**NASA DEVELOP National Program**

****National Centers for Environmental Information

**Summer 2015**

**Short Title: Pacific Water Resources**

**Subtitle:** Using NOAA CDRs and Satellite Data to Connect Phases of the El Niño Southern Oscillation (ENSO) with Precipitation across Hawaii and the U.S. Affiliated Pacific Islands (USAPI)

**VPS Title:** Mapping ENSO: A Climatology of ENSO Related Precipitation for Hawaii and the U.S. Affiliated Pacific Islands

**Project Team & Partners**

**Project Team:**

Jessica Sutton (Project Lead), jessica.sutton@noaa.gov

Nicolas Luchetti

Ethan Wright

**Advisors & Mentors:**

Michael Kruk (Pacific Water Resources Product Development Lead)

John Marra (NOAA Region Climate Services, Director, Pacific Region)

**Partner Organizations**

ERT, Collaborator, POC: Michael Kruk, Pacific Water Resources Product Development Lead

Regional Climate Services Director (RCSD), Collaborator, POC: John Marra, Pacific Regional Director

Pacific ENSO Applications Climate (PEAC) Center, Boundary Organization, POC: Carl Noblitt, NOAA Corp Communication Officer

**Project Details**

**Applied Sciences National Applications Addressed:**

Water Resources, Climate

**Study Area:** Exclusive Economic Zones (EEZ’s) encompassing American Samoa, Guam, the Republic of the Marshall Islands (RMI), the Federated States of Micronesia (FSM), and the Commonwealth of the Northern Mariana Islands (CNMI), the Republic of Palau, and Hawaii.

**Study Period:** January 1985 – December 2014

**Earth Observations & Parameters**

PERSIANN CDR, GridSat-B1 IR Window Channel – Precipitation Estimation

**Ancillary Datasets Utilized**

* NOAA Climate Prediction Center (CPC), Monthly Oceanic Nino Index (ONI)- ENSO phases
* Global Historical Climate Network-Daily (GHCN-Daily) in-situ station rainfall data

**Software Utilized**

ArcGIS – NCDF to Raster, Raster Processing

R – Statistical Analysis

Dnppy- Python scripting

wget – Ftp download

**Project Overview**

**80-100 Word Objectives Overview**

This project aims to examine and document the influence of specific phases of the El Niño Southern Oscillation (ENSO) on long-term precipitation averages for the Exclusive Economic Zones (EEZ’s) encompassing American Samoa, Guam, the Republic of the Marshall Islands (RMI), the Federated States of Micronesia (FSM), the Commonwealth of the Northern Mariana Islands (CNMI), the Republic of Palau, and the Hawaiian Islands. The results from this project will be used to help manage water resources on the different islands during different ENSO phases.

**Abstract**

There are over 2000 islands in the U.S.-Affiliated Pacific Islands (USAPI), which are highly susceptible to extreme events such as drought and floods. A direct societal impact of these extreme events is the effects they have on island fresh water resources, as they are heavily dependent on precipitation. With this in mind, meteorologists and decision-makers are becoming increasingly interested in understanding regional precipitation trends. These precipitation trends differ by sub-region, and are predominantly influenced by phases of the El Niño Southern Oscillation (ENSO). Other than a few historical ENSO events, decision- makers in this region do not have a historical context to frame and understand the influence of ENSO on precipitation. Forecasters currently rely on outdated ENSO climatologies from *in situ* station data to inform their precipitation outlooks. On many islands these stations are sparse and, at times, unreliable which leads to a minimum in spatial resolution. This project aims to provide an updated ENSO-based climatology of long-term precipitation patterns for each USAPI using the NOAA PERSIANN Climate Data Record (CDR) for the purposes of filling the spatial *in situ* station void. The PERSIANN CDR provides a 30-year record of daily precipitation at 0.25° resolution making it a powerful database for regional precipitation studies. The end products of this project will provide the missing historical context of how the likelihood of precipitation changes within seven specific ENSO phases, defined using the Oceanic Niño Index (ONI). These seven phases are strong negative (<-1.5), moderate negative (-1.5 to -1.0), weak negative (-1.0 to -.5), neutral (-.5 >.5), weak positive (.5 to 1.0), moderate positive (1.0 to 1.5), and strong positive (>=1.5). By understanding the relationship established in this project, end-users will be able to look at existing forecasted ENSO values and have a better understanding of the likelihood of precipitation or drought occurring in their region.

**Community Concerns**

* Pacific Island Nations’ leaders and decision makers are increasingly interested in growing their understanding and knowledge of regional climate variability and the associated impacts.
* Leaders of these nations are especially interested in understanding how ENSO affects their freshwater availability, as water resources for these nations are heavily dependent upon precipitation.
* Leaders are becoming increasingly concerned with the frequency and distribution of future heavy precipitation and drought events as they relate to the dynamical nature of the climate system.

**Current Management Practices & Policies**

Meteorologists at the Weather Station Offices on each of these islands currently collaborate with the Pacific El Niño Southern Oscillation Applications Climate (PEAC) Center when forecasting seasonal precipitation and impact outlooks. PEAC makes use of the Climate Prediction Center (CPC)’s ENSO products and observational analysis tools in order to create regional climate overviews and forecasts. Additionally, forecasters and decision makers make use of *in situ* station based ENSO precipitation climatologies in order to assess and mitigate potential impacts from different phases of ENSO. However, due to their sparse spatial coverage, climatologies based solely on *in situ* stations can only explain a fraction of the actual rainfall distribution.. The addition of satellite-based rainfall climatologies aims to compliment the station data by offering a larger spatial scope of the rainfall averages.

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| 30 Year Climatology Maps & Figures | PERSIANN CDR – precipitation | Enhance water resource management by providing quantitative information on how ENSO impacts monthly, seasonal, and annual precipitation in the region. |
| Anomalous Wet and Dry Maps  | PERSIANN CDR – precipitation | Identification of abnormally wet and dry months, seasons, and years. |
| Validation analysis of PERSIANN CDR with *in situ* data | PERSIANN CDR – precipitation | To show how well the PERSIANN precipitation data compares to *in situ* precipitation data. |

**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)