Poster #GC42L - 0868

Utilizing Earth Observations to Delineate Wetland Extent, Model Sea-Level Rise Inundation Risk, and Assess Impacts on Historic Hawaiian Lands

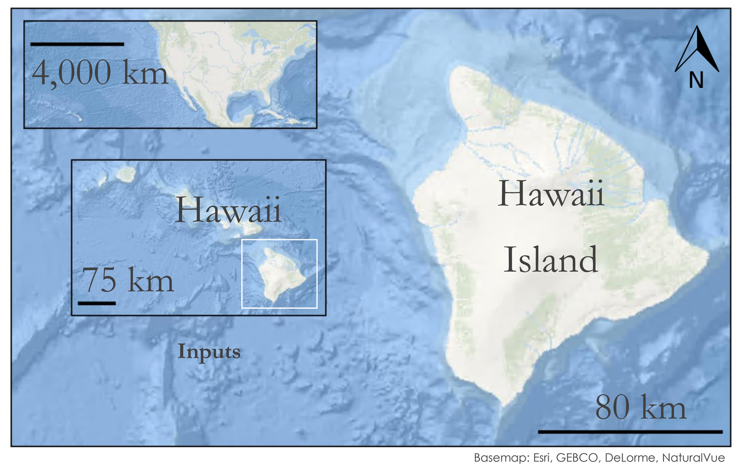
Lisa Tanh[1,2] (lisa.tanh@ssaihq.com), Matilda Anokye[1,2] (matilda.anokye@sus.edu), Ian Lee[1,2] (ianrj.lee@gmail.com), Connor Racette[1,2] (racette.connor72@gmail.com), Ryan Hammock[1,2] (Ryan.Hammock@utexas.edu), Roberta Martin[3] (Roberta.Martin@asu.edu), Jiwei Li[3] (jiwei@asu.edu)
[1] NASA DEVELOP National Program, [2] Science Systems and Applications, Inc., [3] Arizona State University, Center for Global Discovery and Conservation Science

HAWAII ISLAND Climate

ABSTRACT

Climate induced sea-level rise poses a risk to coastal areas on the Island of Hawai'I, and many of the island's historic cultural lands are in danger of becoming overtaken by wetlands or inundation. In partnership with the County of Hawai'i, State of Hawai'i Department of Land and Natural Resources, and Arizona State University, NASA DEVELOP mapped wetland extent and short-term sea-level rise inundation risk. We utilized Earth observations over a 10-year span (2013 – 2022) that included the NASA MEaSUREs Gridded Sea Surface Height Anomalies and MEaSUREs Group for High Resolution Sea Surface Temperature datasets, United States Geological Survey (USGS) Hawaii Digital Elevation Models (DEM), and in situ tidal gauge data. Flood risk index values were acquired for 5 known Hawai'i flood events between 2019 – 2021 from the Global Flood Mapper tool on Google Earth Engine. We used a random forest model to predict short-term sea-level rise inundation risk along the entire coast of Hawai'i. Current wetland extents and probabilistic locations of new wetlands were modeled with the most recently available data from PlanetScope Surface Reflectance optical imagery (2022), USGS 3D Elevation Program (3DEP) 10m DEM (2013), temperature and precipitation data from the Hawai'i Climate Atlas, and soils data from the Hawai'i Soil Atlas (2014) using the Wetland Intrinsic Potential tool. Results indicated locations that had the highest probability of wetland creation. The end products aimed to help the partners prioritize efforts to meeting regulation requirements for wetlands protection, evaluate the inundation risk to historical features, and support decision-making for their Shoreline Setback and Climate Adaption plans.

