**NASA DEVELOP National Program**

****NASA Jet Propulsion Laboratory

**Fall 2015**

**Short Title: Los Angeles Oceans**

**Subtitle:** Using Remotely Sensed Observations to Detect Wastewater Plumes and Assess Their Impact on Public Water Quality in Los Angeles County, California

**VPS Title:** TBD

**Project Team & Partners**

**Project Team:**

Rebecca Trinh (Project Lead), Rebecca.Trinh@jpl.nasa.gov

Lindsay Almaleh

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**Advisors & Mentors:**

Benjamin Holt (Oceans-Ice Group, NASA Jet Propulsion Laboratory)

Michelle Gierach (Oceans-Ice Group, NASA Jet Propulsion Laboratory)

**Past or Other Contributors:**

Christine Rains

Jack Pan

**Partner Organizations:**

City of Los Angeles Hyperion Treatment Plant (End-User POC: Curtis Cash, Water Biologist III, Ashley Booth, Water Biologist I, and Mas Dojiri: Division Manager, Environmental Monitoring Division)

**Project Details**

**Applied Sciences National Applications Addressed:** Oceans

**Study Area:** Santa Monica Bay, CA

**Study Period:** September - October 2015

**Earth Observations & Parameters:**

Sentinel-1, ALOS-2: Surface roughness, slick detection

Aqua-MODIS: SST, Chl-a, water leaving radiance

Terra-ASTER: Sea surface temperature (SST)

Landsat-8, OLI: SST, surface roughness from sun-glint

**Ancillary Datasets Utilized:**

* NASA Ocean Color Data (MODISA/L1)
* JAXA - Japan Aerospace Exploration Agency (ALOS’s PALSAR)
* USGS EarthExplorer (Lansat-8, ASTER)
* ESA (Sentinel-1)

**Models Utilized:**

* NASA Ocean Color Web (MODIS AQUA DAY)
* NASA HiTide podaac (MODISA SST)
* NASA Worldview (cloud cover)

**Software Utilized:**

ArcGIS - raster manipulation/analysis, image enhancement & map creation of Landsat-8, ASTER, MODIS, and ALOS

SeaDAS- data processing and manipulation of MODIS data

SNAP- Sentinel Applications Platform used in the processing of Sentinel-1 & ALOS-2 SAR data

ENVI – ASTER and Landsat-8 processing

**Project Overview**

**80-100 Word Objectives Overview:**

Sewage treatment plants must periodically undergo facility maintenance or upgrades to their current infrastructure of outfall pipes that routinely carry treated wastewater into deep, offshore coastal waters. During this maintenance, the outflow is typically diverted to a shorter outfall pipe releasing effluent into shallow coastal waters. By combining NASA Earth Observations and in situ readings taken during the outflow event at the Hyperion treatment plant of the city of Los Angeles, we can determined whether the expelled effluent is negatively impacting the local plant and wildlife or washing ashore to potentially contaminate beach goers.

**Abstract:**

The Hyperion Treatment Plant (HTP) is one of the largest wastewater treatment plants in the western United States. Treated sewage is generally released at depths of approximately 60 m through 5-mile (8.05 km) outfall pipes into the coastal waters of Southern California in the Santa Monica Bay. In times of repair and maintenance services on the main outfall pipe are temporarily suspended and require the plant to divert treated sewage to a shorter pipe 1-mile (1.6km) that extends into shallow coastal zones. These shallow zones make it possible for the buoyant freshwater plumes to reach the surface and cause harm to the local environment. This study highlights our participation in providing concurrent satellite data analysis of thermal signature, surface movement, and ecosystem response to the planned September-October 2015 wastewater diversion undertaken at the Hyperion Treatment Plant. We combine remotely-sensed observations with GPS-equipped drogued surface drifters and in-situ readings of temperature, salinity, dissolved oxygen, pH, conductivity, transmissivity, CDOM and chlorophyll-a florescence to accurately assess the full impact and extent at which these effluent plumes affect the LA Basin.

**Community Concerns:**

* Treated wastewater is diverted to shorter outfall pipes that may only extend into shallow coastal zones, where buoyant, freshwater plumes containing possible containments may reach the surface and potentially the coastline.
* Contaminants can be harmful to humans who come in contact with the wastewater
* Excessive nutrients near the surface may also cause harmful algal blooms that are toxic to many sea creatures with the ability to also cause health problems to humans
* Etc.

**Current Management Practices & Policies**:

The Hyperion Treatment Plant is administered by the city of Los Angeles and primarily receives funding to conduct research operations through them. However, conducting in situ operations are very costly and Hyperion officials typically look for outside sources to bolster their near real-time observations. By using NASA Earth Observations, combined with multiple other remote sensing instruments, our team is able to provide the Hyperion research team with multiple regional measurements of the waste water plume’s effect to ultimately create more holistic observations.

**Decision Support Tools & Benefits:**

|  |  |  |
| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Thermal Plume Detection | In situ sampling planning, impact on water quality | Impaired water quality may impact human health. Knowing where the plume location travels could lead to public notice of poor water quality along beaches |
| Water Quality and Biological Response | In situ sampling planning, impact on water quality | In situ sampling to help validate satellite data |

**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**

What category do the tools your project is creating fall within? [Category I to V]

Category I

If your decision support tools fall within Category IV, fill out this section:

**Software Title:** Insert here (ex. DEVELOP National Program Python Package)

**Software Abbreviation:** Insert here (ex. dnppy)

**Technical Point of Contact:** Insert full name, permanent email, and node here. Also include whether employed through SSAI or Wise County. (Team member who knows the most about the software.)

**Brief Description of the Software:** Insert here (ex. The dnppy package will be used to functionalize common programming tasks in the geospatial community, specifically for working with NASA data products. It will include functions for processing satellite data and assist in structuring analysis to reduce the startup time for DEVELOP teams to learn programming and create tools for end users.)

**Type of Code:** *Executable Code* and/or *Source Code* (Select one or both)

**Will the software include any embedded computer databases?** *Yes* or *No* (Select one)

**Does the software use or call any open software or libraries?** *Open Source* and/or *Proprietary/Commercial* (Select one or both)

**List the software or libraries used, under what license they were obtained, and the URL for the license in the table below:**

|  |  |  |
| --- | --- | --- |
| **Name** | **License** | **License URL** |
| Ex. Arcpy module | Ex. group license through ArcGIS | http://www.esri.com/software/arcgis |
| Ex. Python | Ex. Open source license | http://opensource.org/licenses/Python-2.0 |
|  |  |  |

**Full Software Description and Plan**

**Introduction/Objective:**

What motivated the creation of this software, what problem does it address?

**Applications and Scope:**

Where and how will this software be used to influence decisions?

**Capabilities:**

What can it do better than what was previously available?

**Interfaces:**

How is one expected to use the software? For example, command line, GUI, script execution, etc.

**Assumptions, limitations, & Errors:**

What areas that the software could be improved upon in the future? This is where limitations of the theory, model, science, etc should be briefly documented. If the tools only work for a specific scenario, say so.

**Testing:**

What validation techniques and testing strategy will be used to build confidence in the software?