UTILIZING TREE RING CHRONOLOGIES TO RECONSTRUCT PALEO STREAMFLOW: A CASE STUDY AT THE ALABAMA-FLORIDA STATE BORDER

by

MELANIE VINES

LEIGH TERRY, COMMITTEE CHAIR

GLENN TOOTLE

MATTHEW THERRELL

A THESIS

Submitted in partial fulfillment of the requirements for the degree of Master of Science in the Department of Civil, Construction, and Environmental Engineering in the Graduate School of the University of Alabama

TUSCALOOSA, AL

2020

ABSTRACT

This study examined the results from a statistical screening of tree-ring width records to evaluate the strength of the hydrological signal in dendrochronological records from the Southeastern region of the United States. We used United States Geological Survey (USGS) streamflow data from five gages near the Alabama-Florida border and 74 regional tree-ring chronologies to create and analyze seasonal flow reconstructions. Prescreening methods included correlation and temporal stability analysis of predictors to ensure practical and reliable reconstructions. Seasonal correlation analysis revealed that several regional tree-ring chronologies were significantly correlated ($p \leq 0.05$) with March–October streamflow, and stepwise linear regression was used to create the reconstructions. Reconstructions for all five rivers were considered statistically skillful ($R^2 \geq 0.50$), with lengths ranging from 144 to 782 years. The reconstructions were statistically validated using the following parameters: R^2 predicted validation, the sign test, the variance inflation factor (VIF), and the Durbin-Watson (D-W) statistic. The long-term streamflow variability was analyzed for the Choctawhatchee, Conecuh, Escambia, and Perdido Rivers and the recent (2000s) drought was identified as being the most severe in the instrumental record. The 2000s drought was also identified as being one of the most severe droughts when compared to the paleo-records developed for all five rivers.

LIST OF ABBREVIATIONS

CE	common era
CHKR	Choctawhatchee Ringwidth Standard
CHK_{EW}	Choctawhatchee Earlywood Standard
D-W	Durbin Watson statistic
EBE	Ebenezer Creek
$IOLA_1$	Iola Lake shifted forward +1 year)
ITRDB	International Tree Ring Database
MCM	million cubic meters
NOAA	National Oceanic and Atmospheric Administration
OCM_1	Ocmulgee River (shifted forward +1 year)
PC_1	Piney Creek (shifted forward +1 year)
SKY	Sky Lake Swamp
SUWR	Suwannee River
TRC	Tree Ring Chronology
USA	United States of America
USGS	United States Geological Survey
VIF	Variance Inflation Factor

ACKNOWLEDGEMENTS

I would like to take this opportunity to thank several people who have been instrumental in my life and in my work, and without whom I would not be where I am today. First and foremost, I would like to thank my parents, Gary and Christy Vines, for valuing my education and always supporting my endeavors. I would also like to thank my brother, Colby Vines, for always believing in me and cheering for me. I would like to thank my advisor, Dr. Leigh Terry, for giving me the opportunity for advanced work on my graduate degrees and for all of her continued support. None of this work would be possible had she not taken a chance on an eager undergraduate student curious about attending graduate school. I would like to thank my committee members, Dr. Glenn Tootle and Dr. Matthew Therrell, for allowing me the opportunity to work on this project and for their continued input and guidance throughout the process. I would like to thank Joni Corbin for all of her help working alongside me on this project. Her experience and advice have been invaluable to my thesis writing process. I would like to thank Dr. Emily Elliott for her input and insight in this project. Finally, I am so grateful to all of my friends and family who have supported me throughout this endeavor. This research would not be possible without your continued love and support.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 Research Context

Paleo reconstructions of streamflow are advantageous to water planners and policy makers, as reconstructions extend streamflow records far past the instrumental and historical period, elucidating natural variability and the associated climatic drivers within the system. However, to develop a reliable model of past streamflow conditions, the accuracy and length of the streamflow gage records is crucial for both validating and bias correcting the reconstructed values to that of the observed period. Although the USGS streamflow-gaging program began collecting streamflow data as early as 1887 CE, many gages are limited in complete records (Tootle and Piechota, 2005, Crockett et al., 2010; Tootle et al., 2018). Most streamflow gage data for rivers unimpaired by human activity consist of 60 years of data or less, which fails to capture the full range of climate variability, therefore limiting the reliability of the overall modeled streamflow. Tree ring chronologies (TRCs) often date back centuries and are used as a surrogate for hydroclimate data reconstruction to provide further historical insight (Stahle and Cleaveland 1992; Cook et al., 1999; Woodhouse and Lukas, 2006; Meko et al., 2007; DeRose et al., 2015; Stahle et al., 2019) as certain tree species are sensitive to the moisture signal of the region and serve as good proxies for streamflow reconstruction (Stahle et al., 1988; Cleaveland, 2000; Stahle et al., 2003; Seager et al., 2009; Crockett et al., 2010; Cook et al., 2013; Harley et al., 2017; Maxwell et al., 2017; Stahle et al., 2019).

1.2 Reconstructions in the Southeastern United States

While dendrochronological reconstructions of streamflow have been widely utilized in the Western United States due to the arid, moisture-limited environment (Stockton and Jacoby, 1976; Meko and Graybill, 1995; Meko et al., 2001; Gray et al., 2003; 2004; Woodhouse et al., 2006; Meko et al., 2007; Timilsena et al., 2007; Watson et al., 2009; Barnett et al., 2010; Wise, 2010; Margolis et al., 2011;

Anderson et al., 2012a, 2012b; DeRose et al., 2015), until recently, similar studies have been relatively limited in the Southeastern United States (Stahle and Cleaveland, 1992, 1994; Stahle et al., 1988; Pederson et al., 2012; Tootle et al., 2015; Harley et al., 2017; Therrell et al., 2018; Tootle et al., 2018; Anderson et al., 2019; Bregy et al., 2019; Stahle et al., 2019; Tootle and Kam, 2019; Kam et al., 2020). There is a perception among some researchers that using Southeast streamflow reconstructions to understand hydroclimatic patterns is a frivolous effort due to the relative abundance of rainfall, human impacts on regional waterways, and the discontinuity of historical data in the region (Grissino-Mayer, 2009). However, Crockett et al. (2010) established TRCs to be useful and statistically significant proxies even in the humid subtropical climate of northern Florida. For another example, Harley et al. (2017) demonstrated a strong reconstruction of streamflow in the Suwannee River over the period of 1550-2005 CE. Furthermore, multiple studies have utilized reconstructed streamflow in the Southeast to identify hydroclimatic extremes (i.e. floods and droughts) and the associated climatic drivers (e.g., Atlantic Multi-decadal Oscillation (AMO), El Nino Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO), of such events (McCabe et al., 2004; Tootle et al. 2004; 2005; Johnson et al. 2013; Kam and Sheffield 2016; Wang and Asefa 2017; Engstrom and Waylen 2018; Maleski and Martinez 2018; Sadeghi et al. 2019).

1.3 Research Rationale

Water management has reached a critical point in the state of Florida. It is estimated that Florida is the third most populous state in the USA, and currently the water supply is insufficient to support the growing population (Bureau, 2019). Additionally, there has been an ongoing legal conflict regarding water supplies between the states of Alabama, Florida, and Georgia, (the Tri-State Water Wars) since the 1980s CE (Bearden and Andreen, 2017). With the compounding impacts of climate change, interstate water policy conflict, and agricultural growth influencing fresh water supply, it is imperative to reconstruct and examine streamflow patterns of Florida's rivers.

The purpose of this thesis is to reconstruct streamflow at five different streamflow gages near the Alabama-Florida state border. Tree-ring chronologies from the surrounding region were used to reconstruct streamflow for the following rivers: the Choctawhatchee River near Newton, AL, the

Choctawhatchee River near Bruce, FL, the Conecuh River, the Escambia River, and the Perdido River as measured at the gages in Table 1. This intrastate hydrological reconstruction across the Alabama-Florida border provides valuable information regarding the water availability and urban population growth in these areas, while also highlighting the need for additional TRCs and intrastate streamflow reconstructions throughout the region.

2. SITE DESCRIPTION

This study examines four rivers along the state border region between Alabama and Florida (USA) at five different gages (Figure 1; http://waterdata.usgs.gov/nwis/sw). Additionally, a sixth gage is added on the Pascagoula River in Mississippi for regional comparison. The Choctawhatchee River flows from Alabama into Florida and was studied at the Newton, AL and Bruce, FL gages. Its headwaters are located in Barbour County, AL and it terminates in the Choctawhatchee Bay in Florida. The Conecuh River in Alabama was studied at the Brantley, AL gage. Its headwaters are located in Union Springs, AL, and it flows into the Escambia River in Florida. The Escambia River was studied at the Century, FL gage, and it flows into Pensacola Bay. The Perdido River constitutes the western border between the Florida Panhandle and Alabama. The Perdido River was studied at the Barrineau Park, FL gage. It originates in Escambia County, AL and empties into Perdido Bay.

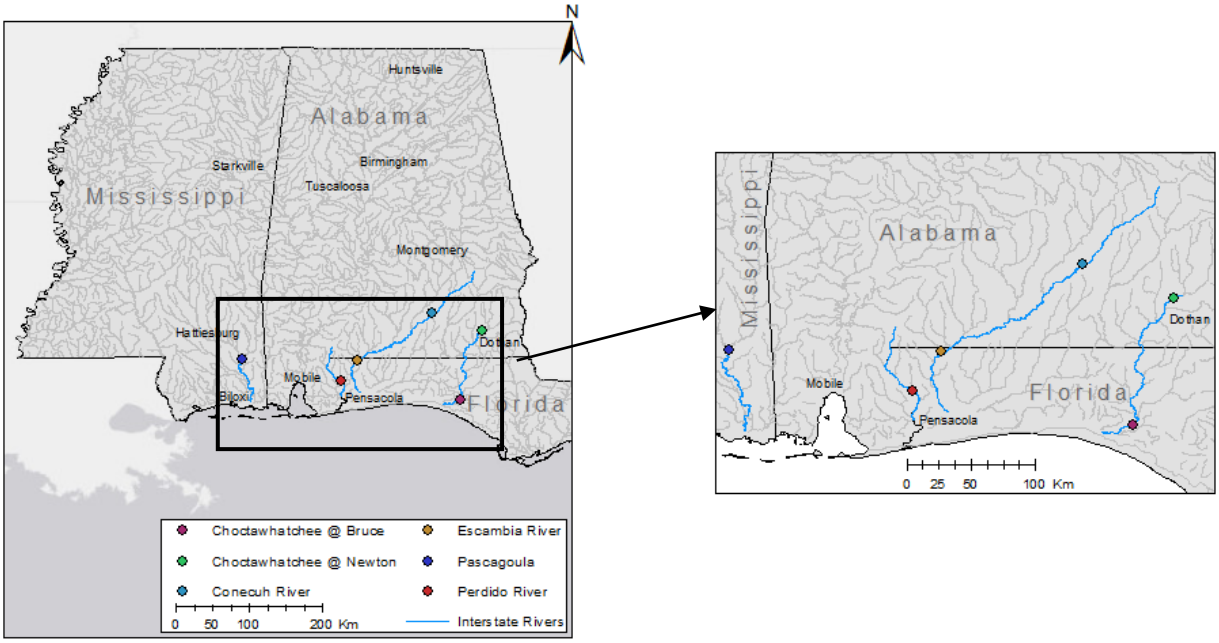


Fig. 1. Location map showing the 6 United States Geological Survey (USGS) streamflow gages.

