**NASA DEVELOP National Program**

**** NASA Ames Research Center

**Fall 2015**

**Short Title: Lake Tahoe Water Resources**

**Subtitle:** Creating a Global Continuous Detection Lake Level Monitoring Algorithm using Landsat Imagery.

**VPS Title:** Prepare for the Future! Measuring Lakes from Space

**Project Team & Partners**

**Project Team:**

Nolan Cate (Project Lead), Nolan.R.Cate@NASA.gov

Anton Surunis

Chelsea Ackroyd

**Advisors & Mentors:**

Brian Coltin (NASA Ames Research Center)

Dr. Juan Torres-Perez (Bay Area Environmental Research Institute)

**Partner Organizations:**

USDA Forest Service, Lake Tahoe Basin Management Unit, End-User, POC: Joey Keely

**Project Details**

**Applied Sciences National Applications Addressed:** Water Resources

**Study Area:** Lake Tahoe Basin, CA/NV

**Study Period:** April 1984 - present

**Earth Observations & Parameters:**

Landsat 5, Thematic Mapper (TM) – Land cover

Landsat 8, Operational Land Imager (OLI) – Land cover

**Ancillary Datasets Utilized:**

* WWF Global Lakes and Wetlands Database (GLWD) - global lakes and reservoirs (levels 1 and 2)

**Software Utilized:**

Google Earth Engine - Landsat image classification

ArcGIS - raster and vector manipulation/analysis

ENVI - raster and vector manipulation/analysis

**Project Overview**

**80-100 Word Objectives Overview:**

As climate change becomes a growing concern across the globe, it is becoming increasingly important to get fast and accurate reports on available water resources. The lake level monitoring algorithm from this project aims to provide near real-time water level monitoring of not only Lake Tahoe, but any terrestrial water body around the globe, to better inform hydrologists and water managers.

**Abstract:**

As global climate change continues to escalate and droughts become more frequent and severe, it becomes increasingly necessary to monitor available water resources. Lake Tahoe (CA/NV) is an important reservoir particularly in the tourism industry. With nearly 5 million visitors contributing over $300 million to the local economy annually, Lake Tahoe is one of northern California’s most popular attractions for recreation and outdoor activities. The decreasing water levels, therefore, are a concern for both residents and the economy. Current methods for monitoring lake levels, however, are often based on gauges that require time-intensive field work to record data. This project provides a continuous detection lake level monitoring algorithm based on Landsat imagery and a Modified Normalized Difference Water Index (MNDWI), coupled with radar altimetry. The algorithm allows managers in the USDA Forest Service Lake Tahoe Basin Management Unit to monitor the lake level in near real-time. The final objective is to produce a lake level monitoring algorithm that measures Lake Tahoe, as well as lakes and reservoirs throughout the world via Google Earth Engine.

**Community Concerns:**

* In early 2015, Governor Jerry Brown declared a State of Emergency regarding California’s severe drought.
* Lake Tahoe’s low water levels may have negative impacts on local endangered species, including yellow cress.
* Lake levels are of particular economic importance as Lake Tahoe is a major source of revenue, and attracts nearly 5 million tourists annually.

**Current Management Practices & Policies**:

Currently, the Lake Tahoe Basin Management Unit (LTBMU) team does not have a formal method for monitoring the water level of Lake Tahoe nor its surrounding lakes. Both USGS and the UC Davis Tahoe Research Group have *in situ* data for specific locations throughout Lake Tahoe, but the current methods have yet to assess the lake as a whole. Likewise, relatively small water bodies near Lake Tahoe, including Fallen Leaf Lake, do not have a precise system for measuring water level.

**Decision Support Tools & Benefits:**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Lake level monitoring algorithm for Lake Tahoe and surrounding lakes. | Landsat 5 TM - Land cover  Landsat 8, OLI – Land cover | Will provide a quick and easy-to-use method for monitoring lake levels without the use of costly equipment and time-consuming fieldwork. |
| Google Earth Engine Tutorial | N/A | The end-user will have a clear understanding of how to install Google Earth Engine to Windows and instructions on how to use the algorithm |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)

**Software Release Requirements**

Category V:

The algorithm being developed is run through Google Earth Engine, which is free and open to developers. No imagery will need to be downloaded. Additionally the algorithm will likely be included in Dr. Brian Coltin’s Crisis Mapping Toolkit which has already passed software release. This project will not require any software release.