STUDY AREA



OBJECTIVES

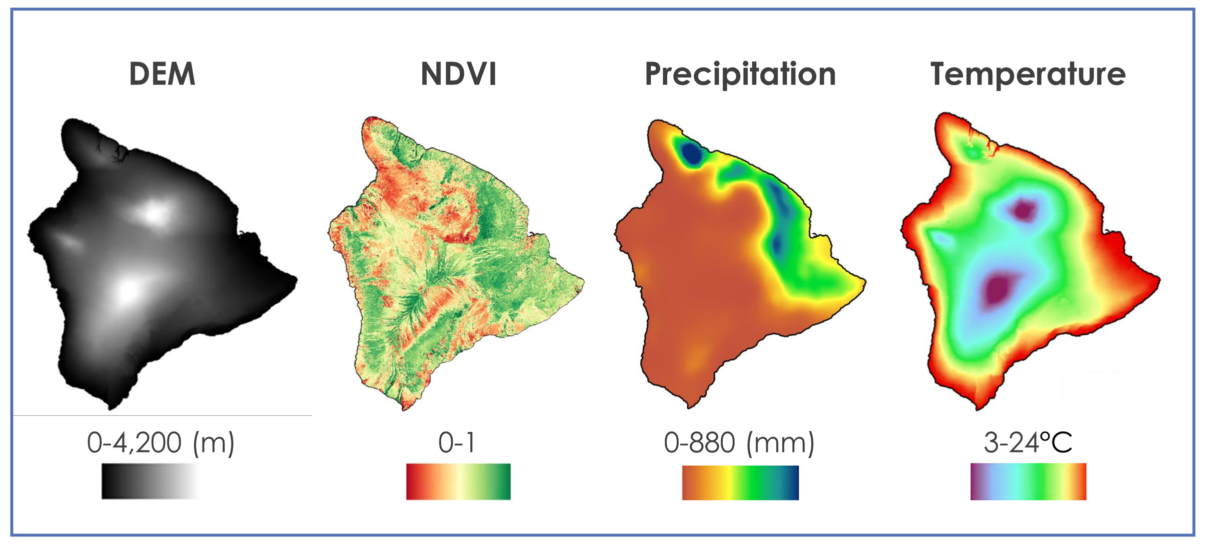
- **Create** an up-to-date coastal wetlands extent map of Hawaii, showing the probability of potential and current coastal wetland extents of the study area
- **Model** short-term inundation risk of present-day Hawaii to generate risk indexes (e.g., high, medium, low risk of inundation/flooding)
- **Compare** mean sea level height data from in situ tidal gauges to the sea surface height anomaly data for correlative and predictive analysis.

PROJECT PARTNERS

- County of Hawaii Planning Department
- State of Hawaii Department of Land and Natural Resources
- Arizona State University Center for Global Discovery and Conservation Science

