**NASA DEVELOP National Program**

****Langley Research Center

**Summer 2015**

**Short Title: Alaska Disasters**

**Subtitle:** Utilizing NASA Earth Observations to Identify Oil Spills and Natural Oil Seeps off Coastal Alaska

**VPS Title:** Double, Double Oil and Trouble: Remote Sensing of Oil Spills and Natural Oil Seeps of Coastal Alaska

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Kenton Ross (DEVELOP National Program Office)

**Partner Organizations**

United States Coast Guard Auxiliary University Programs (USCG AUP), Boundary Organization,

POC: Dr. David Kellogg, Internship Coordinator

United States Coast Guard, End User, POC: MST1 Justin Hoffer, CG-MER-1

**Project Details**

**Applied Sciences National Applications Addressed:**

Disasters

**Study Area:**

Alaska (Ak), United States

**Study Period:** May 2000 - Present

**Earth Observations & Parameters**

Aqua/Terra MODIS - Land Surface Reflectance

Landsat 8 OLI/TIRS - Land Cover Analysis

Sentinel-1 - Radar Analysis

**Ancillary Datasets Utilized**

* Arctic Environmental Response Management Application (ERMA): this dataset will be used to acquire real-time and static spatial data for coastal Alaska

**Models Utilized**

* General NOAA Operational Modeling Environment (GNOME) - POC Mike Bender

**Software Utilized**

ENVI - land classification of Landsat imagery

ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation of Landsat 8 OLI/TIRS, Aqua/Terra MODIS, Sentinel-1

Python - Scripting of tool and methodology

**Project Overview**

**80-100 Word Objectives Overview**

Satellite data indicates a dramatic decrease in Arctic sea ice over the last thirty years. This decline is encouraging an increase in maritime transportation and oil exploration activity. In May 2015, the US conditionally approved a multi-year plan for offshore oil exploration in the Arctic. This surge in activity, combined with harsh environmental conditions and a lack of infrastructure, increases the risk of an oil spill. An oil spill represents a significant ecologic and economic disaster for a sensitive Arctic environment. Our project aims to assist the United States Coast Guard in detecting and monitoring oil using remote sensing techniques.

**Abstract**

NASA DEVELOP partnered with the United States Coast Guard (USCG) Auxiliary University Program to develop a methodology to rapidly detect oil spills and natural seeps off the coast of Alaska. Due to the complexity of an Arctic spill, a combination of sensors, both passive and active, must be employed to successfully detect and map oil. This project utilized NASA Earth Observations from Aqua/Terra MODIS and European Space Agency Earth Observations from Sentinel-1 to demonstrate the ability to detect oil spills and natural oil seeps. Using these two platforms, this project combined spectral and radar analysis to offer an all-source approach at detecting oil signatures.

**Community Concerns**

* Environmental impacts, especially on marine ecosystems, from oil seeps and spills are more severe in the Arctic because lower temperatures slow the rate of dissipation and dispersion of hydrocarbons.
* Arctic oil spill response operations are hindered by cold temperatures, severe environmental conditions, lack of support infrastructure, and winter darkness.
* Due to ice and snow cover, oil spills can go undetected for days, which increases the potential magnitude of an oil spill disaster.
* Oil spills shut down valuable shipping channels which can have major economic impacts for the United States and other Arctic countries.

**Current Management Practices & Policies**

Current methods for detecting oil spills in Arctic regions include satellite, airborne, surface and subsurface platforms. It is acknowledged that a mix of high-resolution spectral sensors combined with radar imagery can likely provide effective wide-area, all-weather coverage of an incident; however, a dedicated study intended to test this combination has yet to be conducted for the Arctic.

The USCG’s mission in Alaska is to serve and safeguard the public, protect the environment and its resources, and defend the Nation’s interests in the maritime region. US Federal Law requires all citizens to report an oil spill to the National Response Center. Once a spill has been reported, the USCG will investigate the location and formulate a clean-up and/or dispersal plan. A robust combination of spectral and radar imagery analysis could provide a strategic response planning tool for the USCG in the event of an Arctic spill.

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Oil Seeps Time Series | Aqua/Terra MODIS  Landsat 8 OLI/TIRS  Sentinel-1 | Exemplar series showing oil seep spread through arctic environment. |
| Oil on Ice Time Series | Aqua/Terra MODIS  Landsat 8 OLI/TIRS  Sentinel-1 | Exemplar series showing oil spread over ice in arctic environment |
| Oil Seeps Detection Tool | Aqua/Terra MODIS  Landsat 8 OLI/TIRS  Sentinel-1 | Programmatic tool automating detection of oil seeps over water in project area. |
| Oil on Ice Detection Tool | Aqua/Terra MODIS  Landsat 8 OLI  Sentinel-1 | Programmatic tool automating detection of oil over ice in project area. |

**Project Imagery**

**[Insert imagery 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)