**NASA DEVELOP National Program**

Langley Research Center

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**CALIPSO Health and Air Quality**

Creating tool to help identify Smoke Plumes Observed with CALIPSO and LANDSAT to Improve Future Research and Decision-making

**Project Team:**

Jordan Vaa (Project Lead), jordan.s.vaa@nasa.gov

Ashna Aggarwal

Courtney Duquette

**Advisors & Mentors:**

Dr. Kenton Ross (National Science Advisor)

**Partner Organizations**

NASA CALIPSO Science Team, Partner POC: Dr. Charles Trepte and Dr. Amber Soja

**Applied Sciences National Applications Addressed:**

Health and Air Quality

**Study Area:** Global

**Study Period:** May 2006 - Current

**Earth Observations & Parameters**

CALIPSO, CALIOP - Vertical Profile of Aerosols

Terra, MISR - Thermal Anomalies

S-NPP, VIIRS - Fire Detections

**Objectives Overview**

This project is focused on the development of a tool based off an existing IDL code that will allow researchers working with Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) to analyze clouds and other aerosols. The tool will allow researchers to identify, outline, and categorize a suspected object. Then, the object will be catalogued into a dataset with a querying ability based on location, time, vertical features, classification, and more. Next, this information will be exported into an accessible database. With an organized method of storing specific aerosol objects, future analysis by the CALIPSO science team and other research groups will be more efficient.

**Abstract**

The CALIPSO mission has been providing researchers with information about the global distribution of aerosols and clouds since 2006. Aboard the CALIPSO satellite is the CALIOP lidar, which sends laser pulses of 532 nm and 1064 nm into the Earth’s atmosphere. By measuring backscatter, researchers are able to map the distribution of aerosols (such as pollutants, dust, and smoke) and clouds. However, it remains difficult to track specific objects as they progress through the environment. To solve this issue, the Langley DEVELOP team created a tool that will allow researchers to identify, select, and categorize aerosol objects. The objects will then be exported to an easily accessible database. This method will allow researchers to follow key objects as they move through time and space, since some types of aerosols are more difficult to identify than others. For example, the CALIPSO science team hopes to use this tool to identify smoke plumes. Smoke, specifically, has a variety of compositions depending on the fuel used for the fire. Monitoring how these compositions change with increased residence time will help understand the impact of smoke on air quality downstream of a source fire.

**Community Concerns**

* Through the wealth of CALIPSO data, it is difficult for researchers to quickly query aerosol types based on classification

**Current Management Practices & Policies**

Currently the CALIPSO science team is using IDL to read and view CALIOP lidar data. This system does not have the functionality to select objects in the data. There is currently no centrally organized database of objects making selecting specific characteristics difficult.

**Decision Support Tools**

* Lidar Data viewing tool that will allow for the selection of aerosol smoke objects

**Benefit to End-User:**

* Simplify the data acquisition
* A means of organizing data based on identifiable characteristics of smoke and other aerosol objects

**Ancillary Datasets Utilized**

* GEOS-5 - Atmospheric data
* NASA MERRA - Atmospheric data
* NOAA Hazard Mapping System (HMS) Fire and Smoke Product - Smoke Plume detection

**Software Utilized**

IDL - existing tool to use as reference

Python - visualization of CALIPSO data

ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation of Landsat ETM+, NPP VIIRS, Aqua/Terra MODIS