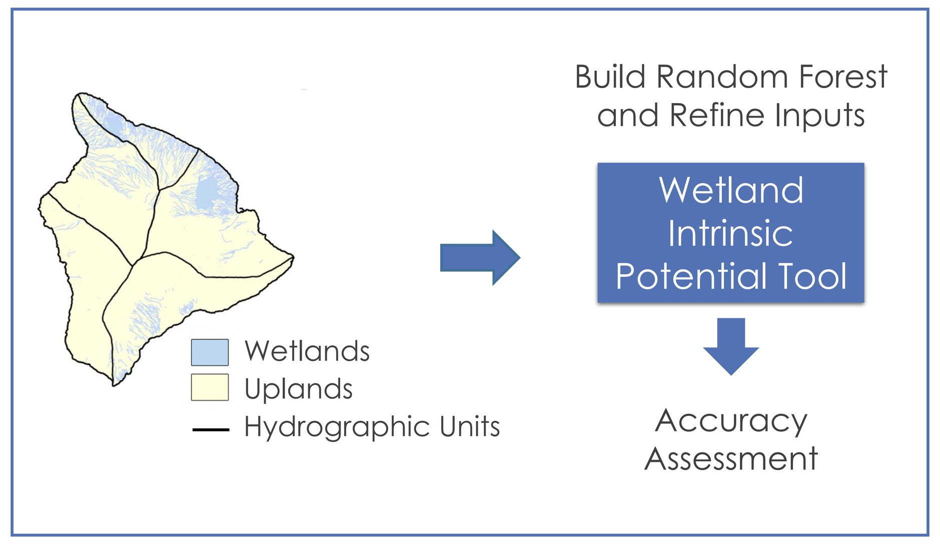
WETLAND EXTENT

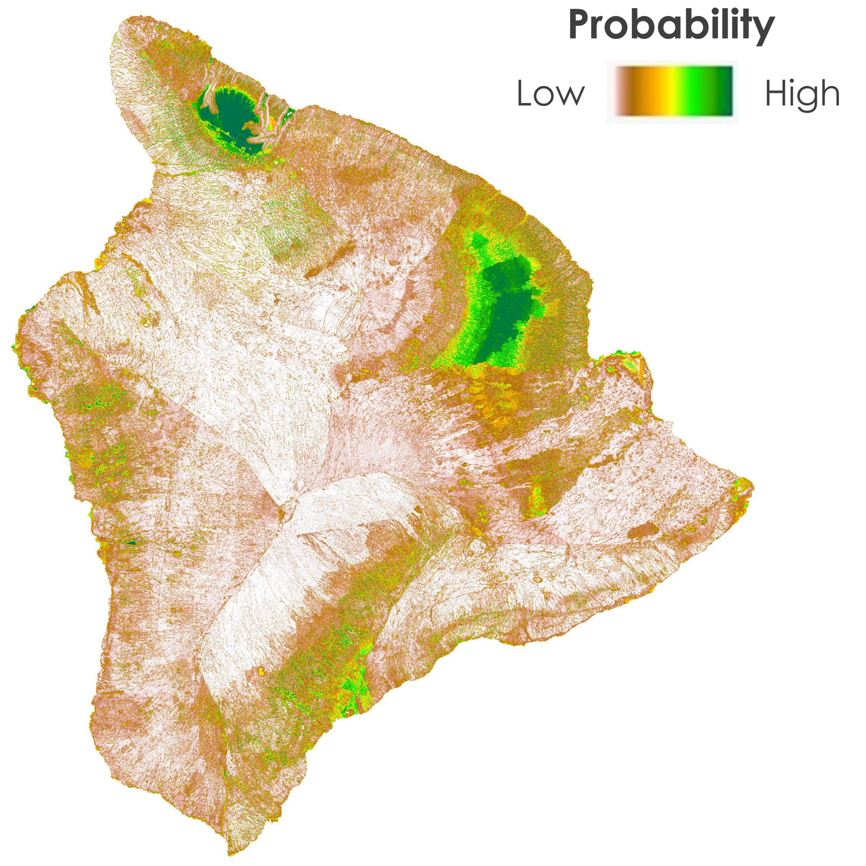
Inputs



Train Model

Processing





Results

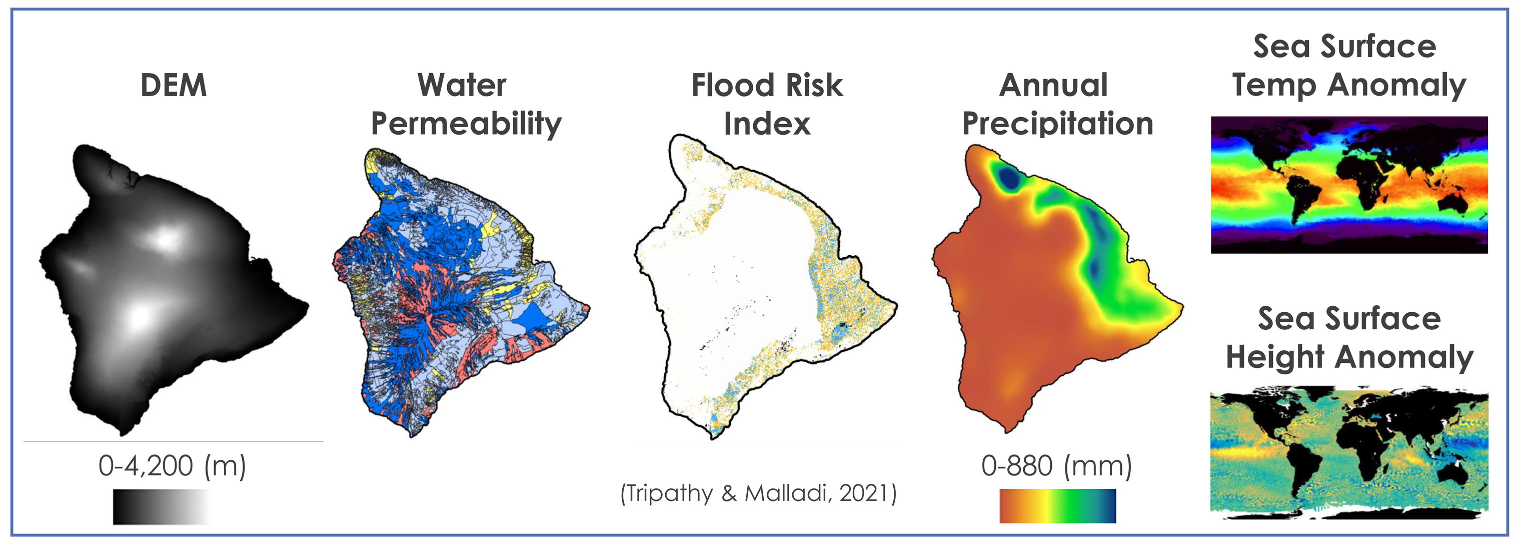
Ranked importance for all wetland models showed that both climate and soils data variables scored highly. All probability models were tuned to achieve a less than 10% Out of Bag Error.

Conclusions

- Soils and climate data continually ranked highly in model importance statistics
- Volcanic activity causes frequent landscape changes and having the most recent and highest resolution elevation data would increase model accuracy and mitigate false positives

