***Using Climate Variability to Predict Precipitation at Various Time Scales throughout the Carolinas***

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Mechanisms related to climate variability have a strong impact on changes in weather patterns, including the development of extreme conditions. As the Carolinas have experienced periods of extreme wet and dry conditions in the recent past, an attempt is made to develop a method using climate variability to be able to predict when such extreme events are going to occur. Relationships between climate variability and precipitation at several sites throughout the North and South Carolina are developed using various global climate indices. Precipitation data for 58 stations are obtained from the United States Historical Climatology Network, which is maintained by the National Climate Data Center, NOAA. All data are totaled over an extended period (up to five years) and correlated to several climate indices averaged over a period of equal length using lag times ranging from six months to three years. This method is referred to as "long-window" correlation analysis. A climate index that exhibits a high correlation with precipitation is identified at each site; the period length and lag time are then optimized in order to produce the maximum correlation. Strong correlations (r2 values > 0.70) were found at several sites, some of which are analyzed in further detail. Maps of North and South Carolina that illustrate the indices that correlate best in different locations are constructed. Predicted values of total historic precipitation for time periods of near 12, 24, and 36 months are compared to observations at several sites, revealing close fits in all cases. Future predictions of total precipitation for the next 6 to 36 months are also made using the same correlations. The final results not only allow a greater understanding of the major climate mechanisms that are responsible for variability in precipitation throughout the Carolinas, which leads to improved predictions of future droughts and above-average precipitation events, but will also allow improved predictability of precipitation over multiple time scales. In addition, the ability to predict total rainfall for periods greater than one year will allow an estimate of the persistence of trends and extreme events to be made well in advance.