This region is located along the Gulf of Mexico and is prone to hurricanes as well as seasonal rainfall from convective thunderstorms and frontal systems. The Florida panhandle region experiences approximately 1520-1650 mm (60-65 inches) of rainfall per year (https://www.ncdc.noaa.gov/ghcn/comparative-climatic-data) and is characterized as a humid subtropical climate. Details about the location and watershed encompassed by each gage studied are exhibited below in Table 1. The streamflow gauges selected have minimal anthropogenic influences and are considered unimpaired (Wallis et al. 1991; Slack et al., 2001).

Table 1 Descriptions of the United States Geological Service (USGS) streamflow gages used for reconstruction.

Station Name	Station ID	Latitude	Longitude	Drainage Area (km^2)	Period of Record
Choctawhatchee River near Newton, AL	02361000	31:20:34N	085:36:38W	1,777	1936-2016
Choctawhatchee River near Bruce, FL	02366500	30:27:03N	085:53:54W	11,355	1931-1982
Conecuh River at Brantley, AL	02371500	31:34:24N	086:15:06W	1,295	1938-2015
Escambia River near Century, FL	02375500	30:57:54N	087:14:03W	9,886	1935-2018
Perdido River at Barrineau Park, FL	02376500	30:41:25N	087:26:25W	1,020	1942-2017
Pascagoula River at Merrill, MS	2479000	30:58:40N	088:43:35W	17,068	1931-2019

3. METHODS

The methodology for developing streamflow reconstructions begins with the collection of streamflow (discharge) and TRC datasets. The discharge data were converted from flowrate to seasonal volume and used as the dependent variable in regression models. Tree-ring chronology data were the independent variable in the regression model. Prior to inputting the TRC data into the regression model, prescreening (correlation and stability) was performed. Regression models were then developed, and model fit (skill) was evaluated.

3.1. Streamflow (United States Geological Survey (USGS))

Streamflow data for five rivers near the Alabama-Florida border and one gage near the Louisiana-Mississippi border for regional comparison were obtained from the United States Geological Survey (USGS) website, via the National Water Information System (http://waterdata.usgs.gov/nwis/sw). Raw data can be found in the appendix. The USGS gages contained little missing data and had an acceptable record to calibrate with the regional tree-ring chronologies. The gages presented in this study are located on the Choctawhatchee River (near Newton, AL and Bruce, FL), the Conecuh River, the Escambia River, and the Perdido River (Table 1). These rivers are located in or near the Panhandle region of Florida and constitute important streamflow systems in the region. The Conecuh River flows into the Escambia River, and the Choctawhatchee gage in Newton, AL is upstream of the gage in Bruce, FL, making the streamflow patterns in these gages highly correlated throughout the study. Additionally, the nearby Pascagoula River in Mississippi was investigated for regional comparison. Monthly cumulative flow in million cubic meters (MCM) was used.

3.2 Tree-Ring Chronologies

Seventy-four TRCs from within and around the Southeastern U.S. were used in our analyses. Sixty-one of these were used previously in Harley et al. (2017), six others were retrieved from the

International Tree-Ring Data Bank (ITRDB; https:// www.ncdc.noaa.gov/data-access/paleoclimatology-data/datasets/ tree-ring), which is maintained by the National Oceanic and Atmospheric Administration (NOAA) Paleoclimatology Program, and another seven were developed recently by co-author Therrell (Stahle and Cleaveland, 2002; M. Therrell, personal communication). The program COFECHA was used evaluate the cross-dating accuracy of these TRCS, and the program ARSTAN was used to smooth the chronologies and eliminate outlier data and create a time series of unitless standardized ring width indices (Harley et al., 2017). In addition to year to year comparison, all TRCs were shifted forward one year to account for streamflow record correlating with tree ring growth in the following year, denoted by a +1, and the 74 shifted TRCs were used in analysis for a total of 148 TRC variables.

3.3. Predictor Prescreening Methods

Two prescreening methods were used to identify the most suitable TRCs to use as predictors for the reconstruction models. We selected the spring to early fall (March–October; M-O) period of streamflow to analyze, as it has been found to be optimal for streamflow-TRC correlation in the Southeastern United States (Harley et al., 2017). During this season (M-O) the bulk of streamflow recharge in this region is due to rainfall associated with cold fronts, convective thunderstorms, and tropical cyclone activity (Harley et al., 2017). The overlapping time periods for March–October streamflow and all 148 TRCs were correlated using Minitab, and the TRCs with positive, significant R-values ($p \leq 0.05$) were retained. This initial calibration period stretched from the first year of streamflow data to the earliest end date of an included TRC. As statistically insignificant TRCs were eliminated, the calibration period changed to reflect the end date of the retained TRCs. This correlation was performed repeatedly with retained TRCs while adjusting the calibration period as necessary until it remained stable.

The second pre-screening method involved temporal stability analysis, which consisted of performing correlation over 30-year moving windows, between the various streamflow seasons and residual chronologies, following Biondi and Waikul (2004). No chronologies were found to contain negative 30-year correlation values with seasonal flow, therefore all TRCs were considered and were

retained for this analysis. Stability analysis ensures that reliable and practical streamflow reconstructions are generated.

3.4. Reconstruction Methodology

Because all the available TRCs end before the currently available gage data, model calibration windows were controlled by the date that streamflow data were first collected at each gage and the end date of each TRC. The beginning dates of the calibration windows ranged from 1931 to 1942 CE (Table 1) and the end dates ranged from 1982 to 2011 CE (Table 2). The statistical fitness of the TRCs to estimate streamflow was tested using a forward and backward (standard) stepwise regression model using Minitab. The model adds and removes predictors until all variables not in the model have p-values that are greater than the specified alpha-to-enter value and when all variables in the model have p-values that are less than or equal to the specified alpha-to-remove value. Following the procedure of Woodhouse et al. (2006), the F-level for a predictor chronology had to have a maximum p-value of 0.05 for entry and 0.10 for retention in our stepwise regression model.

Table 2 March-October streamflow reconstruction statistics and standard tree ring chronologies (TRCs) used in each model.

Gage	Reconstruction Period	R^2	R^2 (p)	VIF	D-W	Sign Test +/-	TRCs Retained
Choctawhatchee at Newton	1203-1985	0.56	0.48	1.0	2.2	26/24	EBE, CHK, OCM_1
Choctawhatchee at Bruce	1238-1982	0.51	0.47	1.2	2.3	24/28	SKY, CHK
Conecuh	1652-1983	0.51	0.41	1.1	2.1	23/23	PC_1 CHK_{EW}, OCM_1
Escambia	1725-1993	0.57	0.48	1.2	1.9	30/29	CHK_{EW}, SUWR, SKY
Perdido	1867-2011	0.50	0.43	1.1	2.0	39/31	CHK_{EW}, $IOLA_1$
Pascagoula	1238-1985	0.50	0.42	1.1	2.1	31/24	SKY, CHK_{EW}, OCM_1

CHK= Choctawhatchee Ringwidth Standard; CHK_{EW}= Choctawhatchee Earlywood Standard; EBE= Ebenezer Creek; $IOLA_1$= Iola Lake +1; OCM_1= Ocmulgee River +1; PC_1 =Piney Creek; SKY= Sky Lake; SUWR=Suwannee River

Standard statistical measures were used to establish the statistical skill of each streamflow reconstruction (Anderson et al., 2019). The R^2 value quantified the amount of variance in each model. The R^2-predicted was calculated in Minitab using leave-one-out-cross-validation, in which a single year or observation is removed when fitting the model. As a result, the prediction errors are independent of the predicted value at the removed observation (Garen, 1992). The Variation Inflation Factor (VIF) indicates the extent to which multicollinearity is present in a regression analysis. Generally, a VIF value close to 1.0 indicates low correlation between predictors and is ideal for a regression model (O'Brien, 2007). The Durbin–Watson (D–W) statistic was used to analyze the autocorrelation structure of model residuals (Durbin and Watson, 1950). The sign test, a nonparametric procedure to count the number of agreements and disagreements between instrumental and reconstructed flow, was used for additional model validation.

4. RESULTS

After correlation, the TRCs containing positive, significant R-values ($p \leq 0.05$) were retained. The number of retained TRCs varied by streamflow gage, but out of the original 148 TRCs, 14 TRCs were retained in the Perdido River model, 17 were retained in the Choctawhatchee River (at Bruce, FL) model, 20 were retained in the Escambia River model, and 21 were retained in the Choctawhatchee River (at Newton, AL) and Conecuh models. Following the stability analysis (30-year window), the final number of chronologies introduced into the stepwise linear regression model remained the same, ranging from 14 to 21.

For all streamflow gages, the most feasible calibration models and reconstructions were chosen (Table 2). Feasibility was based on the length of the reconstruction, the overall variance explained, and the statistical skill of the model. The calibration models listed in Table 2 were considered to be statistically skillful ($R^2 \geq 0.50$). The D–W test for autocorrelation in the residuals from the regression showed that the autocorrelation was not significant for any of the models, indicating that the residuals were random and the models were appropriate (Draper and Smith, 1981). VIF values for all models were within the acceptable ranges (1.0-1.2) and the sign test results were insignificant ($p \geq 0.10$) for all the calibration models, indicating that the models were balanced with no significant bias.

TRCs retained by the calibration models were distributed across the Southeast, and most retained TRCs consisted of data from *Taxodium distichum* (*L.*) Rich. (bald cypress) (Table 3). As the longest-lived tree species in eastern North America, *T. distichum* (bald cypress) has been shown to provide a unique annual archive of multi-millennial paleo-hydroclimate conditions (Stahle et al., 1988; Stahle and Cleaveland 1992; 1994; 2002; Harley et al., 2017; Stahle et al., 2019), and thus is ideal for developing

these long reconstructions. Three TRCs were retained in the Choctawhatchee (Newton), Conecuh and Escambia River models, and two were retained by the Choctawhatchee (Bruce) and Perdido River models.

Table 3 Tree ring chronologies (TRCs) retained in streamflow reconstruction models.

Code	ITRDB Code	Chronology	State	Species	Period of Record
CHK_{EW}	FL001	Choctawhatchee Earlywood Standard	FL	TADI	920-2014
CHK	FL001	Choctawhatchee Ringwidth Standard	FL	TADI	920-2014
EBE	GA003	Ebenezer Creek	GA	TADI	990-1985
OCM_1	GA004	Ocmulgee River +1	GA	TADI	1203-1985
SKY	MS003	Sky Lake Swamp	MS	TADI	1238-2010
PC_1	TN005	Piney Creek +1	TN	QUAL	1652-1983
SUWR	FL005	Suwannee River +1	FL	QULY	1725-1993
$IOLA_1$		Iola Lake +1	FL		1867-2011

TADI=*Taxodium distichum* (bald cypress); QUAL=*Quercus alba L.* (white oak); QULY=*Quercus Iyrata Water* (overcup oak); ITRDB=International Tree Ring Database

All five streamflow gages demonstrate comparable patterns in their reconstructions, indicating a common climatic pattern in the AL-FL region (Figures 2a, 2b, 2c, 3). At all four gages reconstructed to the early 1800s, a notable pluvial event was observed in the reconstruction circa 1830 CE, followed shortly after by a severe drought in the mid-1800s. The reconstructed and observed data for the downstream gages along the rivers located in Florida (Choctawhatchee at Bruce, Escambia, and Perdido) were then standardized such that they could be compared against each other (Figure 3). The Conecuh and Choctawhatchee at Newton gages were not included in this analysis because the Conecuh streamflow is highly correlated with the Escambia gage, and the Choctawhatchee at Newton streamflow is highly correlated with the Choctawhatchee at Bruce gages. The three downstream gages followed a very similar pattern over the overlapping 150 year period. Despite recovery in streamflow in the 1990s in the Perdido River, all three rivers appear to be in a drought state now, as the streamflow has been below average for the last 20-30 years (Figure 3a, 3b).

