Climate change is expected to increase the frequency, intensity and duration of droughts in all parts of the United States (US). Snow packs are disappearing earlier in the spring and summer, with reduced stream-flow. Lower reservoir levels, higher temperatures, and greater precipitation variability have been observed. Drought events in the US have threatened drinking water supplies for communities in Maryland and Chesapeake Bay as observed in 2001 through September 2002; Lake Mead in Las Vegas in 2000 through 2004; Peace River and Lake Okeechobee in South Florida in 2006; and Lake Lanier in Atlanta, Georgia in 2007.

ENSO influences the climate of Florida; where El Niño years tend to be cooler and wetter, while La Niña years tend to be warmer and drier than normal in the fall through the spring, with the strongest effect in the winter. Both prolonged heavy rainfall and drought potentially have impacts on land uses and many aspects of Florida's economy and quality of life. Drought indices could integrate various hydrological and meteorological parameters and quantify climate anomalies in terms of intensity, duration, and spatial extent, thus making it easier to communicate information to diverse users. Hence, understanding local ENSO patterns on regional scales and developing a new land use drought index in Florida are critical in agriculture and water resources planning and managements.

Current drought indices have limitations and drawbacks such as calculation using climate data from meteorological stations, which are point measurements. In addition, weather stations are scarce in remote areas and are not uniformly distributed. Currently used drought indices like the PDSI and the Standardized Precipitation Index (SPI) could not fully demonstrate the land use effects. Other limitations include no single index that addresses universal drought impact. Hence, there is a renewed interest to develop a new “Regional Land Use Drought Index (RLDI)” that could be applied for various land use areas and serve for short term water resources planning.

In this study, the first and second research topics investigated water and energy budgets on the specific and important land use areas (urban, forest, agriculture and lake) in the State of Florida by using the North American Regional Reanalysis (NARR) reanalysis data. NARR data were used to understand how drought events, El Niño, La Niña, and seasonal and inter-annual variations in climatic variables affect the hydrologic and energy cycle over different land use areas. The results showed that the NARR data could provide valuable, independent analysis of the water and energy budgets for various land uses in Florida. Finally, the high resolution land use (32km × 32km) adapted drought indices were developed based on the NARR data from 1979 to 2002. The new regional land use drought indices were developed from normalized Bowen ratio and the results showed that they could reflect not only the level of severity in drought events resulting from land use effects, but also La Niña driven drought impacts.

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