**NASA DEVELOP National Program**

****NASA 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: Remotely Sensing Oil in Northern 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

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

National Oceanic and Atmospheric Administration, End-User, POC: Dr. Amy Merten

**Project Details**

**Applied Sciences National Applications Addressed:**

Disasters

**Study Area:**

Alaska (AK), United States

**Study Period:** Present

**Earth Observations & Parameters**

Aqua and Terra, MODIS - Land Surface Reflectance

Landsat 8, OLI and TIRS - Land Cover Analysis

Sentinel-1 - Radar Analysis

**Ancillary Datasets Utilized**

* Arctic Environmental Response Management Application (ERMA) - real-time and static spatial data for coastal Alaska

**Models Utilized**

* None

**Software Utilized**

ArcGIS - vector manipulation, image enhancement and map creation with Global Land Survey 2000 and 2005 (GLS 2000 and GLS 2005)

ENVI – Image enhancement and visualization

Python - scripting of graphical user interface for imagery retrieval tool

Google Earth - georeferencing historical literature

Google Maps - georeferencing historical literature

**Project Overview**

**80-100 Word Objectives Overview**

A projected surge in Arctic maritime transportation and energy exploration increases the risk of an oil spill. Real-time and static datasets composed of geographic and spectral data will assist the United States Coast Guard in strategic planning for Arctic oil spill incidents. The project team developed a Python-based tool to expedite access to optical and radar imagery from NASA EOS, Aqua, Terra, and Landsat, and ESA EO platform, Sentinel-1. A static map of natural oil seeps was also created to update a baseline dataset available on the Arctic ERMA for use as an emergency responder planning tool.

**Abstract**

Sea ice is rapidly decreasing in the Arctic, encouraging a surge in maritime transportation and energy exploration in the region. This increase in traffic, combined with challenges unique to an Arctic environment, escalates the risk of an oil spill. In addition to human activity, a significant amount of oil enters the marine environment through natural oil seeps. The United States Coast Guard (USCG) is the lead response agency for oil spills in U.S. coastal waters. Ancillary responsibilities include monitoring natural oil seeps in order to rule out anthropogenic sources. Complexities inherent to an Arctic oil spill – ice-infested waters, strong currents, cloud cover, and extended darkness - require a combination of sensors operating across the electromagnetic spectrum to accurately portray the incident. NASA DEVELOP partnered with the USCG Auxiliary University Program to create a Python-based tool that automates access to optical and radar imagery. The project incorporated optical data from the NASA Earth Observing Systems - Aqua, Terra and Landsat 8 - and radar data from the European Space Agency platform, Sentinel-1. Additionally, the study constructed a natural oil seeps map using ArcGIS 10 by spatially enabling data discovered in historical literature. The resultant dataset was injected into the interactive Arctic Emergency Response Management Application to facilitate fast visualization and coordination for emergency responders. These products will be used by the USCG to improve strategic oil spill response planning for the northern coast of Alaska.

**Community Concerns**

* Environmental impact from oil spills and seeps is more severe in the Arctic because oil persists longer in freezing temperatures.
* Arctic oil spill cleanup efforts are difficult due to harsh environmental conditions and poor understanding of oil behavior and fate in freezing environments.
* 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 optical sensors combined with radar data may 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 or dispersal plan. A robust combination of optical and radar imagery analysis could provide a useful strategic response planning tool for the USCG in the event of an Arctic spill.

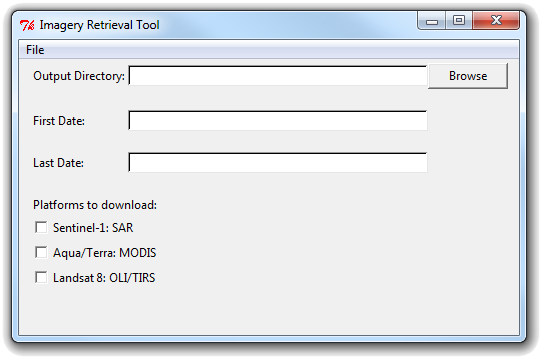
**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Natural Oil Seeps Static Map | Global Land Survey 2000 and 2005 (Landsat 7 ETM+ and TM) | Establishes baseline knowledge of known natural oil seeps which allows USCG to rule out anthropogenic source |
| Imagery Retrieval Tool | Aqua/Terra MODIS  Landsat 8 OLI/TIRS  Sentinel-1 | Python-based tool for retrieving optical and radar imagery to augment USCG strategic response to oil spills |
| Natural Oil Seeps Shapefile | Landsat 8 OLI/TIRS | Allows fast visualization for emergency responders through the NOAA ERMA web application |

**Project Imagery**

**Caption:** The Imagery Retrieval Tool quickly imports near real-time satellite data to improve early oil spill detection and monitoring.

**Image:** 2015Sum\_LaRC\_AlaskaDisasters\_GUI\_RD.jpg

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**Caption:** Below is a static map detailing natural seeps and exploration wells off the Northern Shore of Alaska.

**Image:** 2015Sum\_LaRC\_AlaskaDisasters\_NaturalOilSeeps\_RD.jpg

