**NASA DEVELOP National Program**

**2018 Spring Project Proposal**

**North Carolina – NCEI**

**Alaska Disasters**

*Development of a Snow Melt and Fuel Conditions Monitoring Tool Using NASA MODIS and NOAA Climate Data Records to Aid Wildfire Managers in Alaska*

**Project Overview**

***Project Synopsis*:** This project will work with the Alaska Interagency Coordination Center (AICC) and NOAA Regional Climate Services Alaska Region to aid the AICC in their current fire risk and monitoring efforts. This project will create a snow cover melt tool that will calculate changes in the near-real time Normalized Difference Snow Index from NASA’s Terra and Aqua Moderate Resolution Imaging Spectroradiometer (MODIS) data. The team will also study climatologic trends in seasonal snow cover melt using NOAA’s Snow Cover Extent – Climate Data Record (SCE-CDR) to provide end-users with a better idea of historic and expected changes in snowmelt.

***Community Concern:*** Wildland fires are not unusual in Alaska and in a typical year the state experiences approximately 1.2 million acres burnt by approximately 500 fires. Alaska is also warming twice as fast as the rest of the nation causing shorter winters, thawing permafrost, and rapidly receding glaciers. All of these weather changes are increasing the number of wildfires experienced by the state (Cochran et al., 2014). Unfortunately, there are severe data gaps for the largest (~663,300 square miles), yet least densely populated state in the US. Currently, the AICC helps to distribute information about current fires, fire risk, and risk outlooks. However, there are limited data available to inform the AICC of when snow cover melts throughout the state, leaving uninhabited and sparsely inhabited areas at risk to wildfire before mitigation planning and efforts can be provided. The AICC is interested in incorporating more satellite data to address these glaring data gaps and improve their current methods.

***Source of Project Idea:*** At the beginning of 2017, a meeting between National Centers for Environmental Information (NCEI), the National Weather Service (NWS), and Alaskan regional fire meteorologists helped identify data gaps and potential improvements to Alaska’s current wildland fire risk assessments. A science advisor at the NASA DEVELOP NC node asked the node to help address these stakeholder concerns to help improve current wildland fire risk monitoring efforts.

***National Application Area Addressed:*** Disasters

***Study Location:*** AK

***Study Period:*** 1967 – 2017 (January – May)

***Advisor:*** Jake Crouch (NOAA NCEI)

**Partner Overview**

***Partner Organizations:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| **Alaska Interagency Coordination Center** | Heidi Strader, Meteorologist | End User | No |
| **NOAA Regional Climate Services, Alaska Region** | James Partain, Director | Collaborator | Yes |
| **National Weather Service, Alaska Region** | Rick Thoman, Climate Science and Services Manager | Collaborator | No |

***End-User Overview***

***End User’s Current Decision-Making Process:***The AICC developed the Alaska Fire and Fuels (AKFF) Website, an online fire monitoring and risk tool to distribute information about current wildfires and wildfire risk across the state with various maps, graphics, and tabular displays. A number of data sources are used to create these figures including weather station data (from a variety of sources), NOAA’s Real-Time Mesoscale Analysis, Quantitative Precipitation Estimates (QPE) from weather models, and National Digital Forecast Database (NDFD) data. Satellite data from MODIS and VIIRS are only used to analyze fire movement and spread in remote areas. The AICC has had several issues determining when various areas within Alaska become snow-free in the spring. This data gap makes it difficult to know when they should start calculating wildfire related indices to identify areas in risk.

***End User’s Capacity to Use NASA Earth Observations:***

*Alaska Interagency Coordination Center* – The AICC currently uses MODIS and VIIRS data to analyze the movement and spread of wildfires in remote areas. There have been some efforts to incorporate other satellite datasets such as the Global Precipitation Measurement Mission (GPM) and satellite derived fuel moisture indices with various groups. However, these efforts have not been incorporated into current practices as of yet. This project will assist them with an immediate problem and focus on expanding their capacity to introduce other satellite data into their current practices.

***Collaborator & Boundary Organization Overview***

***Collaborator Support:***

*NOAA Regional Climate Services, Alaska Region* – James Partain, the RCSD of Alaska, will help connect the team with regional experts in Alaskan climate trends, *in situ* data sources, and identifying gaps in actionable data.