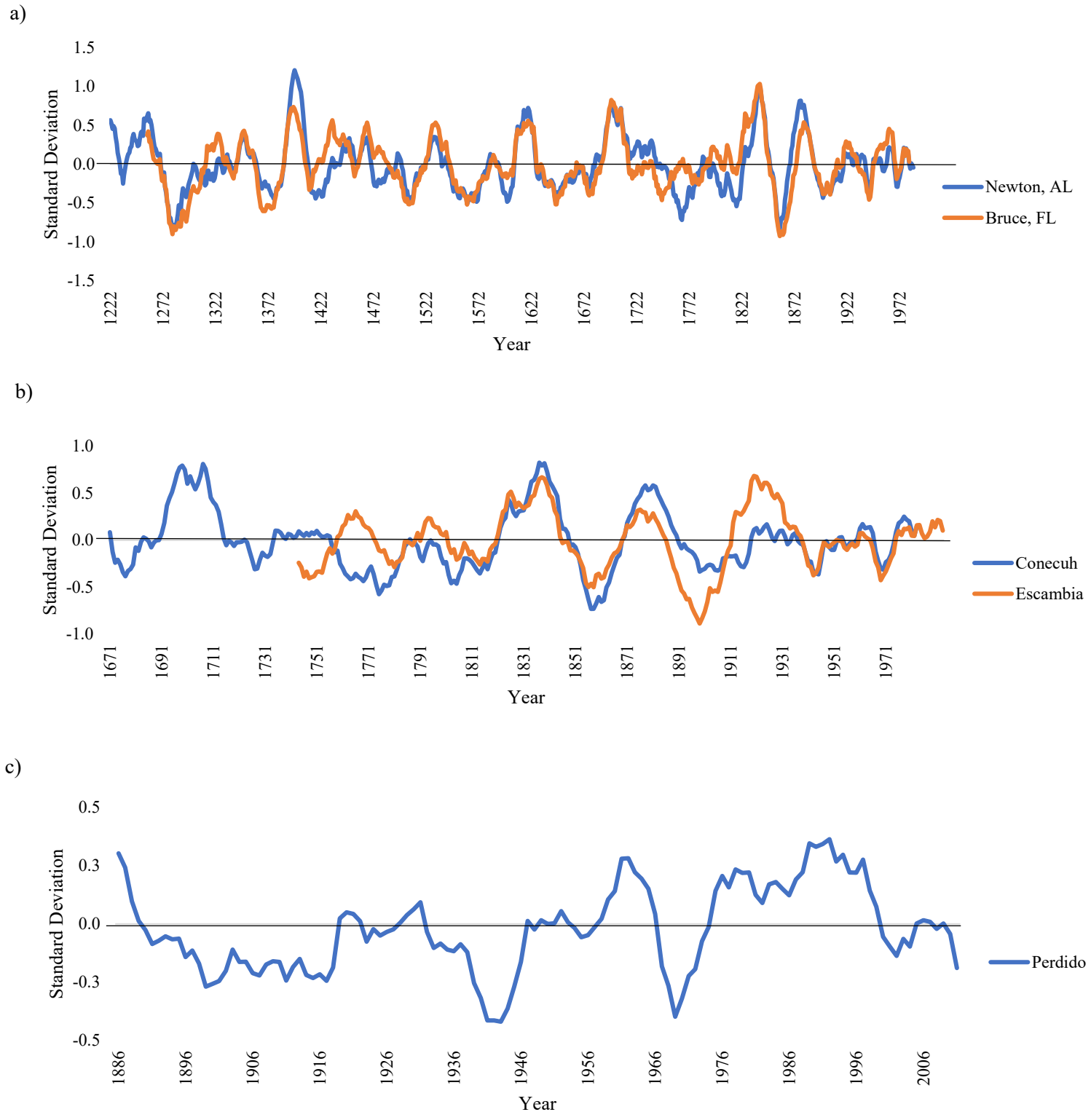
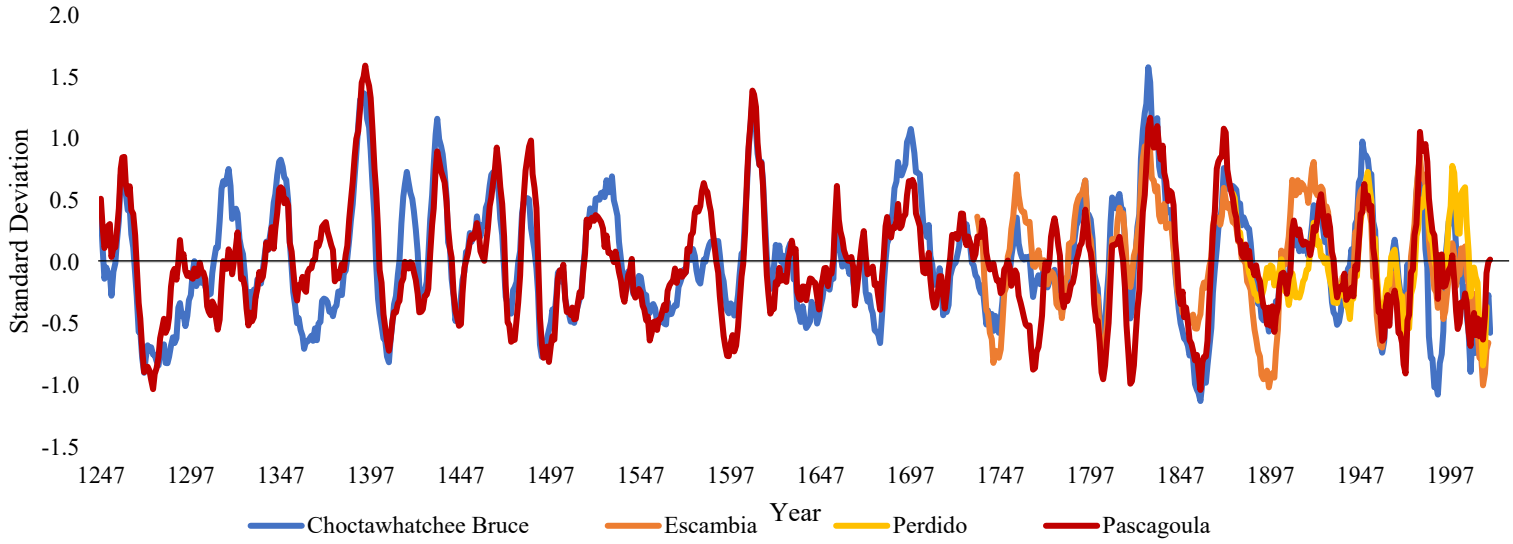


Fig. 2. Standardized streamflow reconstructions for the a) Choctawhatchee River at gages in Newton, AL (1222-1985) and Bruce, FL (1257-1982), b) Conecuh River (1671-1983) and Escambia River (1744-1993), and c) Perdido River (1885-2011). All datasets have been smoothed with a 20-year filter.

For comparison to a river system outside of the AL-FL intrastate system, and to better understand the potential hydroclimatic drivers throughout the region, a streamflow reconstruction was also performed following the same techniques for the Pascagoula River gage in Merrill, MS west of our study area (Figure 1 Table 1, 2). Like all other reconstructions in this study, streamflow reconstructions for the Pascagoula River were standardized, and therefore made comparable to recent observed period (post-1980s CE), as well as the reconstructions of intrastate rivers along the AL-FL border (Figure 3, Table 2). Contrary to the rivers along the AL-FL border, the Pascagoula River demonstrates a recovery in streamflow over the last 20-30 years (Figure 3).

a)



b)

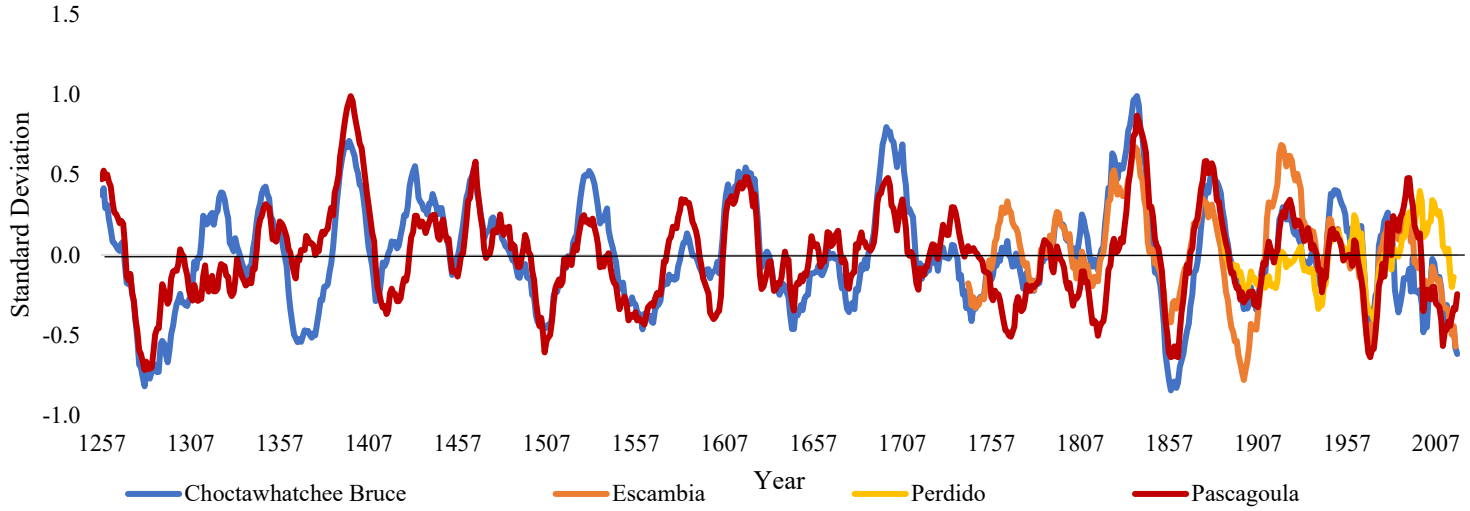


Fig. 3. Standardized reconstructed and observed streamflow for the Choctawhatchee, Escambia, Perdido, and Pascagoula rivers (1318-2019) smoothed with a a) 10-year end year filter (1327-2019) and b) 20-year end year filter (1337-2019).

5. DISCUSSION

Clear patterns in hydroclimatic regimes emerge from the streamflow reconstructions in each of these different rivers, as all five of the reconstructions indicate similar hydroclimatic extremes within the paleo-record. As indicated in the 10- and 20-year filtered reconstruction data (Figure 3a, 3b) periods of multi-year pluvial activity are indicated in the 1390s, 1600s to 1610s, 1690s to 1700s, 1820s to 1840s (including the 1830 CE event) and 1860s to 1880s. While streamflow reconstructions that extend back to the early 1300s are limited within the region, historical and reconstructed records from rivers in Florida and Georgia show that the late 17th century, early and late 19th century experienced intense pluvial periods (Seager et al., 2009; Pederson et al., 2012; Harley et al., 2017; Kam et al. 2020).

While periods of intense pluvial events are clearly present within the reconstructions, multi-year droughts are indicated throughout the record and are validated by other similar findings throughout the region. Two of the more extreme periods of dryness and drought within the record occur between ~1840-1860 and ~1890-1910. The period from 1840-1860 is identified regionally (Henderson, 2006; Harley et al. 2017; Kam et al. 2020) and is of particular interest due to the abrupt shift in hydroclimatic conditions from intense drought to extreme moisture and pluvials in the later 1860s. The subsequent period of drought from ~1890-1910 marks a period of dryness noted in multiple hydroclimate reconstructions throughout the Southeastern U.S. (Stahle and Cleveland 1992; Harley et al. 2017; Kam et al., 2020). Climate models presented in Herweijer et al. (2006) indicate that this period of extreme drought is likely a response to cold tropical Pacific sea surface temperature (SST) forcing.

