**NASA DEVELOP National Program**

**2017 Summer Project Proposal**

**NASA Langley Research Center**

**CALIPSO Cross-Cutting**

*Enhancing the Usability of the* Visualization of CALIPSO *(VOCAL) Tool*

**Project Overview**

***Project Synopsis*:** Over multiple terms, CALIPSO Cross-Cutting project teams have built an interactive visualizer for CALIPSO data named *Visualization of CALIPSO (VOCAL)*. Further enhancements to the software will expand on its interactive and collaborative qualities. Currently, the user interface limits the way in which users can highlight a region of the CALIPSO data curtain (either with a rectangular selection box or a vertex-based pen). The end-user has voiced that a more natural, “magic wand” selection tool like those found in image editing programs would be more intuitive. Furthermore, the software should better incorporate multiple levels of CALIPSO data, allowing user-drawn shapes to propagate through levels for direct inter-product comparisons. Lastly, data input and output are currently very static processes; making these processes more flexible would free the user to customize their analysis.

***Community Concern:*** The Cloud-Aerosol LiDAR and Infrared Pathfinder Satellite Observation (CALIPSO) satellite is a NASA Earth observation that actively senses aerosol particles suspended in Earth’s atmosphere. Researchers use visualized CALIPSO data to track the global and vertical distribution, dispersion, and source of aerosols. However, the standard visualization tool for displaying CALIPSO data, written in the proprietary language Interactive Data Language (IDL), does 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 built an improved replacement for this software, called *Visualization of CALIPSO* (VOCAL), 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.

***Source of Project Idea:*** The end-user has expressed satisfaction with the current state of the VOCAL software but would like to see it continue to evolve as a means of validating automated processes for aerosol and cloud identification. This includes improvements to the user interface as well as to back-end design.

***National Application Areas Addressed:*** Cross-Cutting, Health & Air Quality

***Study Location:*** Global

***Study Period:*** May 2006 – June 2017

***Advisors:*** Dr. Katie Moore (NASA Langley Research Center), Dr. Kenton Ross (NASA Langley Research Center), and Grant Mercer (University of Nevada, Las Vegas)

**Partner Overview**

***Partner Organizations:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| NASA CALIPSO Science Team | Dr. Charles (Chip) Trepte, CALIPSO Project Scientist | End-User | No |

***End-User Overview***

***End-User’s Current Decision-Making Process:***The CALIPSO Science Team currently uses a tool to visualize CALIPSO data that is written in IDL, a proprietary language that has only a few features and is difficult to update. Additionally, the program does not allow for sharing results among researchers electronically, which inhibits collaboration beyond in-person meetings. The end-user, a member of this team, requested the aforementioned software and is overseeing its beta-testing. Before it is adopted by the group at-large, more improvements need to be made to the software.

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

*NASA CALIPSO Science Team* – The CALIPSO Science Team is very experienced with NASA Earth observations, but their current visualization tool is ineffective at analyzing data. This project increases the team’s capacity to use NASA Earth observations by allowing for collaboration and more efficient analysis of CALIPSO data.

***Project Communication & Transition Overview***

***In-Term Communication Plan*:** The team will have in-person meetings with the CALIPSO Science Team as necessary to discuss updates to the visualization software.

***Transition Plan*:** A beta version of the visualization tool is already being used and tested by the CALIPSO Science Team. Since the end-users are at Langley Research Center, no software release is required for the beta version to be shared. As new features are added, the DEVELOP team will re-release the software to the CALIPSO Science Team as soon as possible in order to continue the feedback loop and prioritize further enhancements. The software has completed open-source software release classification, and will soon be uploaded to DEVELOP’s GitHub page for distribution.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameters** | **Use** |
| CALIPSO | CALIOP | Captures a vertical profile of the atmosphere, capturing an image of aerosols. |

***Software & Scripting:***

Python – editing script

**Decision Support Tool & End Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Product** | **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 visualization tool. This will enable them to track aerosols by identifying, annotating, and exporting region of interest for collaborative purposes. | This project will be utilizing CALIPSO data from CALIOP; however, no analyses will be conducted on the data beyond any use-cases requested by the end-users as a means of testing software functionality. | IV-V |

***End-User Benefit*:** The enhancements described above, such as the greater variety of selection tools, will save the user frustration and time in the process of manually identifying aerosols for the purposes of these validations. Enabling dynamic downloading of CALIPSO data through the OPeNDAP protocol would save time and storage space, as data could be subset prior to downloading. Finally, ease of collaboration will be improved through a more flexible scheme for data output, decentralizing the location of the shape database of drawn polygons.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 5 Terms: 2015 Spring (Start) to 2017 Summer (Completion)

***Multi-Term Objectives:***

* **Previous Terms:**
  + Previous terms of this project have focused on first creating an initial GUI, and then improving upon features and functionality through subsequent iterations of the project. The enhancements requested from the first term of the project included: shape-drawing capabilities, creating a database manager for storing shape attributes, improving sanity-checking within software, enhancing error-logging, and adding more verbose axis information. Additional functionality was introduced to the software in order to ensure software compatibility with Version 4 data products, and support for multi-level data product display.
* **Summer 2017 Term (Proposed Term):** 2017 Summer (LaRC) – CALIPSO Cross-Cutting
  + The proposed term of this project would focus on improving selection tools, extending flexibility of input and output means, and finalizing incorporation of multi-level data products.

**Notes & References:**

***References:***

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