Pacific ENSO Application Climate (PEAC) Center's Monthly Climate Summary and Forecast for the Federated States of Micronesia Experimental Product Description Document (PDD)

From: NWSI 10-102
Part I - Mission Connection

a. Product Description –
The Pacific ENSO Applications Climate (PEAC) Center was established in August 1994 as a multi-institutional partnership, to conduct research and produce information products on climate variability related to the El Niño - Southern Oscillation (ENSO) climate cycle in the U.S.-Affiliated Pacific Islands (USAPI). To this end the PEAC Center provides rainfall, sea level, general and island/island grouping specific forecasts, and a tropical outlook to the USAPI on a monthly and quarterly basis by means of a printed bulletin (see http://www.weather.gov/peac/update). The dissemination of these summaries and forecasts need wider distribution to the climate community. Therefore, placing these forecasts into AWIPS will allow not only wider distribution, but an easily accessible archive. Providing climate data is part of the NWS's mission and connected to all six of our primary goals. By making these forecasts easily available, the NWS is enhancing climate services to help communities, businesses, and governments understand and adapt to climate-related risks.

The product proposed, issued monthly, is a seasonal climate summary and forecast of rainfall and sea level for the four states of the Federated States of Micronesia: Yap, Chuuk, Pohnpei and Kosrae. Individual sections for each island will include a summary of climate conditions observed on the island along with observed rainfall and sea level values. The forecast for each section/state will include a forecast summary of expected climate conditions over the next season, a probabilistic seasonal rainfall forecast by season for the next 12 months, a long range rainfall forecast in percent of total rainfall, and a deterministic sea level forecast.

b. Purpose/Intended Use -

The USAPI governments have relied on the PEAC Center's summaries and forecasts to make critical decisions on how they are going to protect their communities. These tailored island-specific forecasts have allowed the USAPI governments to respond to seasonal climate variability, avoiding or minimizing potentially disastrous impacts. Government officials can better prepare by using these summaries and forecasts when water quality, food security, infrastructure, livelihoods and health may be impacted. Quality climate forecasts can help emergency managers anticipate and prepare for changing risks. For example, during drought conditions, smaller islands can order supplemental potable water

from larger islands prior to a crisis (some of the USAPI only have a three month supply of potable water on island for their communities). Therefore, this forecast is essential to the communities they serve and parallels the use of the Climate Predication Center's products produced for the contiguous United States. This forecast directly address goal three of the Weather Ready Nation Strategic Plan, "Enhance Climate Services to Help Communities, Businesses, and Governments Understand and Adapt to Climate-Related Risks." Monitoring climate change across the USAPI is essential for the communities of the Pacific islands to make long term plans, prepare for changes, and mitigate impacts so the residents and visitors can remain informed and safe as weather patterns change. Weather services and related programs are part of the Compacts of Free Association (http://www.gpo.gov/fdsys/pkg/PLAW-108publ188/html/PLAW-108publ188.htm), which are agreements the United States has with the Government of the Federated States of Micronesia and the Government of the Republic of the Marshall Islands.

c. Audience –

The PEAC Center's forecasts are intended for the climate community, Pacific Island Governments, and those affected by climate influences. By having a climate forecast easily accessible and updated monthly, the climate community will be able to use the data for additional understanding of climate cycles. Also, the USAPI governments will continue to make life and property saving decisions.

d. Presentation Format –

This forecast will be in text format issued through AWIPS. Also, graphics and tables will be available on the PEAC website (http://www.weather.gov/peac/).

The climate summary, observed rainfall and sea level as well as the forecast discussion and rainfall and sea level forecasts will be presented in a way consistent with the PEAC Center Newsletter, assuring that the main user community will be familiar with the information contained in this products.

e. Feedback Method –

Feedback for the PEAC Center's forecast can be provided through a formal survey, directly to PEAC via email and telephone, or through the PEAC Webmaster's email. Following is information for use during the feedback period.

- Point of Contacts
    - Carl Noblitt
        - National Weather Service PEAC Center
        - Pacific Region Climate Officer
        - 2525 Correa Rd., Suite 350, Honolulu, Hawaii
        - (808) 956-2324

    - Tom Evans
        - National Weather Service Forecast Office
        - Acting Meteorologist in Charge
        - 2525 Correa Rd., Suite 250, Honolulu, Hawaii
        - (808) 973-5273
- Dates of Comment Period
    - February 1st to April 30th, 2016
- Link to survey

www.nws.noaa.gov/survey/nws-survey.php?code=PEAC

Part II - Technical Description

a. Format and Science Basis –

The PEAC Center's product will be in a text format transmitted through AWIPS (ASCII). Supplemental tables and graphics as well as this text forecast will be available of their website at http://www.weather.gov/peac/.

