**NASA DEVELOP National Program**

**Langley Research Center**

**Spring 2015 Project Proposal**

**CALIPSO Health & Air Quality**

Identifying Smoke Plumes Observed with CALIPSO to Improve Future Research and Decision-making

**Objective:**

The objective of this project is to identify and catalogue smoke plumes observed by CALIPSO. A database will be constructed and used with an air parcel trajectory model to help improve current and future research efforts in identifying smoke plume characteristics and sources.

**Community Concern:**

Atmospheric aerosols, depending on composition, can have significant impacts on the air quality of a region. Smoke, specifically, is an aerosol that can have varying compositions based on the materials that serve as fuel for the fire. Identifying the specific compositions of aerosols in smoke plumes and monitoring how those compositions change with increased residence time is vital to understanding the impact of smoke on air quality downstream of the source fires. By creating a database of spectral signatures of smoke sampled by CALIOP, the research efforts for identifying and monitoring these aerosols will be greatly enhanced.

**End-Users/Partners/Boundary Organizations:**

CALIPSO Science Team (POC: Dr. Charles Trepte and Dr. Amber Soja)

Through on-going communication with the CALIPSO Science Team at Langley Research Center, this DEVELOP project will seek to identify smoke layers observed by CALIOP on board CALIPSO. Identifying and developing a database of spectral signatures for smoke will enhance the research efforts of the CALIPSO Science Team and numerous other research organizations.

**Letters of Support:** Organization, Author, Affiliation (copies of *any letters to be attached at the end of the proposal*). Drop this section if no letter(s) of support are available upon final submission of proposal to NPO.

**Decision Making Process:**

Currently, aerosol transport is often modeled using Chemical Transport Models that generate smoke plumes from MODIS/VIIRS fire hot spots, however the height to which these plumes are injected has not been validated. A team of researchers at LaRC is identifying where satellite paths cross the smoke plumes to categorize the sampling as “smoke.” Smoke plumes are also increasingly difficult to identify as they travel further away from the source, therefore building a database of typical smoke samples will aide researchers in differentiating between smoke and clouds. Creating a website that allows for the public to help identify these smoke samples through crowdsourcing techniques offers a sustainable methodology for updating the database as new observations are taken.

**Earth Observations:**

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| --- | --- | --- |
| **Platform** | **Sensor** | **Geophysical Parameter** |
| **CALIPSO** | CALIOP | Vertical Profile of Aerosols |
| **Terra** | MISR | Thermal Anomalies |
| **S-NPP** | VIIRS | Fire Detections |
| **Multiple** | Multiple | NOAA Hazard Mapping System smoke plumes |

**NASA Earth Observations to be Highlighted:**

The CALIPSO satellite mission provides measurements of aerosol and cloud profiles worldwide. Since its launch in 2006, the mission has acquired a rich and diverse data set which can be used to identify different aerosol types. With the launch of the CATS LIDAR in the near future, the same methodologies can be used with the new data set to make it ready for use with real-time data. The MISR instrument on board Terra is commonly used to identify smoke plumes, however is only available in the morning hours and requires distinct boundaries, so large plumes are often unobserved.

**Ancillary Datasets:**

GEOS-5 – Atmospheric data

NASA MERRA – Atmospheric data

NOAA Hazard Mapping System (HMS) Fire and Smoke Product – Smoke Plume detection (MODIS as one data source)

**Software & Scripting Utilized:**

* MATLAB- visualization of CALIPSO data
* ArcGIS- map creation, data analysis, smoke plume identification
* Excel – Database creation

**Decision Support & Analyses:**

|  |  |  |
| --- | --- | --- |
| **Proposed End Products** | **Decision Impacting** | **Current Partner Tool/Method** |
| Database of smoke layers | Identification of smoke aerosol compositions and injection heights | Atmospheric transport models for Air Quality and Climate |

*Database of smoke layers* – with the identification of fresh and aged smoke from a variety of ecosystems using CALIPSO, a database of known smoke layers will be created

**Project Details:**

**National Application Area(s) Addressed:** Health & Air Quality

**Source of Project Idea:** This project idea was proposed by Dr. Amber Soja and Dr. Charles Trepte. The project will help the CALIPSO science team in future research and in preparation for the CATS LIDAR

**Advisor(s):** Dr. Charles Trepte, CALIPSO Science Team

Dr. Amber Soja, Acting with the CALIPSO Science Team

Dr. Kenton Ross, NASA DEVELOP National Program

**# of Participants Requested:** 4

**Project Timeline:** 2 terms: Spring 2015, Summer 2015

**Study Location:** United States

**Period being Studied:** TBD

**Previous Related DEVELOP Work:**

None

**Multi-Term Objectives:**

* **Term 1 (Proposed Term)** – Identify and catalogue smoke layers observed by CALIPSO. Construct a website that offers crowdsourcing for CALIOP data.
* **Term 2** – Build on the smoke layers database by adding more events