The recent drought (since approximately 2000 CE) in the Choctawhatchee, Escambia, and Perdido Rivers ranks as one of the most severe in the reconstructed paleo record. At each gage we identified a recent 10-year drought period that ranked in the top 5% in drought severity. The 2008 CE (1999-2008) drought in the Choctawhatchee River and the 2015 CE (2006-2015) and 2016 CE (2007-

2016) droughts in the Escambia and Perdido Rivers ranked in the top 5% most severe droughts in the reconstruction, only exceeded by droughts in the mid- and late-19th century. When examining the 20-year filtered results, the Conecuh, Escambia, and Perdido reconstructions again display a notable decline since 2000 CE, with several 20-year drought periods ending since 2000 in the top 10% of severity. This evidence suggests that Florida is experiencing a significant decline in streamflow, and yet specific drivers of this based on this study are not necessarily evident.

This period of multi-decadal streamflow decline has been observed throughout other states in the Southeastern U.S. and appears to be associated with the confluence of multiple La Niña events (5) during a warm phase of the Atlantic Multidecadal Oscillation (AMO), with an inverse relationship between mid-Atlantic SST and streamflow over the same period (Sadeghi et al., 2019). Multiple studies have shown the association between Southeastern U.S. water resources, AMO, ENSO, and PDO conditions (McCabe et al., 2004; Tootle et al. 2004; 2005; Johnson et al. 2013; Kam and Sheffield 2016; Wang and Asefa 2017; Engstrom and Waylen 2018; Maleski and Martinez 2018; Sadeghi et al. 2019), indicating the influence of both high and low frequency climate teleconnections within the region.

Interestingly, the Pascagoula River displays a strong recovery in streamflow during the 2000s when compared to the AL-FL interstate rivers in both the 10-year and 20-year end-filter analyses. This finding is consistent with Ho et al. (2017), which suggests that a shift in climate exists along the Alabama-Mississippi state border. It is possible that increased moisture is found in the western regions of the Gulf of Mexico's coastal rivers compared to the eastern regions. Further work investigating the hydroclimatic drivers and teleconnections are needed to elucidate the spatial variability in streamflow conditions across the Northern Gulf of Mexico. The end dates of these reconstructions reaffirm the need for new and updated TRCs in the studied region. To develop strong correlations and reconstruction models and to better predict streamflow variability, it is imperative that the ITRDB be continually updated and expanded. The new and updated chronologies developed by co-authors Harley, Maxwell, and Therrell, are part of an ongoing effort by multiple research teams to update and add new chronologies to the ITRDB (Therrell and Stahle, 2011; Trouet et al., 2016; Tucker et al., 2018; Strange et al., 2020).

Additionally, most reconstructions currently published in the region do not extend past the early 2000s (Harley et al., 2017, Pederson et al., 2012). For example, a reconstruction of the Suwannee River in Florida, east of our study area, (Harley et al., 2017) demonstrated evidence of low streamflow in the Suwannee River since 2000, but the article did not discuss data more recent than 2005 CE. Thus, the Suwannee reconstruction cannot be compared to the 2015 CE drought observed in this study. Similarly, Pederson et al. (2012) reconstructs drought in the Apalachicola-Chattahoochee-Flint river basin. This study demonstrated evidence of drought since 2000, but the reconstruction ended in 2010, so the period from 2010-2019 is not observed.

Knowledge of previous years' droughts and pluvial events are critical when making water policy decisions. With the combined stressors of population growth, interstate water wars, and climate change, it is imperative for Florida water managers and planners to have a full understanding of hydrologic parameters in the region. Instrumental observations for the five streamflow gages used in this study began in the 1930-1940s CE, but the statistically skillful reconstructions presented in this study provide insight into streamflow as far back as the 1200s CE. We recommend additional paleo-reconstructions of interstate and coastal rivers in the southeastern United States be conducted to provide more insight into historical climate patterns in this region.

6. CONCLUSION

Tree ring chronologies serve as a valuable proxy for reconstructing paleo streamflow records. Reconstructions are important for scientists and policy makers as they allow for the observation of patterns in streamflow over a longer period than is provided by the instrumental record. Such reconstructions were not as common in the humid subtropical southeastern United States as compared to the arid western United States, yet recently reconstructions in the southeastern US are gaining traction. This study examined the paleo record of streamflow in four rivers along the Alabama-Florida state border at five streamflow gages: the Choctawhatchee River (at the Newton, AL and Bruce, FL gages), the Conecuh River, the Escambia River, and the Perdido River. The reconstructions for all five instrumental gages demonstrated similar patterns that were comparable to those observed in other studies in the region.

When comparing the paleo record to more recent data in the downstream gages, it became evident that the Alabama-Florida state border region has been in a drought since approximately 2000 CE. At least one 10-year period was identified in each reconstruction as ranking in the top 5% most severe droughts in the paleo record. This observed streamflow decline is consistent with noted variations in streamflow across other states in the Southeast (Sadeghi et al., 2019) and correlates with AMO, PDO, and ENSO climatic drivers. However, it was noted that streamflow recovery was observed during that same period in the Pascagoula River in Mississippi, which was reconstructed for regional comparison.

Further investigation into the climate drivers and teleconnections across the southeastern United States and the Gulf of Mexico will be necessary to understand this regional shift in water availability. Future work in this region should also consist of adding and extending TRCs available in the ITRDB such that robust reconstruction models can be created and climate patterns better understood.

REFERENCES

Anderson, S., Moser, C. L., Tootle, G. A., Grissino-Mayer, H. D., Timilsena, J., & Piechota, T. (2012a). Snowpack reconstructions incorporating climate in the upper Green River Basin (Wyoming). *Tree-ring research*, *68*(2), 105-114.

Anderson, S., Ogle, R., Tootle, G., & Oubeidillah, A. (2019). Tree-Ring reconstructions of streamflow for the Tennessee valley. *Hydrology*, *6*(2), 34.

Anderson, S., Tootle, G., & Grissino-Mayer, H. (2012b). Reconstructions of Soil Moisture for the Upper Colorado River Basin Using Tree-Ring Chronologies 1. *JAWRA Journal of the American Water Resources Association*, *48*(4), 849-858.

Barnett, F. A., Gray, S. T., & Tootle, G. A. (2010). Upper green river basin (United States) streamflow reconstructions. *Journal of Hydrologic Engineering*, *15*(7), 567-579.

Bearden, B.L., Andreen, W.L., 2017. Update on the Tri-State Water Wars. The Wave. 37(4), 15-21.

Biondi, F., & Waikul, K. (2004). DENDROCLIM2002: A C++ program for statistical calibration of climate signals in tree-ring chronologies. *Computers & geosciences*, *30*(3), 303-311.

Bregy, J. C., Roberts, T., Elliott, E. A., Therrell, M. D., Lampman, C. R., Maxwell, J. T., & Harley, G. L. (2019). Utilizing Anatomical Anomalies in Taxodium distichum to reconstruct Tropical Cyclone Activity along the Northern Gulf of Mexico. *AGUFM*, *2019*, PP11C-1397.

Bureau, US Census. (2019, December 30). *State Population Totals: 2010-2019*. The United States Census Bureau. www.census.gov/data/tables/time-series/demo/popest/2010s-state-total.html.

Cleaveland, M. K. (2000). A 963-year reconstruction of summer (JJA) stream flow in the White River, Arkansas, USA, from tree-rings. *The Holocene*, *10*(1), 33-41.

Cook, E. R., Palmer, J. G., Ahmed, M., Woodhouse, C. A., Fenwick, P., Zafar, M. U., ... & Khan, N. (2013). Five centuries of Upper Indus River flow from tree rings. *Journal of hydrology*, *486*, 365-375.

Cook, E., Meko, D.M., Stahle, D.W., Cleaveland, M., 1999. Drought reconstructions for the continental United States. J. Clim. 12, 1145–1162.

Crockett, K., Martin, J.B., Grissino-Mayer, H.D., Larson, E.R., Mirti, T., 2010. Assessment of tree rings as a hydrologic record in a humid subtropical environment. J. Am. Water Resour. Assoc. 46 (5), 919–931.

DeRose, R.J., Bekker, M.F., Wang, S.Y., Buckley, B.M., Kjelgren, R.K., Bardsley, T., Allen, E.B., 2015. A millennium-length reconstruction of Bear River stream flow, Utah. J. Hydrol. http://dx.doi.org/10.1016/j.jhydrol.2015.01.014.

Draper, N.R.; Smith, H. Applied Regression Analysis, 2nd ed.; John Wiley: New York, NY, USA, 1981; p. 736.

Durbin, J., & Watson, G. S. (1950). Testing for serial correlation in least squares regression: I. *Biometrika*, *37*(3/4), 409-428.

Engström, J., Waylen, P., 2018. Drivers of long-term precipitation and runoff variability in the southeastern USA. Theoretical and Applied Climatology. 131 (3–4), 1133–1146.

Garen, D. C. (1992). Improved techniques in regression-based streamflow volume forecasting. *Journal of Water Resources Planning and Management*, *118*(6), 654-670.

Gray, S. T., S. T. Jackson, and J. L. Betancourt, 2004. Tree-ring based reconstructions of interannual to decadal-scale precipitation variability for northeastern Utah. Journal of the American Water Resources Association 40:947–960.

Gray, S.T., J.L. Betancourt, C.L. Fastie, and S.T. Jackson, 2003. Patterns and Sources of Multidecadal Oscillations in Drought- Sensitive Tree-Ring Records From the Central and Southern Rocky Mountains. Geophysical Research Letters 30:491-494, doi:10.1029/2002GL016154.

Grissino-Mayer, H. D. (2009). Preface an introduction to dendroarchaeology in the southeastern United States. *Tree-Ring Research*, *65*(1), 5-10.

Grissino-Mayer, H.D., Fritts, H.C., 1997. The international tree-ring data bank: an enhanced global database serving the global scientific community. Holocene 7 (2), 235–238.

Gudmundsson, L., Bremnes, J. B., Haugen, J. E., & Engen-Skaugen, T. (2012). Downscaling RCM precipitation to the station scale using statistical transformations—A comparison of methods. Hydrology and Earth System Sciences, 16(9), 3383–3390.

Harley, G. L., Maxwell, J. T., Larson, E., Grissino-Mayer, H. D., Henderson, J., & Huffman, J. (2017). Suwannee River flow variability 1550–2005 CE reconstructed from a multispecies tree-ring network. *Journal of Hydrology*, *544*, 438-451.

Henderson, J., 2006. Dendroclimatological analysis and fire history of longleaf pine (Pinus palustris Mill.) in the Atlantic and Gulf Coastal Plain. Ph.D. Dissertation, The University of Tennessee, Knoxville, 463.

Herweijer, C., Seager, R., & Cook, E. R. (2006). North American droughts of the mid to late nineteenth century: a history, simulation and implication for Mediaeval drought. The Holocene, 16(2), 159-171.

Ho, M., Lall, U., Sun, X., & Cook, E. R. (2017). Multiscale temporal variability and regional patterns in 555 years of conterminous US streamflow. *Water Resources Research*, *53*(4), 3047-3066.

ITRDB (International Tree Ring Data Bank), 2020. Tree-Ring Data Search. https://www.ncdc.noaa.gov/data-access/paleoclimatology-data/datasets/tree-ring, accessed June, 2020.

