**NASA DEVELOP National Program**

Langley Research Center

**Spring 2015**

**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:**

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**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 and Aqua, Moderate Resolution Imaging Spectroradiometer (MODIS)

**Objectives Overview**

This project is focused on the development of a tool translated from an existing IDL code that will allow researchers working with Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) to analyze clouds and aerosols. This tool will allow researchers to identify, outline, and categorize a suspected object. Then, the object will be exported into a database organized by criteria based on the researchers needs, such as location and aerosol type. 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 Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) mission has been providing researchers with information about the global distribution of aerosols and clouds since 2006. Aboard the CALIPSO satellite is the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP), 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, especially as some types of aerosols are more difficult to identify than others. To solve this issue, the Langley DEVELOP team created a tool that will allow researchers to identify, select, and categorize aerosol objects. The objects are then exported to an easily accessible database. This method will allow researchers to follow key objects as they move through time and space. The CALIPSO science team will use this tool to identify smoke plumes and explore their compositions. The composition of smoke plumes varies significantly depending on the fuel type. Monitoring how these compositions change with time will help researchers understand the impact of smoke on air quality downstream of a source fire.

**Community Concerns**

* Currently, the CALIPSO science team is using an outdated tool for data visualization and manipulation. This makes it very difficult to adapt and update the tool.
* Amidst 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 a tool written in the proprietary IDL language to read and view CALIOP lidar data. This system does not have the functionality to export objects to a database, nor does the proprietary nature of IDL allow for ease of updating. 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 data collaboration by providing researchers with a centralized data repository
* By translating the tool over from IDL into Python, it will allow for greater adaptability and flexibility
* A means of organizing data based on identifiable characteristics of smoke and other aerosol objects

**Ancillary Datasets Utilized**

* MODIS - Map Data to enable geographic representation of CALIPSO Curtain data

**Software Utilized**

IDL - Language used to create existing tool to use as reference

Python - Language used for visualization of CALIPSO data

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