NASA Hydrosphere, Biosphere, and Geophysics (HBG) Services

Project Highlights

Societal Impacts

- Tracks changes to the frequency and severity of wildfires and how this impacts Arctic residents and the global community

- Documents impacts of disturbance on ecosystem services such as hunting, harvest, and other natural resources

- Leads to more complete understanding of climatic change in the Arctic and beyond

- Provides near real-time imagery of active fires

- Provides science communications that reach millions of people every year, including scientists and the general public

Significant Accomplishments

- Developed the laser detector subsystem on Global Ecosystems Dynamics Investigation (GEDI) lidar that is now operational on the International Space Station

- Developed a tree height cell phone app that now has photos of >92,000 trees from almost 30,000 sites in 127 countries

- Implemented data services, database nodes, and high-speed and high-capacity storage in the cloud for the ASC

- Received NASA Hydrospheric, Biospheric, and Geophysics Laboratory Award for Excellence in ICESat-2 Mission Outreach

- Received Federal Government Distant Learning Association (FGDLA) Innovation Award

- Received the NASA Agency Group Achievement Award from 2018 for the ABoVE Airborne Science Campaign Team

GST Support for NASA HBG

GST supports multiple projects under the auspices of the HBG contract, including the Arctic-Boreal Vulnerability Experiment (ABoVE), the ABoVE Science Cloud (ASC), the Global Learning and Observation to Benefit the Environment (GLOBE), the Fire Information for Resource Management System (FIRMS), MODIS Adaptive Processing System (MODAPS), and Global Ecosystems Dynamics Investigation (GEDI).

ABoVE: GST provides science support for the ABoVE project, a large-scale NASA-led study of environmental change in Arctic and boreal regions investigating the implications for ecological systems and society. This project is leading to a greater understanding of ecosystem vulnerability and resilience to environmental change through integrating field-based studies, modeling, and data from airborne and satellite remote sensing. GST coordinated the collection of airborne data using radar, lidar, and hyperspectral instruments, which was then integrated with satellite and ground data to capture new insights. GST assists ABoVE investigators to order high-resolution satellite imagery. GST also assists with downloading and analyzing imagery in support of site selection and fieldwork preparation, including orthorectifying and georeferencing imagery.

ASC: GST led the implementation of the ABoVE Science Cloud (ASC) data services, database nodes, and high-speed and high-capacity storage. Data services nodes are used for persistent services and can support virtual systems (either virtual machines or containers) to create web services. Database nodes are used for high-performance, highly available database requirements. High-speed and high-capacity storage are configured for use for a variety of purposes, including redundant, snapshotted home directories for code development, scratch space for scientific processing, and large data storage repositories, including more than 3.5 petabytes of shared data.

GLOBE: GST helped lead the development and implementation of the NASA GLOBE Observer App's Trees Tool for measuring tree height by citizen scientists. The NASA GLOBE Program collects input from citizen scientists and student/teacher programs worldwide. Cell phones are now measuring tree height through this GLOBE effort. This has resulted in geolocated data, including tree height data and photographs of 85,000+ individual trees worldwide in 126 countries, to serve as ground-truth data for the NASA ICESat-2 Satellite and the GEDI Instrument (on ISS).

FIRMS: GST partnered with the U.S. Forest Service to develop FIRMS, a web application that provides up-to-date fire information based on satellite data from MODIS, VIIRS, and GOES satellites. During fire season we have recorded over 2 million website hits per day as users at all levels check the status of their neighborhoods, houses, and forest resources. We have followers worldwide, including individual citizens as well as foreign government agencies; we solicit their feedback and work with them to provide the features they need.

MODAPS: GST employees support a variety of efforts in the MODAPS task, including work on data operations and calibrations for MODIS, VIIRS, and other land and atmosphere imaging sensors, and support of near-real-time data delivery. GST personnel perform data operations for Earth-orbiting imager, calibration, image geo-location, data product archiving and delivery; website development; education, public outreach, and communication of Earth science projects, missions, high-end computing applications; and electrical, computer, systems, and software engineering in support of spacecraft instrument development and spacecraft operation.

GEDI: GST personnel led the development of the laser detector subsystem on the Global Ecosystems Dynamics Investigation (GEDI) lidar (light detection and ranging) that is operational on the International Space Station (ISS). The three GEDI laser pulse transmitters work together with a 0.8-meter telescope, six silicon avalanche photodiode detectors, star trackers, and GPS receivers to perform laser pulse waveform analysis. This samples the height and understory structure of trees to obtain a global sample of above-ground carbon from the ISS.

Outreach and Communications: We deliver NASA science to the world face-to-face and virtually at more than two dozen public events and science conferences annually. We spearheaded NASA's Earth Day celebration at Washington, DC's Union Station for many years and have played leading roles in the USA Science & Engineering Festival, the celebration of Apollo's 50th anniversary on the National Mall, and numerous NASA satellite launches. We coordinate NASA exhibits at conferences and partner with other Federal agencies on the U.S. presence at international meetings. A frequent in-person exhibit centerpiece is the NASA Hyperwall, running on software developed by our staff and featuring content from across NASA and presented by scientists, engineers, and outreach personnel to enthusiastic audiences.

Other Projects: GST provides software support for the MAVEN testbed at GSFC and for LANDSAT-9 sensor Ground Support Equipment and supports the MODAPS, MODIS, and VIIRS software development, product generation, data distribution, data archiving, and near real time data delivery. GST provides electrical, computer, systems and software engineering support of spacecraft instrument development and spacecraft operation.

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