Johnson, N.T., Martinez, C.J., Kiker, G.A., Leitman, S., 2013. Pacific and Atlantic Sea-surface temperature influences on streamflow in the Apalachicola–Chattahoochee–Flint River Basin. Journal of Hydrology. 489, 160–179.

Kam, J.H., Sheffield, J., 2016. Changes in the low flow regime over the eastern United States (1962–2011): variability, trends, and attributions. Climate Change. 135 (3-4), 639–653.

Kam, J.H., Tootle, G.A., Therrell, G.A., Elliott, E.A., 2020. Future Streamflow in a Southeastern US watershed incorporating a Paleo Perspective - St. Marys River, Florida. Journal of Climate, *In Preparation*.

Maleski, J.J., Martinez, C.J., 2018. Coupled impacts of ENSO, AMO and PDO on temperature and precipitation in the Alabama–Coosa–Tallapoosa and Apalachicola–Chattahoochee–Flint River Basins. International Journal of Climatology. 38 (9) https://doi.org/10.1002/joc.5401.

Margolis, E.Q., Meko, D.M., Touchan, R., 2011. A tree-ring reconstruction of streamflow in the Santa Fe River, New Mexico. J. Hydrol. 397 (1), 118–127.

Maxwell, R. S., Harley, G. L., Maxwell, J. T., Rayback, S. A., Pederson, N., Cook, E. R., ... & Rayburn, J. A. (2017). An interbasin comparison of tree-ring reconstructed streamflow in the eastern United States. *Hydrological processes*, *31*(13), 2381-2394.

McCabe, G.J., Palecki, M.A., Betancourt, J.L., 2004. Pacific and Atlantic Ocean influences on multidecadal drought frequency in the United States. Proceedings of the National Academies of Sciences U.S.A. 101 (12), 4136–4141.

Meko, D.M., Graybill, D.A., 1995. Tree-ring reconstruction of upper Gila River discharge. J. Am. Water Resour. Assoc. 31 (4), 605–616.

Meko, D.M., M.D. Therrell, C.H. Baisan, and M.K. Hughes, 2001. Sacramento River Flow Reconstructed to A.D. 869 From Tree Rings. Journal of American Water Resources Association 37:1029-1039.

Meko, D.M., Woodhouse, C.A., Baisan, C.A., Knight, T., Lukas, J.J., Hughes, M.K., Salzer, M.W., 2007. Medieval drought in the upper Colorado River Basin. Geophys. Res. Lett. 34 (10), L10705. http://dx.doi.org/10.1029/2007GL029988.

National Oceanic and Atmospheric Administration (NOAA): Comparative Climatic Data. Available online: https://www.ncdc.noaa.gov/ghcn/comparative-climatic-data (accessed on 23 September 2020).

National Weather Information System (NWIS): USGS surface-water data for the nation. Available online: http://waterdata.usgs.gov/nwis/sw (accessed on 16 June 2020).

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & quantity*, *41*(5), 673-690.

Pederson, N., Bell, A.R., Knight, T.A., Leland, C., Malcomb, N., Anchukaitis, K.J., Riddle, J., 2012. A long-term perspective on a modern drought in the American Southeast. Environ. Res. Lett. 7 (1), 014034. http://dx.doi.org/10.1088/1748- 9326/7/1/014034.

Sadeghi, S., G. Tootle, E. Elliott, V. Lakshmi, M. Therrell, J. Kam and B. Bearden, 2019. Atlantic Ocean Sea Surface Temperatures and Southeast United States streamflow variability: Associations with the recent multi-decadal decline. Journal of Hydrology, 576 (2019) 422-429.

Seager, R., Tzanova, A., & Nakamura, J. (2009). Drought in the southeastern United States: causes, variability over the last millennium, and the potential for future hydroclimate change. *Journal of Climate*, *22*(19), 5021-5045.

Slack, J., Lumb, A. M., & Landwehr, J. M. (2001). HCDN: Streamflow Data Set, 1874 - 1988 USGS Water-Resources Investigations Report 93-4076. Retrieved October 27, 2020, from https://pubs.usgs.gov/wri/wri934076/region03.html.

Stahle, D. W., Cook, E. R., Cleaveland, M. K., Therrell, M. D., Meko, D. M., Grissino-Mayer, H. D., ... & Luckman, B. H. (2000). Tree-ring data document 16th century megadrought over North America. *Eos, Transactions American Geophysical Union*, *81*(12), 121-125.

Stahle, D. W., Edmondson, J. R., Howard, I. M., Robbins, C. R., Griffin, R. D., Carl, A., ... & Torbenson, M. C. A. (2019). Longevity, climate sensitivity, and conservation status of wetland trees at Black River, North Carolina. *Environmental Research Communications*, *1*(4), 041002.

Stahle, D. W., Fye, F. K., & Therrell, M. D. (2003). Interannual to decadal climate and streamflow variability estimated from tree rings. *Developments in Quaternary Sciences*, *1*, 491-504.

Stahle, D.W., Cleaveland, M.K., 1992. Reconstruction and analysis of spring rainfall over the southeastern US for the past 1000 years. Bull. Am. Meteorol. Soc. 73 (12), 1947–1961.

Stahle, D.W., Cleaveland, M.K., 1994. Tree-ring reconstructed rainfall over the southeastern USA during the medieval warm period and little ice age. Clim. Change 26 (2–3), 199–212.

Stahle, D.W., Cleaveland, M.K., Hehr, J.G., 1988. North Carolina climate changes reconstructed from tree rings: AD 372 to 1985. Science 240, 1517–1519.

Stahle, D.W.; Cleaveland, M.K. (2002-04-26): NOAA/WDS Paleoclimatology - Stahle - Choctawhatchee River - TADI - ITRDB FL001. NOAA National Centers for Environmental Information. https://doi.org/10.25921/xz8h-1b76. Accessed [January 2020].

Stockton, C., Jacoby, G., 1976. Long-term surface-water supply and streamflow levels in the Upper Colorado River basin, Lake Powell Res. Proj. Bull. 18, Inst. of Geophys. and Planet. Phys., Univ. of Calif., Los Angeles, Calif.

Strange, B.M., Maxwell, J.T., Robeson, S.M, Harley, G.L., Therrell, M.D., Ficklin, D.L. 2020. Comparing three approaches to reconstructing streamflow using tree rings in the Wabash River basin in the Midwestern, US. Journal of Hydrology, 573, 829-840. doi: 10.1016/j.jhydrol.2019.03.057.

Therrell, M. D., Elliott, E. A., & Harley, G. L. (2018). Potential for Reconstruction of Summer Streamflow Using False Rings in Taxodium distichum. *AGUFM*, *2018*, B21G-15.

Therrell, M.D.; Stahle, D.W. (2011-05-24): NOAA/WDS Paleoclimatology - Therrell - Lakeport Plantation (rafters) - TADI - ITRDB AR075. NOAA National Centers for Environmental Information. https://doi.org/10.25921/j986-ms31. Accessed [2020-10-09].

Timilsena, J., T. C. Piechota, H. G. Hidalgo, and G. Tootle, 2007. Five hundred years of drought in the upper Colorado River Basin. Journal of the American Water Resources Association 43(3):798–812.

Tootle, G. A., & Kam, J. (2019). Southeastern United States Interstate Streams and a Changing Climate: A Paleo Perspective. *AGUFM*, *2019*, H21O-1962.

Tootle, G. A., Therrell, M., Kam, J., Elliott, E. A., Bearden, B., & Sadeghi, S. (2018). Southeast US Streamflow Drought Variability: Past, Present and Future. *AGUFM*, *2018*, H51G-1393.

Tootle, G. A., Therrell, M., Moat, T., & Meko, M. (2015). Seasonal Streamflow Reconstructions of the Choctawhatchee River (AL-USA). *AGUFM*, *2015*, PP51A-2256.

Tootle, G.A., Piechota, T.C., 2004. Suwannee river long-range streamflow forecasts based on seasonal climate predictors. Journal of the American Water Resources Association 40 (2), 523–532.

Tootle, G.A., Piechota, T.C., Singh, A.K., 2005. Coupled oceanic/atmospheric variability and United States streamflow. Water Resources Research. 41, W12408.

Tucker, C.S.; Harley, G.L.; Trepanier, J.C.; DeLong, K.L. (2018-11-29): NOAA/WDS Paleoclimatology - Tucker - Grand Bay - PIEL - ITRDB MS004. NOAA National Centers for Environmental Information. https://doi.org/10.25921/8w3h-cy76. Accessed [2020-10-09].

Valerie Trouet, Grant L. Harley, Marta Domínguez-Delmás. 2016. Shipwreck rates reveal Caribbean tropical cyclone response to past radiative forcing. Proceedings of the National Academy of Sciences, 113(12), 3169-3174. doi: 10.1073/pnas.1519566113.

Wallis, J. R., D. P. Lettenmaier, and E. F. Wood, 1991. A daily hydroclimatical data set for the continental United States. Water Resources Research, 27(7):1657-1663.

Wang, H., Asefa, T., 2017. Impact of different types of ENSO conditions on seasonal precipitation and streamflow in the southeastern United States. International Journal of Climatology. https://doi.org/10.1002/joc.5257.

Watson, T. A., Anthony Barnett, F., Gray, S. T., & Tootle, G. A. (2009). Reconstructed Streamflows for the Headwaters of the Wind River, Wyoming, United States 1. *JAWRA Journal of the American Water Resources Association*, *45*(1), 224-236.

Wise, E.K., 2010. Tree ring record of streamflow and drought in the upper Snake River. Water Resour. Res. 46 (11).

Woodhouse, C. A., Gray, S. T., & Meko, D. M. (2006). Updated streamflow reconstructions for the Upper Colorado River basin. *Water Resources Research*, *42*(5).

Woodhouse, C., Gray, S., Meko, D.M., 2006. Updated streamflow reconstructions for the Upper Colorado River Basin. Water Resour. Res. 42, W05415. http://dx.doi. org/10.1029/2005WR004455.

Woodhouse, C., Lukas, J., 2006. Multi-century tree-ring reconstructions of Colorado streamflow for water resource planning. Clim. Change 78, 293–315.

APPENDIX

Table A1. Streamflow data for all six gages as gathered from (http://waterdata.usgs.gov/nwis/sw).

