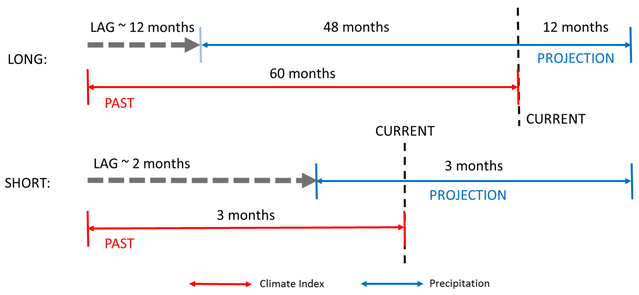
Using Climate Variability to Predict Annual Precipitation at Various Time Scales throughout North and South Carolina

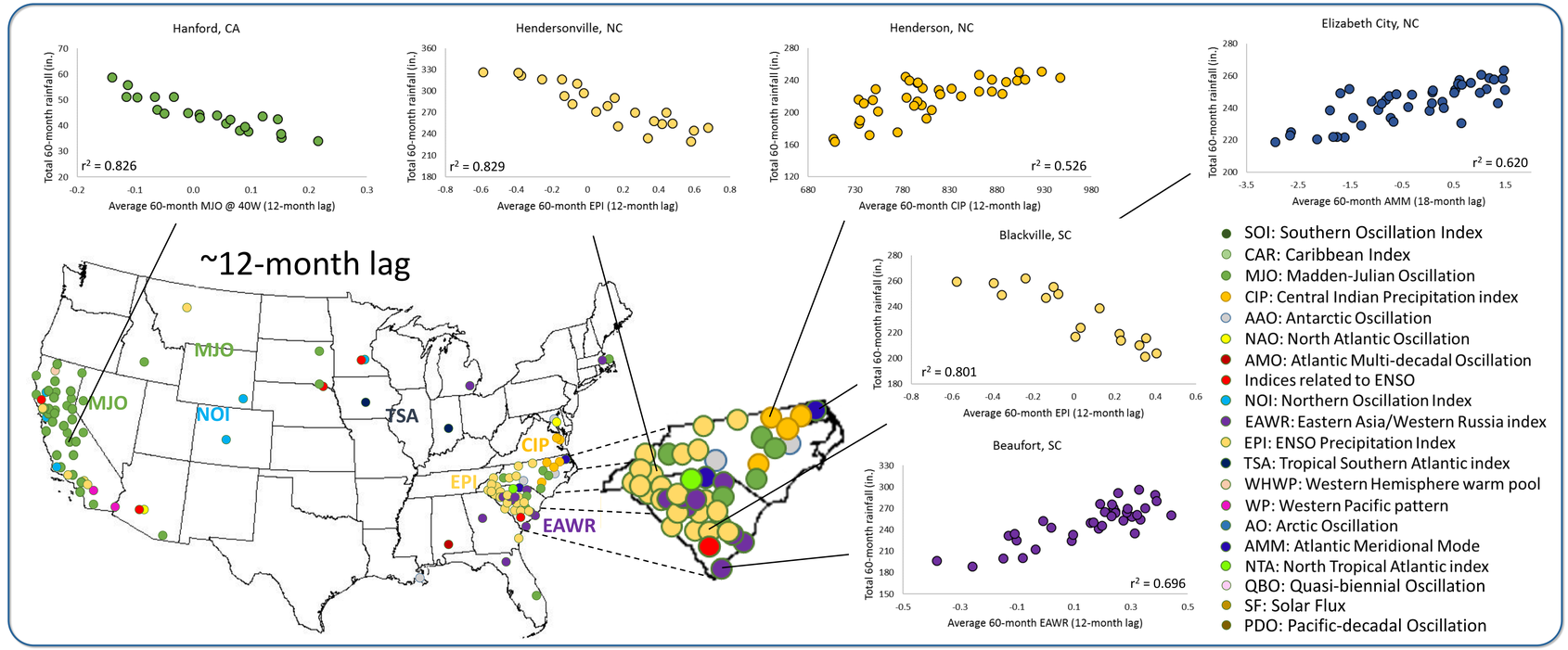
Jason Giovannettone (HydroMetriks, Ltd.)