*National Weather Service, Alaska Region* – Rick Thoman, the Climate Science and Services Manager for the NWS, Alaska Region will provide the team with professional guidance on incorporating end products into current decision-making processes regarding weather and climate in the Alaska Region.

***Dissemination by Boundary Organizations*:**

*NOAA Regional Climate Services, Alaska Region* – James Partain, the RCSD of Alaska, will assist the team with the transition of the project results and snow cover melt tool and serve as the shepherd of these end products. As RCSD, James serves as a regional representative of NOAA NCEI and is tasked with connecting regional organizations, agencies, and communities with useful environmental resources. James will also connect the team to any regional partners that may also benefit from the project end products.

***Project Communication & Transition Overview***

***In-Term Communication Plan*:** The project team will communicate with the end user and collaborator weekly or bi-weekly via teleconference and email. The project lead will serve as the primary point of contact to partners.

***Transition Plan*:** The project team will handoff project results at the end of the term via a video conference with the end user and collaborators. The team will also give a brief presentation of their project results and demonstrate the snow cover melt tool to partners during the hand-off event. A software release as well as tutorial deliverable will likely be required before the snow cover melt tool can transfer to the end user. However, the team and node leadership will run the tool to provide the end user with results through the duration of the software release process.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameters** | **Use** |
| **Terra MODIS** | Normalized Difference Snow Index (NDSI) | Near-real time NDSI data will be used to measure recent snow cover melt throughout Alaska.  |
| **Aqua MODIS** | NDSI | Near-real time NDSI data will be used to measure recent snow cover melt throughout Alaska. |
| **Snow Cover Extent – Climate Data Record (SCE-CDR)** | Snow Cover Extent | The long-term record of snow cover extent data available from the SCE-CDR will be used to determine climatologic trends and patterns in Alaskan snow cover melt. |
| **Suomi NPP VIIRS** | Albedo, Ice Motion and Temperature, Land Surface Temperature | The Visible Infrared Imaging Radiometer Suite will be used to measure surface reflectance, ice temperature and motion, and land surface temperature to aid in mapping snow cover extent. |

***Ancillary Datasets:***

Natural Resources Conservation Service Snotel snowpack characteristics *in situ* data – will be used as validation of snow cover satellite data

National Weather Service Alaska Weather Forecasts – may be incorporated into the near-real time snow cover melt tool

***Software & Scripting:***

Esri ArcGIS – Geospatial analyses; map creation

R – Data acquisition, processing, validation, and various statistical analyses

Python – Data acquisition, processing, and validation

Javascript – Software Carpentry

Google Earth Engine – Software Interfacing

Esri ArcGIS Online – Online map and data hosting

**Decision Support Tool & End Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Products** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| Near-Real Time Snow Cover Melt Monitoring Tool | This tool will be used by the AICC to identify areas in Alaska where they need to start calculating various fire indices to inform regional managers of developing wildfire risk. A near-real time tool will replace the currently used modeled snow free analysis data.  | A change detection analysis will be applied to daily MODIS and VIIRS imagery to monitor changes in the NDSI that are indicative of snowmelt per pixel. The tool will then identify which pixels have most likely experienced majority snow cover melt. | III |
| Tutorial of Snow Cover Melt Monitoring Tool | This tutorial will demonstrate the use and application of the snow cover tool for AICC use. | N/A | N/A |

***End-User Benefit*:** These end products will be incorporated into current wildfire risk monitoring in Alaska and provide end-users with a better estimate of when and where snow melt occurs throughout the state of Alaska. As a result, the AICC will be given a more reliable method of monitoring snow cover melt to calculate wildfire risk as soon as wildfires are feasible. End users will also be able to use the snow cover melt trends and patterns analysis to inform future preparation planning and better understand the start of their seasonal wildfire season.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 1 Term: 2018 Spring

***Related DEVELOP Work:***

Spring 2015 (JPL) – Western United States Disasters: Using GRACE-derived Water and Moisture Products as a Predictive Tool for Fire Response in the Western United States

Spring 2017 (NC) – Missouri River Climate II: Utilizing NASA Earth Observations and NOAA Data Records to Produce Climate Indicators of Wildland Fire

**Notes & References:**

***References:***

Cochran, P., Huntington, H., Markon, C., McCammon, M., McGuire, A. D., & Serreze, M. (n.d.). Alaska. In 2014 National Climate Assessment. Retrieved from <http://nca2014.globalchange.gov/>