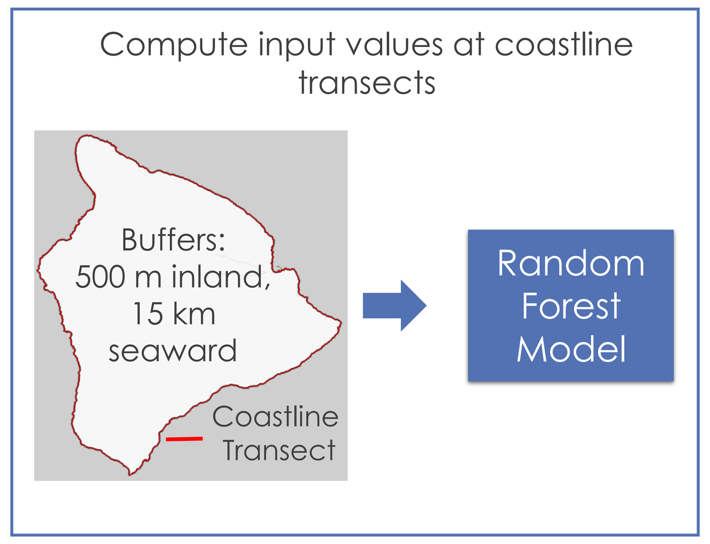
SEA LEVEL RISE INUNDATION

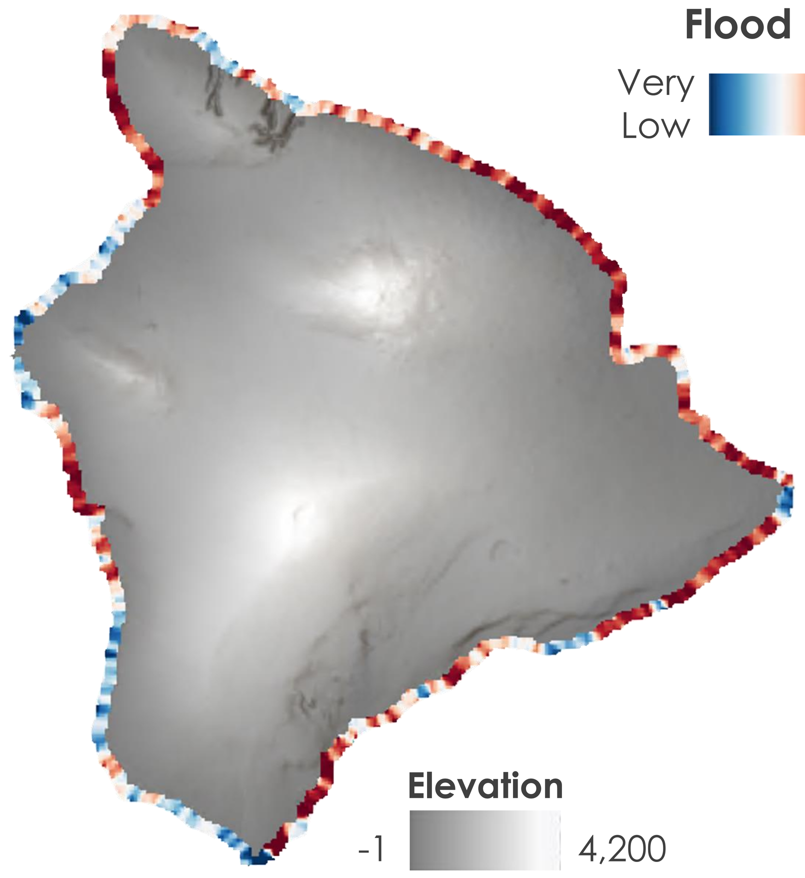
Inputs



Train Model

Processing





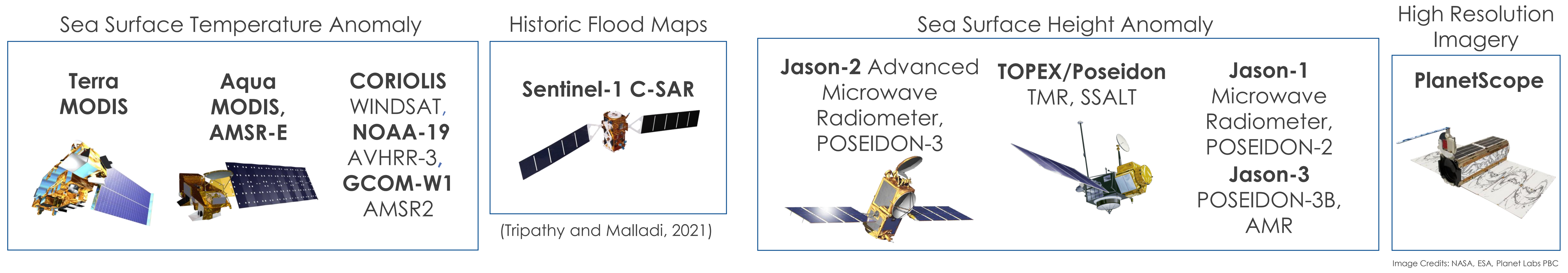
Results

The simple random forest model had a 90% (and 10% OOB) for intra-event classification, with sea surface temperature anomalies (SSTA) and precipitation being the most important features.

Conclusions

- Feasibility study that support past findings (Nieves, V., Radin, C., & Camps-Valls, G., 2021), showing the potential of using RF for flood prediction
- Much more data is still needed to make inter-event and future predictions possible

EARTH OBSERVATIONS



ACKNOWLEDGEMENTS

We thank our science advisors Dr. Roberta Martin, Dr. Jiwei Li, Dr. David Hondula from Arizona State University, and Ryan Hammock, NASA DEVELOP Fellow.

Tool developers and support:

WIP Tool: Meghan Halabisky, University of Washington and Dan Miller, TerrainWorks.

Global Flood Mapper: Pratyush Tripathy and Teja Malladi, Indian Institute for Human Settlements

This material contains modified Copernicus Sentinel data (2015-2022), processed by ESA and modified PlanetScope data (2022) processed by Planet.

Nieves, V., Radin, C., & Camps-Valls, G. (2021). Predicting regional coastal sea level changes with machine learning. *Scientific Reports*, 11(1), 1-6. DOI: 10.1038/s41598-021-87460-z

For more information visit: