**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 of 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)

**Study Period:** May 2000 - Present

**Earth Observations & Parameters**

Aqua/Terra, Modis - Land Surface Reflectance

Landsat 8, OLI/TIRS - Land Cover Analysis

UAVSAR- Radar Analysis

Sentinel-1- Radar Analysis

**Ancillary Datasets Utilized**

* Environmental Response Management Application (ERMA): this dataset will be used to acquire historic records of past oil seeps

**Models Utilized**

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

**Software Utilized**

ENVI - land classification of Landsat imagery

ERDAS IMAGINE - land classification of Landsat imagery

IDRISI - land classification of Landsat imagery

ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation of Landsat ETM+, NPP VIIRS, Aqua/Terra MODIS

Python - Scripting of tool and methodology

R - Scripting of tool and methodology

**Project Overview**

Coastal Alaska is home to extensive drilling efforts in the search for and the production of crude oil. In addition, the use of major shipping lanes for modern shipping practices is increasing. This surge in oil exploration and shipping traffic increases the risk of an oil spill in the area. Our project aims to help the United States Coast Guard detect and track oil spills. Oil spills have a devastating impact on both the marine environment and shipping in the area, so timely detection is key for cleanup efforts.

**Abstract**

NASA DEVELOP partnered with the United States Coast Guard Auxiliary University Programs to develop a method for the US Coast Guard to expedite detection of oil spills and natural seeps off the coast of Alaska. In May 2015, the United States Government Bureau of Ocean Energy Management conditionally approved offshore oil exploration North of Alaska. Oil spills have gone undetected for days in this region, and any oil spilled there will close valuable shipping channels. It is also important to consider the fact that oil degradation is slower in cold, marine environments. Consequently, ecologic and economic damage in the Arctic from an oil spill will persist longer. Utilizing NASA Earth Observations, NASA DEVELOP created an early detection tool for oil spills and natural oil seeps. The tool utilizes real time satellite data from a NASA Earth Observation System to search for spectral signatures indicating oil on water or ice.

**Community Concerns**

* Oil spills shut down valuable shipping channels. This can have major economic impacts for the United States and other Arctic countries. This is exacerbated by recent increases in the volume of shipping commerce in the area.
* Environmental impacts from oil seeps and spills are more severe in the Arctic because lower temperatures slow down the rate of degradation of hydrocarbons. This means the environmental effects will be long lasting in an Arctic environment compared to a more temperate climate.
* Recent oil spills can often go undetected for days, which increases the severity of the impact. Improving detection methods would be beneficial to the local marine environment through earlier response. Earlier detection of an oil spill or natural oil seep will discharge less oil than one undetected for a day. Thus, shipping lanes would be closed for shorter periods of times as cleanup efforts would be quicker.
* Recently the United States Government approved the creation of multiple offshore drilling platforms throughout the Arctic.
* Oil spills can leave fishermen out of work until the oil is cleared. Fishing is seasonal and closed fishing areas can result in major financial setbacks for entities accustomed to fishing the area. Further, many important and fished species are likely to exhibit an irregular atrial arrhythmia as a result of oil toxicity. Thus, fishermen are likely to be affected long after an oil spill is cleared.
* Oil spills can have lasting effects on human health. Some toxins in oil bioaccumulate up the food chain, and may be consumed in higher quantities than what was present in the environment at the time of the original spill. Further, seafood may be sent out across the country for consumption, so nationwide public health can be affected. The accumulation of volatile gases as a result of an oil spill and/or the use of dispersants for cleanup efforts can affect lung and brain function of those who inhale the toxic fumes. Oil can also leave rashes or burn skin depending on the type. It is imperative that early oil spill detection measures are in place to reduce the potential public health impacts as a result of the oil spill.

**Current Management Practices & Policies**

Current methods for detecting oil spills in Arctic regions are limited to reports from passing vessels and aircraft. Further, US federal law requires all US citizens to report an oil spill to the National Response Center. Once a spill has been reported, the United States Coast Guard will investigate the suspect location and formulate a cleanup and/or dispersal plan. Ultimately, the responsible party will be incur any cleanup expenses.

**Decision Support Tools & Benefits**

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

**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)