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Title of Pre-Proposal

Impact of climate oscillations on precipitation variability in Texas

Information of Faculty Advisor

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Information about the Research

These funds will be initiating new research.

Abstract

Drought and flood are two natural hazards caused by the precipitation anomalies. The occurrence of droughts and floods have a significant impact on agriculture, society and the economy. Both of the 2011 Texas drought and the 2015 flood caused substantial damage and economic losses. Climate oscillations are one of the factors that are responsible for causing precipitation variations. Although past research has investigated the impacts of climate oscillations on precipitation, there has been relatively little research done in Texas. This project will use Canonical Correlation Analysis (CCA) to examine how five of major climate oscillations (El Niño-Southern Oscillation, North Atlantic Oscillation, Atlantic Multidecadal Oscillation, Pacific Decadal Oscillation, and Pacific-North American pattern) influence precipitation in Texas. This research will provide a better understanding of the interaction between climate oscillations and precipitation and it will provide the basis for developing skillful seasonal precipitation forecasts. Therefore, this project will have practical value for mitigating the impacts of droughts and floods.

Description of Proposed Research

This project will quantify the impacts of five common climate oscillations on precipitation variation in Texas. Specifically, the objectives of this project are to: (1) investigate the simultaneous relationships between the climate oscillations and precipitation at monthly and seasonal time scales; (2) investigate the lagged relationships between the climate oscillation and precipitation at different time-lags; (3) develop an appropriate model for predicting seasonal precipitation variations using the climate oscillations. These forecasts are valuable for managing water resources and mitigating the impacts of natural hazards such as droughts and floods.

Data and Methods: The climate oscillation indices are from the NOAA Physical Sciences Divisions (PSD) (1900 to present). Precipitation are from the Parameter-Elevation Regressions on Independent

Slopes Model (PRISM) dataset (1895 to present). The relationships between the climate oscillation indices and precipitation will be determined using canonical correlation analysis (CCA). CCA is a linear multivariate approach used to compare an independent dataset (climatic oscillations) to a dependent dataset (precipitation), where each dataset is composed of multiple arrays of variables. CCA has previously been used to examine how climate oscillations influence mesoscale surface meteorological variability in the Apalachicola-Chattahoochee-Flint River Basin for the purposes of water resource management.

In this project, precipitation anomaly will be calculated firstly to study the impact of climate oscillations on precipitation variability. Then, the study region of Texas will be divided into several similar climate regions based on the trends of precipitation anomalies using rotated empirical orthogonal function (REOF) method. REOF is a useful statistical tool for data reduction when working with large amounts of data. In climatology, large datasets are common, and spatial data analysis often seeks to find a correlation between a given variable and different locations. This is typically known as regionalization, a technique that uses REOF. Finally, CCA will be performed in each region using the climate oscillation indices and regionalized precipitation anomalies. Data from 1901 to 2000 will be used to analyze the relationship between the climate oscillations and precipitation anomalies at monthly and seasonal time scales and at different time-lags to develop a model to predict seasonal precipitation variations using the climate oscillations. Data from 2001 to present will be used to validate the model.

The timelines for this project is provided below:

Research Objectives and Tasks	**Spring 2016**	**Summer 2016**	**Fall 2016**
Data collection and data processing			
Objective 1: Investigate the simultaneous relationships between the climate oscillations and precipitation at monthly and seasonal time scales			
Objective 2: Investigate the lagged relationships between the climate oscillations and precipitation at different time-lags			
Objective 3: Develop a model for predicting seasonal precipitation variations using the climate oscillations			
Attend 2016 AGU Fall Meeting			
Write journal article that summarizes project findings			

Intended Career Path

I plan to pursue a career in climate and hydrologic science upon graduating from Texas A&M University. I am eager to become an outstanding researcher in drought monitoring / hydroclimatology fields and to use my research to make contributions to society. My graduate research prior to arriving at Texas A&M University, focused on remote sensing and agricultural applications. The significant impact that climate change and drought have on agriculture led me to pursue doctoral studies in climate sciences. It is my honor to work with Dr. Quiring who is an expert in hydroclimatology, drought monitoring, and climate change. Inspired by my mentor, I earnestly hope that I can become an excellent researcher like him in this field, help others, and make a contribution to society.