Year	Streamflow Gage					
	Choctawhatchee (Newton, AL)	**Choctawhatchee (Bruce, FL)**	**Conecuh (Brantley, AL)**	**Escambia (Century, FL)**	**Perdido (Barrineau Park, FL)**	**Pascagoula (Merrill, MS)**
1931		2440				3438
1932		3308				3915
1933		5006				6573
1934		2926				4310
1935		2789		3089		5854
1936	478	3901		2432		2947
1937	696	5935		4309		3680
1938	500	3637	505	3668		6658
1939	771	6553	607	5344		5405
1940	453	3831	349	3482		7087
1941	296	2739	174	1954		3679
1942	526	4826	389	3835	513	5031
1943	546	3712	496	4118	461	5327
1944	935	6586	844	7375	707	8655
1945	378	3147	225	2608	317	5270
1946	880	7427	588	6475	709	7063
1947	832	6379	540	5255	749	7567
1948	918	7000	473	4001	494	6876
1949	679	5377	460	4312	607	9403
1950	358	3719	352	2415	521	4475
1951	300	2400	180	2120	378	4670
1952	404	3147	385	3034	322	2936
1953	621	3999	549	2964	342	5968
1954	256	2118	137	1415	206	2632
1955	243	2342	269	2629	387	3148
1956	375	2875	244	2175	324	3683
1957	526	3524	336	3148	457	3977
1958	486	3951	284	2758	376	6933
1959	425	4451	337	4118	600	5224
1960	514	4696	497	4553	443	4834
1961	606	4959	531	5315	673	9265
1962	419	3358	296	3076	449	4501

Year	Streamflow Gage					
	Choctawhatchee (Newton, AL)	Choctawhatchee (Bruce, FL)	Conecuh (Brantley, AL)	Escambia (Century, FL)	Perdido (Barrineau Park, FL)	Pascagoula (Merrill, MS)
1963	354	2950	126	1472	284	1605
1964	921	7287	493	4842	516	6758
1965	534	4162	252	3110	438	2951
1966	469	3725	268	2570	354	4759
1967	280	2157	121	1712	258	2214
1968	207	1728	95	1034	171	2669
1969	472	3254	242	2534	490	5135
1970	547	4426	366	4252	440	3501
1971	869	4947	546	4071	374	6170
1972	332	2588	283	1906	223	3252
1973	869	6484	609	6617	483	9144
1974	472	3031	287	3160	483	7524
1975	1053	8708	802	9001	817	8969
1976	579	4326	428	4439	432	5217
1977	493	3527	296	3507	402	7165
1978	599	6027	349	4700	593	4140
1979	542	5082	458	4589	567	9985
1980	627	5291	484	6058	775	11809
1981	244	1960	137	1572	285	3488
1982	400	3153	253	2367	271	3216
1983	638	1088*	426	5510	660	10157
1984	515	1301*	228	3574	443	4960
1985	255	2265	144	2321	419	3789
1986	214	2342	216	2283	292	2497
1987	354	3433	244	2558	372	5206
1988	314	3381	203	2450	394	3562
1989	438	5249	539	4197	471	6630
1990	703	4423	454	4334	525	6120
1991	520	4910	349	3450	631	9685
1992	423	3982	219	2125	322	3317
1993	414	3228	260	2630	390	5601
1994	1058	7902	490	4438	406	5065
1995	362	3877	336	4087	754	4597
1996	644	4379	391	4337	652	3908
1997	386	3243	258	2666	528	5734
1998	786	6441	469	6107	844	5163
1999	348	3036	319	2980	394	3207
2000	122	1279	87	781	156	1546
2001	532	3739	494	4952	323	7189

Year	Streamflow Gage					
	Choctawhatchee (Newton, AL)	**Choctawhatchee (Bruce, FL)**	**Conecuh (Brantley, AL)**	**Escambia (Century, FL)**	**Perdido (Barrineau Park, FL)**	**Pascagoula (Merrill, MS)**
2002	194	2043	186	1879	320	4191
2003	748	6033	731	5551	832	8517
2004	307	3211	272	3452	452	4527
2005	741	5240	435	5303	784	6406
2006	204	1732	130	1324	240	2595
2007	226	1736	103	1460	225	1593
2008	285	2692	190	1904	343	3130
2009	662	5669	424	4593	533	6255
2010	317	2798	266	2328	338	3204
2011	136	1334	123	1221	220	4033
2012	164	2278	104	1494	258	6564
2013	661	6099	365	2555	313	5998
2014	669	5519	401	3840	501	6779
2015	371	3076	167	1832	331	3658
2016	421	3930	248	2640	418	5971
2017	472	3582	447	4153	703	7709
2018	418	3617	220	2638	433	4717
2019	211	2125	193	2038	357	6589

*This data was interpolated using standard deviation of streamflow in the closely correlated Choctawhatchee River gage in Newton, AL

Table A2. Retained tree ring chronologies (TRCs; tree ring standardized growth index) as obtained from https:// www.ncdc.noaa.gov/data-97access/paleoclimatology-data/datasets/ tree-ring and personal communication with Dr. Therrell.

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
920	995	1154						
921	1199	1338						
922	1402	1374						
923	895	974						
924	1184	1266						
925	1218	1307						
926	787	890						
927	985	1195						
928	983	1168						
929	847	1017						
930	860	942						
931	620	673						
932	1059	1149						
933	1302	1142						
934	1425	1472						
935	1543	1563						
936	954	1089						
937	1227	1345						
938	1010	1129						
939	784	884						
940	846	903						
941	774	879						
942	735	796						
943	798	888						
944	1026	1027						
945	931	967						
946	851	996						
947	890	1019						
948	536	539						
949	597	687						
950	971	1049						
951	657	777						
952	472	530						

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
953	789	858						
954	631	705						
955	746	895						
956	664	639						
957	722	768						
958	680	717						
959	740	788						
960	859	939						
961	1055	948						
962	968	1151						
963	1538	1282						
964	1510	1349						
965	1108	1099						
966	1149	1030						
967	998	899						
968	962	1014						
969	752	849						
970	1051	1106						
971	2210	2103						
972	1505	1625						
973	1324	1187						
974	829	823						
975	989	975						
976	635	643						
977	1177	1074						
978	727	615						
979	973	871						
980	1165	1039						
981	1368	1202						
982	945	558						
983	747	469						
984	969	610						
985	1265	708						
986	856	987						
987	1399	955						
988	843	867						
989	1282	855						
990	608	674	942					
991	947	819	1193					
992	666	732	1155					
993	815	763	2176					

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
994	238	142	860					
995	615	580	926					
996	383	453	1078					
997	342	331	1145					
998	451	434	800					
999	610	549	1084					
1000	611	700	578					
1001	977	837	597					
1002	1598	1143	1190					
1003	1431	1290	1226					
1004	1220	1080	1300					
1005	857	882	1062					
1006	1310	1275	1403					
1007	1120	1110	1207					
1008	950	873	1290					
1009	866	819	951					
1010	548	595	987					
1011	410	413	776					
1012	660	721	1043					
1013	716	827	878					
1014	427	479	1015					
1015	697	715	1328					
1016	688	601	1625					
1017	612	616	1242					
1018	605	678	1336					
1019	545	566	691					
1020	624	666	860					
1021	770	780	823					
1022	672	668	936					
1023	583	627	822					
1024	940	899	1551					
1025	821	956	1006					
1026	794	662	528					
1027	911	918	626					
1028	960	992	696					
1029	815	898	733					
1030	829	928	928					
1031	1011	1028	872					
1032	959	1036	826					
1033	1039	1103	530					
1034	832	794	454					

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1035	948	948	1141					
1036	792	792	850					
1037	1392	1494	788					
1038	1623	1644	1073					
1039	1111	992	929					
1040	1278	1228	1054					
1041	1404	1402	972					
1042	1335	1399	1152					
1043	842	865	652					
1044	601	521	676					
1045	933	880	564					
1046	1555	1720	1276					
1047	1265	1457	988					
1048	1430	1388	574					
1049	1435	1343	847					
1050	1005	979	450					
1051	1410	1360	654					
1052	1645	1567	1036					
1053	1176	1128	1325					
1054	999	971	748					
1055	1014	985	667					
1056	1077	1024	547					
1057	1572	1530	605					
1058	1366	1457	784					
1059	1689	1590	1028					
1060	972	1037	620					
1061	1412	1178	580					
1062	1353	1295	1673					
1063	1492	1466	2608					
1064	1987	2092	3674					
1065	2441	2479	3876					
1066	1990	1915	3480					
1067	1945	1904	4072					
1068	1624	1712	2247					
1069	1796	1816	1445					
1070	1223	1334	1579					
1071	1056	1097	905					
1072	565	611	983					
1073	791	869	1041					
1074	313	304	969					
1075	586	557	810					

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1076	535	527	525					
1077	799	833	628					
1078	64	14	406					
1079	881	944	471					
1080	990	986	404					
1081	1028	1001	576					
1082	959	878	533					
1083	584	597	429					
1084	1248	1357	757					
1085	911	963	419					
1086	622	654	261					
1087	772	825	713					
1088	483	512	345					
1089	622	639	370					
1090	802	776	551					
1091	852	933	982					
1092	959	946	2049					
1093	941	928	1277					
1094	791	859	1722					
1095	899	844	1368					
1096	622	578	1193					
1097	160	127	911					
1098	521	537	752					
1099	494	503	379					
1100	690	744	505					
1101	989	1030	317					
1102	917	960	391					
1103	1006	986	956					
1104	973	1053	286					
1105	693	744	610					
1106	953	1021	1006					
1107	1271	1313	1695					
1108	753	789	2011					
1109	813	862	1089					
1110	1260	1340	575					
1111	724	779	752					
1112	893	876	812					
1113	897	961	1224					
1114	862	906	1917					
1115	1170	1261	2654					
1116	756	817	900					

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1117	971	937	2031					
1118	973	1031	1282					
1119	511	535	816					
1120	520	518	1016					
1121	342	319	592					
1122	412	401	643					
1123	404	422	630					
1124	261	252	475					
1125	343	350	320					
1126	286	155	496					
1127	710	711	619					
1128	774	835	1016					
1129	1160	1168	637					
1130	471	484	422					
1131	1066	1022	1186					
1132	1009	1163	585					
1133	1332	1137	816					
1134	1779	1713	468					
1135	959	1042	535					
1136	1666	1708	445					
1137	1361	1092	834					
1138	1170	1157	533					
1139	1381	1338	630					
1140	1189	1150	891					
1141	945	1005	803					
1142	703	724	697					
1143	910	847	590					
1144	1052	966	535					
1145	970	949	702					
1146	783	822	602					
1147	845	895	456					
1148	893	832	1032					
1149	704	790	186					
1150	1364	1304	713					
1151	1022	1036	635					
1152	1061	1110	655					
1153	1325	1304	1404					
1154	1436	1438	1513					
1155	1113	1163	1447					
1156	1561	1350	1321					
1157	1439	1549	1203					

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1158	1056	1158	833					
1159	1776	1931	2218					
1160	653	590	2347					
1161	1007	1072	1483					
1162	789	767	2158					
1163	634	634	727					
1164	478	456	521					
1165	749	797	291					
1166	1054	1111	771					
1167	1124	1170	906					
1168	929	970	941					
1169	596	602	716					
1170	775	808	1598					
1171	1061	1135	1809					
1172	913	959	1419					
1173	714	715	1196					
1174	589	619	1439					
1175	492	525	650					
1176	721	732	1032					
1177	1252	1215	1126					
1178	897	871	1597					
1179	438	432	729					
1180	656	681	540					
1181	505	525	600					
1182	693	705	1000					
1183	654	660	1117					
1184	627	624	860					
1185	304	319	305					
1186	522	501	783					
1187	679	698	400					
1188	1106	1159	377					
1189	1296	1360	1047					
1190	700	743	696					
1191	1256	1365	678					
1192	984	1022	669					
1193	901	949	608					
1194	1006	1032	486					
1195	821	844	440					
1196	860	873	833					
1197	727	720	766					
1198	554	580	573					