Seasonal rainfall forecasts are produced using a multi model consensus methodology. The PEAC Center multi model suite is composed from statistical, dynamical, and multi model ensemble forecasts from operational climate forecasting centers around the world as well as models produced in house at the PEAC Center. The forecast from each individual model is used to create a tercile probabilistic and word-category consensus forecast of precipitation for the coming season. An example of the forecast methodology and probabilistic forecast is as follows; during the month of January (2nd week), all model forecasts for the January-February-March season are collected and processed into a final consensus forecast which is given in terms of final average *probability-of-below-normal%:probability-of-near-normal%: probability-of-above-normal%* rainfall i.e. 30:40:30. This numerical forecast is published along with the tercile cut off values for the particular season being forecast. A forecast of 30:40:30 should be read as the probability of observed rainfall being in the lower tercile is 30%, the probability of rainfall being in the middle tercile is 40%, and the probability of rainfall being in the upper tercile is 30%. Word categories are assigned to the forecast to help with the interpretation of the probabilistic rainfall, these categories are Below, Average-Below, Average, Average-Above, and Above. Below, Average, and Above are assigned to forecasts in which the lower, middle, or upper probability values are larger than the probability value in the forecast. A 30:40:30 forecast would carry the word category Average. The Average-Below and Average-Above categories are used when the probabilities of two categories are equal, for example, and forecast with 30:35:35 probabilities will be classified as Average-Above. In the experience of the PEAC Center forecasts this type of probabilistic and word category forecasts are best suited to properly capture forecast uncertainty while at the same time provide ease of use to the end user. For an example of this type of forecast see http://www.weather.gov/peac/rainfall_new.

Long range precipitation forecasts for the islands are based on the expected evolution of ENSO and its climatological effects on island precipitation. Final forecasts are made in terms of % of climatological rainfall for the target season.

Sea level forecasts are produced using a statistical Canonical Correlation Analysis (CCA) model using SST and 850hPa winds as predictors for sea level. Forecasts of expected mean sea level and max sea level are issued in a deterministic departure from the mean in inches format. The methodology is comprised of composite analyses of seasonal variations of SST and trade winds; the effects of SST and wind on sea level by correlation; empirical orthogonal function (EOF) analysis; and employing Canonical Correlation Analysis (CCA) methods to forecast sea level on seasonal time scales. The EOF analyses of the SST data were carried out to minimize problems of collinearity and generate independent, contiguous SST and wind indices. Leading EOFs are selected as independent variables for the CCA model. CCA analysis is performed to identify the optimal coupled anomaly pattern relationship between local and large-scale spatial patterns. Here the relationship is used to obtain small-scale realizations from large-scale climate-change scenarios provided by SST and wind data. The Climate Predictability Tools (CPT) software (http://iri.columbia.edu/our-expertise/climate/tools/cpt/) has been used for CCA analysis.

b. Product Availability –

The PEAC Center's summary and forecast will be available monthly and updated as needed.

c. Additional Information –

The PEAC Center's summary and forecast is developed and written by personnel in the PEAC Center with assistance from Honolulu Weather Forecast Office personnel. AWIPS will be used to format the text product. Data are gathered by PEAC Center personnel for use in this forecast. The following are publications describing the research that is incorporated into the PEAC Center's products and services.

PEAC & Hazards Mitigation

- Schroeder, T. A., M. R. Chowdhury, M. A. Lander, C. Guard, C. Felkley, and D. Gifford, 2012: The role of the Pacific ENSO Applications Climate Center in reducing vulnerability to climate hazards: Experience from the U.S.-Affiliated Pacific Islands. *Bull. Amer. Meteor. Soc.*, **93**, 1003-1015.

ENSO & Recent High Sea Levels

- Chowdhury M. R., A. G. Barnston, C. Guard, S. Duncan, T. Schroeder, and P.-S. Chu, 2010: Sea-level variability and change in the U.S-Affiliated Pacific Islands: Understanding the high sea levels during 2006-08, *Weather*, **65**, 263-268.

Sea Level Extremes and GEV

- Chowdhury M. R., P.-S. Chu, X. Zhao, T. Schroeder, and J. Marra, 2009: Sea-level extremes in the U.S.-Affiliated Pacific Islands—a coastal hazards scenario to aid in decision analysis, *J. Coast. Conserv.*, **14**, 53-62.

- Chowdhury M. R., P.-S. Chu, T. Schroeder, and X. Zhao, 2008: Variability and predictability of sea-level extremes in the Hawaiian and U.S.-Trust Islands—knowledge base for coastal hazards management, *J. Coast. Conserv.*, **12**, 93-104.

Seasonal Sea-level Forecasts

- Chowdhury M. R., P.-S. Chu, T. Schroeder, and N. Colasacco, 2007: Seasonal Sea-level Forecasts by Canonical Correlation Analysis – An Operational Scheme for the U.S-Affiliated Pacific Islands (USAPI), *Int. J. of Climatol.*, **27**, 1389-1402.

ENSO & Sea-level Variability

- Chowdhury M. R., P.-S. Chu, and T. Schroeder, 2007: ENSO and Seasonal Sea-level Variability – A Diagnostic Discussion for the U.S-Affiliated Pacific Islands, *Theo. Appl Climatol.*, **88**, 213-224.

ENSO & Rainfall Variability

- Yu Z.-P., P.-S. Chu, and T. Schroeder, 1997: Predictive skills of seasonal to annual rainfall variations in the U. S. affiliated Pacific islands: Canonical correlation analysis and multivariate principal component regression approaches, *J. Climate*, **10**, 2586-2599.