Value of Adaptive Drought Management for the ACF River Basin

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Abstract. In recent times, severe droughts in the southeast US occur every 6 to 10 years and last for up to 4 years. During such drought episodes, the ACF river basin supplies decline up to 50% of their normal levels, and water stresses increase rather markedly exacerbating stakeholder anxiety and conflicts. Drought management is the most critical piece of a sustainable water management plan that has eluded the region for more than two decades. As part of the ACF Stakeholder planning process, GWRI has developed new tools and carried out comprehensive assessments to provide quantitative answers to several important questions related to drought prediction and management: (i) Can drought and other climatic periods be reliably anticipated? What drought indices can support reliable, skillful, and longlead forecasts? (ii) What management objectives can drought/nondrought forecasts benefit? How should benefits/impacts be shared? (iii) What operational adjustments are likely to mitigate stakeholder impacts or increase benefits consistent with stakeholder expectations? Regarding drought prediction, a large number of indices were defined and tested at different basin locations and lag times. These included local/cumulative unimpaired flows (UIFs) at 10 river nodes (Buford, West Point, George, Montezuma, Albany, Bainbridge, [Bfrd+WP], [Bfrd+WP+Grg], [Flint+Below Grg], ACF at Chattahoochee); Mean Areal Precipitation (MAP) over the previous 10 subbasins; Standard Precipitation Index (SPI) over same 10 subbasins; Palmer Drought Severity Index (10 subbasins); Palmer Modified Drought Index (10 subbasins); Palmer ZIndex (10 subbasins); Palmer Hydrologic Drought Severity Index (10 subbasins); Total Soil Moisture GWRI Watershed Model (10 subbasins); Lower Soil Moisture GWRI Watershed Model (10 subbasins). Our findings show that all ACF subbasins exhibit good forecast skill throughout the year and with sufficient lead time. Index variables with high explanatory value include: previous UIFs, soil moisture states (generated by the GWRI watershed model), and PDSI. Regarding drought management, assessments with coupled forecastmanagement schemes demonstrate that the use of adaptive forecastmanagement procedures improves reservoir operations and meets basin demands more reliably. Such improvements can support better management of lake levels, and/or higher environmental and navigation flows, and/or higher dependable power generation hours, and/or better management of consumptive uses without adverse impacts on other stakeholder interests. However, realizing these improvements requires (1) operationalization and usage of adaptive reservoir management procedures (that explicitly incorporate forecasts into operations), and (2) stakeholder agreement on equitable benefit sharing.