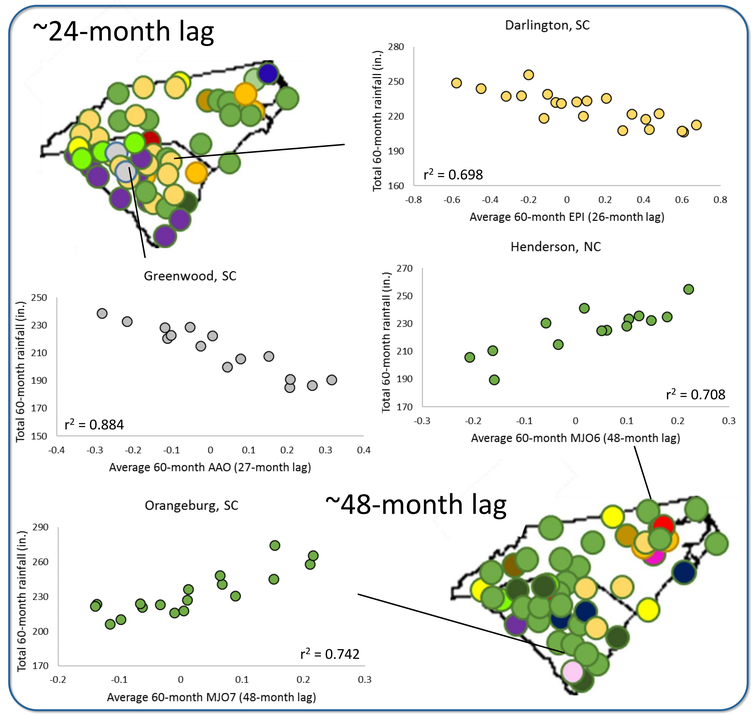
INTRODUCTION: Climate variability is the primary driver of weather as we know it. Therefore, in order to determine the impacts of global warming on the future weather for a particular region, the impacts of warming on the global climate indices that affect weather in that region need to be determined. The first step is to identify the climate indices that exhibit a high correlation with such weather variables as precipitation within the area or country of interest. This index analysis is currently being performed within the United States, particularly in North and South Carolina, using the HydroMetriks – Frequency Intensity Tool (Hydro-FIT), which is available at www.hydrometriks.com, and a method referred to here as long- (vs. short-) window analysis (illustrated below).

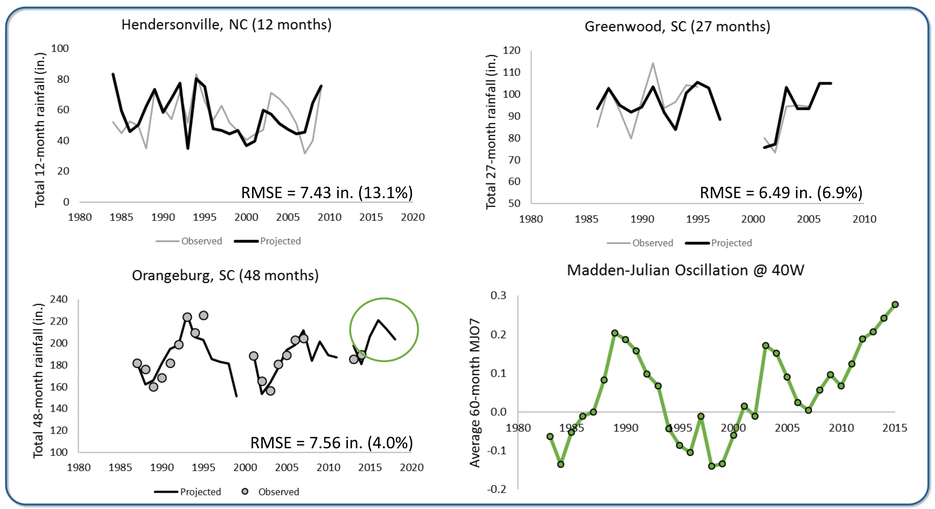


INDEX ANALYSIS: Long-window index analyses were initially performed using 12- to 18-month lag times for sites in the United States, with a particular focus on North and South Carolina, using 60-month rainfall totals and index averages. The colors on the larger map above and to the right identify the climate index that exhibits the strongest correlation at each site. Correlation graphs are shown for 5 sites; notice the dominance of the EPI in western North Carolina and all of South Carolina. This process was repeated for ~24-month and ~48-month lag times (right). Notice the dominance of the MJO at the longer lag time, which demonstrates the impact of the longer temporal cycles of the MJO (illustrated in the graph at the lower-right of this poster).

RAINFALL PROJECTIONS: Projections of rainfall were made for the cities of Hendersonville, NC, Greenwood, SC, and Orangeburg, SC, for future periods of 12 months, 27 months, and 48 months, respectively, using the relationships that were developed between rainfall and the EPI, AAO, and MJO, respectively (far right). When comparing projections to observations, the 12- and 27-month projections were not perfect, but did catch a majority of the wet and dry trends that occurred during the period analyzed. The 48-month projections matched observations substantially well at Orangeburg, SC, and can thus be used as a tool in determining the onset and persistence of wet and dry events; it is projected that the next four years will be markedly wetter than average.







SUMMARY: Climate variability was linked to rainfall by the identification of climate index correlations at several sites using lag times ranging from 12 to 48 months. It was found that the EPI and MJO indices have significant impacts on rainfall within North and South Carolina. The relationship between the MJO and 48-month rainfall in Orangeburg, SC, illustrates the ability to forecast persistence of extreme dry and wet conditions with lead times of up to 4 years.