$, (b) $S_{R0.64}$, (c) $NDV_{SWIR}$, and (d) scattering angles. The original DT (red lines) and DTDL (blue lines) algorithms are used. The shaded areas indicate standard deviations. The grey bars represent the frequency of occurrence of these parameters.


(POC: Tianning Su, tianning@umd.edu, Funding: The project was sponsored by the Taipei Economic and Cultural Representative Office in the United States (TECRO) and the American Institute in Taiwan (AIT) and executed by STAR in collaboration with the Central Weather Bureau (CWB) of Taiwan through OAR.)