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1199	924	905	931					
1200	1048	1159	1075					
1201	725	775	670					
1202	1131	1180	707					
1203	577	577	513		1644			
1204	1571	1580	1213		1046			
1205	1667	1595	677		458			
1206	1738	1884	885		471			
1207	2014	1894	928		681			
1208	1494	1558	1634		1013			
1209	1845	1999	857		1329			
1210	1091	1053	1294		1667			
1211	1275	1229	1257		1396			
1212	1423	1358	1949		1579			
1213	1232	1282	1693		351			
1214	1072	1115	2895		1115			
1215	823	857	781		699			
1216	685	700	866		604			
1217	843	832	674		307			
1218	1254	1280	722		324			
1219	1472	1469	1503		515			
1220	779	781	931		1218			
1221	1087	1097	925		928			
1222	1222	1223	732		866			
1223	345	298	226		1494			
1224	807	801	1432		941			
1225	1090	1106	938		1896			
1226	726	700	1188		1447			
1227	831	825	447		1031			
1228	969	960	880		769			
1229	750	699	392		1394			
1230	888	927	942		982			
1231	1045	1138	505		951			
1232	1023	944	796		760			
1233	1065	1106	1321		1355			
1234	370	370	726		844			
1235	1875	1672	960		746			
1236	1310	1448	1231		953			
1237	1327	1434	427		905			
1238	1116	1072	2352		731		1663	
1239	1639	1660	1517		896		1227	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1240	977	1041	1210		1119		980	
1241	1663	1803	1000		1002		835	
1242	1108	1148	1393		944		819	
1243	1079	1118	1092		1636		1414	
1244	1078	1119	1291		1497		804	
1245	723	743	1232		1232		954	
1246	906	919	546		1178		678	
1247	865	916	311		905		633	
1248	361	339	598		821		540	
1249	823	814	1204		1041		485	
1250	1424	1453	1771		1076		867	
1251	1127	1235	1314		1723		1617	
1252	947	940	935		1000		1132	
1253	459	427	2076		902		1115	
1254	1909	1964	2282		1230		799	
1255	1102	1012	1479		1179		756	
1256	1454	1528	1611		1092		1188	
1257	1342	1480	908		1114		1169	
1258	1664	1716	1298		1068		1254	
1259	579	594	770		1246		1216	
1260	928	972	1980		1096		1476	
1261	713	702	1648		1027		1394	
1262	285	159	981		1060		1384	
1263	392	352	508		1075		1481	
1264	839	817	902		849		1153	
1265	413	350	1367		1194		1307	
1266	636	655	451		977		953	
1267	486	445	743		473		1302	
1268	620	615	537		569		840	
1269	870	925	2164		661		632	
1270	361	337	462		817		563	
1271	581	590	770		644		507	
1272	1102	1134	1359		911		621	
1273	1047	1032	1195		933		1023	
1274	787	740	481		933		822	
1275	640	606	1200		729		1077	
1276	526	492	994		925		592	
1277	698	690	1150		1290		771	
1278	326	261	688		997		1030	
1279	533	542	839		1171		1067	
1280	531	513	851		1144		1155	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1281	338	299	709		944		1080	
1282	1078	1128	619		840		1433	
1283	505	468	479		910		773	
1284	714	730	582		1059		961	
1285	1021	1074	1479		1089		712	
1286	838	847	1124		1890		758	
1287	911	954	1082		1625		955	
1288	251	197	404		1362		750	
1289	843	873	738		657		712	
1290	1574	1643	2143		995		1214	
1291	622	633	1044		1835		798	
1292	841	843	1707		544		895	
1293	590	608	1184		1028		788	
1294	402	380	613		766		689	
1295	1235	1255	1154		511		1029	
1296	1309	1345	954		1515		950	
1297	1115	1188	1222		1292		887	
1298	1053	1079	761		572		776	
1299	1110	1143	1233		762		928	
1300	797	825	1293		1422		1015	
1301	722	713	983		1679		1006	
1302	693	678	866		1014		1242	
1303	469	463	407		680		879	
1304	618	667	471		433		840	
1305	984	1061	395		577		679	
1306	1157	1183	1460		521		823	
1307	1093	1154	661		1164		739	
1308	1062	969	681		457		838	
1309	1634	1522	1197		792		1390	
1310	1156	1198	1099		727		1342	
1311	1036	985	371		737		1200	
1312	755	712	105		638		1059	
1313	1272	1262	1081		339		1113	
1314	1680	1574	1254		1151		1039	
1315	1099	1165	311		1314		1043	
1316	1052	1043	446		534		797	
1317	1242	1310	1337		734		854	
1318	1335	1392	1050		900		992	
1319	1150	1194	1329		964		1134	
1320	248	271	913		939		798	
1321	1061	1059	2128		1042		1583	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1322	1058	1054	1336		1196		745	
1323	1140	1180	1277		1101		1015	
1324	768	744	1048		827		1122	
1325	924	869	1025		610		715	
1326	645	654	1804		601		1244	
1327	531	561	1302		980		763	
1328	632	671	775		657		767	
1329	672	732	1170		943		554	
1330	998	981	2074		631		1288	
1331	797	840	1827		1124		1127	
1332	1164	1124	2997		678		1774	
1333	695	716	773		2116		1373	
1334	1134	1186	1705		470		1770	
1335	811	881	987		1229		871	
1336	792	850	244		457		663	
1337	895	975	981		611		1053	
1338	924	943	1552		739		1302	
1339	969	1059	1009		1336		935	
1340	828	833	965		632		987	
1341	1292	1176	1441		1031		1071	
1342	1778	1634	862		1402		1337	
1343	1642	1634	1183		724		922	
1344	1574	1532	1422		1312		1404	
1345	1300	1273	1112		1378		1286	
1346	1143	1151	1004		1078		949	
1347	963	924	1061		749		1042	
1348	796	820	1109		913		1027	
1349	669	716	967		1092		762	
1350	916	875	887		1028		588	
1351	676	665	917		1332		838	
1352	603	585	808		907		786	
1353	704	667	1033		1073		952	
1354	786	811	1045		1164		1248	
1355	804	792	1054		791		1325	
1356	558	579	761		1141		915	
1357	951	969	978		1105		1490	
1358	545	578	1203		1306		648	
1359	451	490	525		1666		800	
1360	377	394	711		729		778	
1361	890	885	1047		980		937	
1362	544	556	865		1708		926	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1363	876	886	1099		1173		789	
1364	1057	1067	1003		1238		849	
1365	873	905	581		1423		728	
1366	981	848	625		946		944	
1367	827	857	611		2365		824	
1368	1050	1060	850		664		819	
1369	559	619	559		1943		665	
1370	806	791	77		513		1511	
1371	826	834	1383		932		1271	
1372	426	438	225		1770		1123	
1373	495	499	964		633		1473	
1374	546	582	873		1048		1283	
1375	612	634	191		848		1450	
1376	893	966	215		830		676	
1377	1033	957	149		748		1042	
1378	1098	1061	802		1042		863	
1379	952	1019	759		1199		885	
1380	918	949	1334		919		1235	
1381	862	911	860		1379		918	
1382	1061	1108	1027		814		1377	
1383	980	1021	394		1455		597	
1384	1120	1173	1250		1203		941	
1385	1512	1553	1204		1695		853	
1386	1552	1467	1225		1234		621	
1387	1854	1807	2107		1298		501	
1388	2141	2060	1739		1521		657	
1389	1557	1508	793		1337		1278	
1390	1830	1672	2027		579		1403	
1391	1527	1559	2531		1530		1522	
1392	1170	1157	1359		2236		856	
1393	1172	1210	2216		1360		921	
1394	1070	1051	1913		1779		959	
1395	769	792	1036		1886		595	
1396	1096	1109	1592		946		1005	
1397	861	827	1548		1252		962	
1398	767	793	923		856		951	
1399	722	702	1133		652		698	
1400	568	538	1243		971		703	
1401	453	470	868		949		1050	
1402	513	500	1276		710		1223	
1403	516	552	1017		970		1488	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1404	529	559	868		634		1143	
1405	342	356	801		1057		1592	
1406	369	394	984		711		1267	
1407	682	738	180		914		908	
1408	1327	1364	1174		599		1418	
1409	1150	1117	493		868		1168	
1410	1079	1106	598		722		994	
1411	784	873	606		692		935	
1412	1533	1460	558		749		585	
1413	1251	1321	540		857		877	
1414	2117	1946	392		774		455	
1415	1638	1581	836		829		737	
1416	882	880	712		1180		1078	
1417	1157	1141	445		562		799	
1418	1179	1255	716		775		964	
1419	837	882	902		1450		996	
1420	1084	1154	727		933		477	
1421	484	526	598		790		646	
1422	694	725	138		676		1054	
1423	376	370	207		888		1030	
1424	746	786	559		584		924	
1425	1215	1252	1029		1020		895	
1426	760	705	811		1179		1486	
1427	1282	1364	503		922		867	
1428	1284	1271	430		503		1463	
1429	1507	1569	530		906		1422	
1430	1869	1803	1145		1179		1731	
1431	1132	1124	115		1316		1107	
1432	1693	1565	1247		700		1125	
1433	1364	1428	807		1641		1238	
1434	1235	1226	1554		957		1076	
1435	396	262	1172		1210		1130	
1436	849	789	1274		1160		700	
1437	942	921	1520		956		1010	
1438	940	980	806		893		799	
1439	969	983	1510		941		741	
1440	748	735	189		1538		609	
1441	1058	1050	1475		751		672	
1442	937	973	574		1181		496	
1443	1002	1067	1463		652		740	
1444	666	718	809		1041		333	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1445	1014	1066	424		632		610	
1446	714	731	435		901		565	
1447	1703	1649	965		661		664	
1448	1269	1191	1336		1683		1486	
1449	1094	1148	1362		1715		1085	
1450	1245	1195	663		1206		1062	
1451	914	904	1029		923		1120	
1452	1300	1316	1326		1051		1073	
1453	623	645	443		1165		912	
1454	677	706	1129		483		983	
1455	885	934	570		791		1055	
1456	1099	1192	550		657		934	
1457	1094	1071	1603		467		995	
1458	1292	1293	1246		1163		894	
1459	1463	1477	1039		1185		1158	
1460	1271	1313	1219		991		940	
1461	1384	1398	1243		946		1468	
1462	1250	1200	1396		1568		1655	
1463	841	845	457		1461		1793	
1464	936	961	1133		514		1221	
1465	730	748	805		1280		1631	
1466	806	808	959		1330		1135	
1467	982	938	704		1459		1208	
1468	852	892	710		707		819	
1469	617	640	458		1003		1018	
1470	578	595	494		622		1232	
1471	552	542	221		688		621	
1472	743	804	204		379		574	
1473	818	760	77		251		1236	
1474	870	922	529		779		696	
1475	866	905	148		647		1228	
1476	1668	1681	700		807		1017	
1477	952	968	1251		1233		1515	
1478	881	939	1356		1323		1213	
1479	1147	1189	1435		1116		1368	
1480	940	937	1808		1508		1284	
1481	1418	1415	1321		1586		1695	
1482	1027	1090	1400		1176		799	
1483	992	954	1427		1421		1116	
1484	848	870	1359		1360		802	
1485	968	946	2026		1298		893	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1486	750	752	731		1916		842	
1487	924	910	1261		277		742	
1488	550	539	861		1190		956	
1489	699	698	773		869		956	
1490	436	426	937		227		517	
1491	106	62	340		671		524	
1492	636	630	846		431		725	
1493	1196	1176	1800		492		1322	
1494	807	765	1381		1552		771	
1495	1174	1202	1285		1230		1322	
1496	1051	1125	1329		951		829	
1497	1033	1048	1255		635		1136	
1498	764	771	1017		1084		1504	
1499	674	689	484		1076		398	
1500	942	976	1248		974		1029	
1501	733	736	738		1083		969	
1502	586	577	398		635		1025	
1503	1003	1042	1228		657		854	
1504	933	977	1105		1525		1317	
1505	627	652	701		739		392	
1506	822	816	887		732		635	
1507	964	980	1046		966		841	
1508	776	813	1493		1302		764	
1509	441	447	566		1018		1299	
1510	751	781	957		601		1034	
1511	970	966	1824		791		1185	
1512	1009	1027	735		1202		608	
1513	1258	1286	2483		997		848	
1514	1061	1022	951		1191		1444	
1515	1117	1156	1145		857		1310	
1516	1143	1195	1833		666		1616	
1517	1451	1370	1797		1525		1825	
1518	692	709	710		976		881	
1519	917	965	1398		909		1328	
1520	890	924	676		1003		393	
1521	839	834	594		881		987	
1522	1515	1561	533		772		1004	
1523	1199	1256	1315		840		1037	
1524	934	903	1277		1027		1632	
1525	1581	1527	711		799		758	
1526	1430	1416	1182		608		997	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1527	1703	1705	1485		1062		820	
1528	1245	1196	524		1046		964	
1529	730	757	1800		650		785	
1530	698	706	773		781		1045	
1531	1316	1149	1247		514		973	
1532	745	768	1080		1191		852	
1533	911	884	630		1511		1195	
1534	927	939	1047		968		910	
1535	641	651	401		1016		839	
1536	757	756	805		630		1174	
1537	888	903	580		797		1181	
1538	878	888	1017		913		1152	
1539	1001	1011	1205		1030		774	
1540	907	964	996		1136		1145	
1541	1330	1320	1484		779		575	
1542	435	433	84		2047		803	
1543	695	702	377		317		1000	
1544	957	1003	788		775		724	
1545	1055	1047	747		659		1092	
1546	1148	1131	467		948		617	
1547	1055	1081	929		827		690	
1548	509	504	752		726		983	
1549	878	876	1145		1049		648	
1550	1083	1080	1306		824		714	
1551	566	585	789		1352		869	
1552	452	424	61		984		804	
1553	981	996	1074		468		919	
1554	752	749	1150		1060		1354	
1555	1127	1168	1298		953		549	
1556	718	735	1201		901		564	
1557	917	924	448		1279		911	
1558	629	614	1080		789		804	
1559	635	635	730		1095		1377	
1560	705	702	846		1056		1287	
1561	541	556	360		1162		838	
1562	1082	1116	961		1041		1215	
1563	515	442	423		1132		966	
1564	967	1015	761		1265		885	
1565	1255	1330	1171		844		659	
1566	707	707	566		1243		905	
1567	950	984	462		661		782	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1568	1221	1160	503		733		930	
1569	741	784	0		944		1551	
1570	838	822	658		630		1388	
1571	819	841	1100		1073		791	
1572	1116	1087	1024		1375		897	
1573	1178	1232	930		1686		760	
1574	1275	1263	538		1265		370	
1575	814	849	1198		1641		1160	
1576	1160	1202	1842		1082		713	
1577	566	572	1226		1682		1105	
1578	564	543	1620		1195		1311	
1579	456	447	1266		1122		1420	
1580	868	834	914		1090		1041	
1581	1023	1056	1251		1287		1204	
1582	1180	1220	2138		1052		1832	
1583	975	986	548		1412		1045	
1584	1180	1158	731		573		1419	
1585	1136	1144	669		1009		951	
1586	1020	1058	1081		469		1317	
1587	651	677	328		906		781	
1588	760	772	611		453		1076	
1589	539	521	52		763		905	
1590	1129	1171	1026		560		684	
1591	730	768	1015		738		788	
1592	879	902	915		926		980	
1593	726	733	258		762		1016	
1594	897	949	927		670		807	
1595	490	472	272		846		1364	
1596	1088	1147	1797		645		924	
1597	1005	1009	965		1236		747	
1598	758	792	340		908		910	
1599	263	222	875		374		748	
1600	1127	1160	1564		530		1142	
1601	1174	1120	2054		1182		984	
1602	1482	1545	2680		1318		1229	
1603	1429	1476	1424		1323		1066	
1604	690	635	1359		1252		1134	
1605	1841	1757	2328		1205		1465	
1606	2048	2099	1743		2219		1040	
1607	1931	1969	934		1386		1525	
1608	1547	1621	1067		1190		1081	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1609	974	992	1885		967		1121	
1610	635	646	1146		998		781	
1611	643	624	805		815		1321	
1612	907	925	794		580		646	
1613	1055	1060	1811		698		1018	
1614	925	928	1135		1284		848	
1615	1463	1450	1503		864		816	
1616	681	696	666		1134		1049	
1617	772	741	1344		697		1272	
1618	1086	1083	363		1160		475	
1619	724	750	1396		550		721	
1620	892	900	552		821		996	
1621	1169	1187	793		610		1020	
1622	1417	1411	729		980		1297	
1623	523	457	1210		962		1166	
1624	1108	1174	844		1435		1470	
1625	898	890	344		742		808	
1626	860	890	1291		1147		1129	
1627	454	402	949		1114		717	
1628	1129	1181	750		782		836	
1629	1107	1150	922		945		1210	
1630	1056	1055	829		1034		1058	
1631	978	986	940		1335		838	
1632	703	721	599		1375		688	
1633	777	788	105		1104		792	
1634	388	353	627		746		580	
1635	769	779	2397		659		603	
1636	681	593	716		1436		940	
1637	923	958	1101		1179		875	
1638	623	645	614		1108		966	
1639	597	545	1309		508		1706	
1640	1038	1012	987		1444		1337	
1641	959	963	193		1556		1192	
1642	1278	1369	909		675		924	
1643	348	321	246		1231		976	
1644	524	521	153		487		700	
1645	151	89	256		563		673	
1646	1061	1030	1787		699		638	
1647	1092	1142	1322		1780		1259	
1648	868	870	378		1183		1102	
1649	1320	1381	1448		644		1250	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1650	1404	1461	999		1310		1019	
1651	815	809	1346		1240		591	
1652	1286	1343	421		1404	1726	733	
1653	907	951	1140		751	1150	889	
1654	365	333	184		1278	837	751	
1655	1525	1572	1692		629	839	1305	
1656	649	669	446		2208	867	1242	
1657	806	802	523		612	949	1135	
1658	492	445	623		827	961	1386	
1659	1075	1137	663		829	870	718	
1660	1251	1281	646		591	840	1593	
1661	784	791	1230		1025	933	554	
1662	1135	1160	848		1136	852	1066	
1663	625	624	700		1007	836	870	
1664	697	692	432		1031	919	952	
1665	920	936	906		837	1208	1085	
1666	576	563	922		1074	1244	467	
1667	1284	1330	1291		936	964	982	
1668	1189	1239	1337		1251	909	767	
1669	1043	1042	1316		1425	938	1274	
1670	1376	1412	1141		1441	1158	1193	
1671	932	907	520		1412	683	477	
1672	241	191	457		1054	1082	647	
1673	437	425	851		563	688	537	
1674	884	902	1952		903	837	1029	
1675	460	444	1512		1308	984	1089	
1676	173	128	116		1240	1065	1010	
1677	672	661	1315		601	689	1048	
1678	890	926	1544		1237	874	1302	
1679	971	1004	1778		877	1106	1295	
1680	1171	1088	1303		1244	1062	945	
1681	1500	1545	1048		1783	1502	1429	
1682	944	905	1014		914	851	1290	
1683	1173	1205	2114		1081	1138	977	
1684	1325	1325	815		762	958	1370	
1685	871	799	1023		593	1309	578	
1686	992	987	522		552	942	763	
1687	837	798	631		1017	800	937	
1688	1991	1949	1159		696	1040	809	
1689	1275	1253	1592		1099	1154	1147	
1690	1579	1639	1277		1182	1106	1567	

