**NASA DEVELOP National Program**

**Summer 2016 Project Proposal**

**NASA Langley Research Center**

**CALIPSO Cross-Cutting IV**

Interacting with CALIPSO data through a Graphical User Interface

**Project Overview**

***Objective:*** Continue to develop a tool that offers an easy-to-use Graphical User Interface (GUI) allowing users to visualize CALIPSO data, draw 'shapes' around target areas, and label these shapes with attributes and notes, which can be exported to a back-end database that serves as a centralized point for researchers to share data as well as a means to track and identify aerosols in the atmosphere.

***Community Concern:*** The Cloud-Aerosol LiDAR and Infrared Pathfinder Satellite Observation (CALIPSO) satellite is a NASA Earth observation that analyzes aerosol particles suspended in Earth’s atmosphere. Researchers use visualized CALIPSO data to track the global distribution, dispersion, and source of aerosols. However, the standard visualization tool for displaying CALIPSO data, written in the proprietary language Interactive Data Language (IDL), did not support requested features for tracking aerosols such as selecting areas of data and sharing those selected sections. This makes tracking specific airborne objects difficult for researchers.

Through the current term, DEVELOP teams have been building an improved replacement for this software, called *Visualization of CALIPSO* (VOCAL) and written in the Python programming language. It supports drawing, annotating, and exporting shapes on the visualized data. There is still room for development, as enhancing the back-end, database side of the system is requested by the end-user, the CALIPSO Science Team.

***National Application Area(s) Addressed:*** Cross-Cutting, Health and Air Quality

***Study Location:*** Global

***Study Period:*** May 2006 - Present

***Advisor(s):*** Dr. Kenton Ross (NASA DEVELOP National Program), Grant Mercer (University of Nevada, Las Vegas)

***Source of Project Idea:*** This project emerged through ongoing communication with the CALIPSO Science Team at Langley Research Center.

**Partner Overview**

***Partner Organization(s):***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| CALIPSO Science Team | Dr. Charles Trepte, Dr. Amber Soja | End-Users | No |

***End-User Overview***

***End-User’s Current Decision Making Process:***

The tool currently used to visualize CALIPSO data is written in IDL, a proprietary language that lacks many features and hinders open source updates. Currently, the tool lacks any means to share results between researchers electronically. Any kind of collaboration between Earth scientists needs to be done in person.

***End-User’s NASA Earth Observations Capacity:***

CALIPSO Science Team – Very experienced with NASA Earth observations but currently do not have an effective way to analyze their data. This tool serves to build the CALIPSO Science Team’s capacity to share and interpret the curtain plots produced by the satellite.

***Project Communication & Transition Overview***

***In-Term Communication Plan:***

The team will have in-person meetings and telecons with the CALIPSO Science Team as necessary to identify short and long-term objectives.

***Transition Approach:***

A beta-version of the tool is already being used and tested by a few members of the CALIPSO science team. Since the team is at LaRC, no software release is required for them to do so. As new features are added to the software during the proposed term, the DEVELOP project team will re-release the software to the CALIPSO team as soon as is possible, to continue the feedback loop and prioritize further enhancements. The software is currently undergoing open-source software release classification.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| **CALIPSO** | CALIOP | This sensor captures a vertical profile of the atmosphere, capturing an image of aerosols. |

**Decision Support Tool & End-Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product(s)** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| *Visualization of CALIPSO (VOCAL)* | The CALIPSO Science Team will use this software as a replacement for their current visualizer to track aerosols by identifying, annotating, and exporting regions of aerosols, for collaborative purposes. | CALIOP, on the CALIPSO satellite, uses LiDAR to capture a wavelength-based cross-section of the atmosphere, thus highlighting regions of aerosols. | 4-5 |

***End-User Benefit:***

VOCAL will facilitate collaboration among researchers, and be generally easier to use than their current standard. The end-users specifically requested the identification, annotation, and exporting capabilities of the software, which have now been incorporated. Once greater flexibility has been added to the database manager, the end-users will be able to share the data at a more detailed level. Additionally, if there is time, OPeNDAP integration will be incorporated into the software, thus making data acquisition more efficient in terms of both time and storage cost.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 4 Terms: Spring 2015 (Start) to Summer 2016 (Possible completion)

***Multi-Term Objectives:***

* **Term 1:** Spring 2015 (LaRC) – CALIPSO Health & Air Quality
  + Create initial GUI
* **Term 2:** Summer 2015 (LaRC) – CALIPSO Cross-Cutting II
  + Enhance shape-drawing capabilities
  + Build database manager for storing shape attributes
* **Term 3:** Spring 2016 (LaRC) – CALIPSO Cross-Cutting III
  + Improve sanity-checking within software
  + Enhance error-logging
* **Term 4 (Proposed Term):** Summer 2016 (LaRC) – CALIPSO Cross-Cutting IV
  + Extend database flexibility for more detailed aerosol classification
  + Integrate OPeNDAP service

**Project Needs/Requests**

***Participants Requested:*** 4

***Software & Scripting:***

Sphinx 1.3.1 – Links to source code and doc page files to documentation website

Matplotlib 1.4.3 – Library for rendering visualized data to a plot

Python 2.7 – Core development language of the software

SQLAlchemy – Python toolkit for database development

**Notes & References:**

***Notes:*** As this is an atypical DEVELOP project and is more a software engineering project, special consideration should be given to the fact that a fourth term is requested.

***References:***

VOCAL documentation website: <http://syntaf.github.io/vocal/>