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1691	1225	1271	1730		1150	1069	1051	
1692	1201	1166	1478		1230	1221	611	
1693	1418	1474	1366		1353	1009	857	
1694	1742	1717	1144		902	857	841	
1695	1510	1579	1503		619	981	901	
1696	1113	1183	932		947	1159	879	
1697	1281	1161	1049		790	1081	544	
1698	1517	1606	1373		1043	974	1096	
1699	1087	1125	498		1415	902	467	
1700	1112	1166	663		578	959	1092	
1701	1217	1274	855		883	919	1030	
1702	1168	1218	1041		940	1253	538	
1703	644	624	859		1031	974	801	
1704	897	866	928		703	828	629	
1705	1435	1416	1506		831	1207	678	
1706	780	782	903		1345	1428	1047	
1707	1511	1602	1800		881	1274	982	
1708	718	715	127		1013	1418	440	
1709	505	486	985		677	835	1116	
1710	527	502	1522		829	740	812	
1711	1422	1362	2116		990	682	907	
1712	930	910	1257		1614	981	727	
1713	1112	1192	1643		1166	733	1078	
1714	338	312	703		1074	741	735	
1715	283	218	711		876	671	747	
1716	1026	1029	1677		742	774	781	
1717	1556	1542	906		1753	747	827	
1718	940	950	509		1785	969	507	
1719	1569	1539	1382		460	721	967	
1720	921	947	699		1692	926	511	
1721	1519	1508	1718		719	822	1013	
1722	1054	1019	292		1765	1055	568	
1723	1334	1401	1245		656	745	1251	
1724	482	360	994		1180	762	1057	
1725	1008	1043	1285		817	704	1065	888
1726	1007	1001	677		467	924	1223	1525
1727	680	666	604		1081	1094	1270	1302
1728	1165	1198	420		982	1111	970	1996
1729	1188	1208	701		1148	832	902	1407
1730	507	460	514		1630	996	793	1184
1731	956	989	1333		966	752	808	1303

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1732	902	904	858		1266	1031	768	1218
1733	1255	1295	1118		1390	773	609	1263
1734	522	478	906		2092	1146	720	835
1735	717	725	1150		1074	1234	1002	676
1736	882	876	2799		679	909	1059	871
1737	1204	1275	1044		1722	804	663	1365
1738	519	498	675		1241	1201	880	557
1739	601	565	577		718	1161	673	571
1740	1091	1083	770		886	1640	575	605
1741	496	474	1035		893	1457	1001	605
1742	966	926	1898		1045	1199	1237	536
1743	459	425	1212		1954	995	1090	479
1744	968	996	1244		1087	774	883	892
1745	508	495	1314		966	817	1009	845
1746	404	363	566		950	1005	1305	832
1747	1437	1483	583		593	963	1273	1211
1748	861	856	1018		702	1289	1446	1114
1749	1417	1498	1088		738	1059	984	1241
1750	659	659	632		1048	983	1050	946
1751	980	1020	1033		712	1128	1026	1709
1752	692	698	514		890	1072	1289	1093
1753	1189	1188	415		700	951	812	1045
1754	1352	1353	201		1137	956	1028	1148
1755	1404	1343	1062		626	1086	893	1361
1756	690	664	143		886	881	774	1927
1757	738	705	275		550	813	796	1108
1758	739	763	145		776	821	937	897
1759	1085	1084	36		511	1006	1396	1151
1760	522	498	109		675	1036	1231	955
1761	1041	1018	1130		397	902	1083	1127
1762	579	561	903		822	1104	1418	1056
1763	1004	1013	763		491	978	1435	875
1764	600	594	31		649	1044	1084	647
1765	874	861	684		324	941	535	876
1766	1071	1039	2678		599	1053	864	1451
1767	920	892	913		1177	874	700	1446
1768	1133	1160	1419		973	791	477	1292
1769	816	761	1387		1445	1043	1283	870
1770	760	725	1694		1503	1027	895	669
1771	1439	1478	2289		1504	1012	1535	835
1772	746	739	866		1631	1049	895	892

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1773	478	440	993		895	771	943	804
1774	637	615	751		800	685	1473	784
1775	635	620	1426		1116	632	1309	835
1776	1118	1078	1861		851	914	1215	1081
1777	749	744	1619		1166	1006	1397	856
1778	401	349	519		934	926	768	458
1779	755	706	1539		758	1252	1289	726
1780	1232	1281	1042		940	1033	384	1139
1781	462	420	829		747	1242	1137	883
1782	1243	1244	1575		652	1272	1103	1345
1783	937	922	790		889	1647	1157	1253
1784	669	692	803		744	1338	1089	1038
1785	1736	1740	1846		422	1040	1376	1546
1786	884	942	1071		1522	985	1083	1350
1787	852	870	706		1084	1253	1532	758
1788	872	917	853		702	786	969	871
1789	1291	1311	1269		895	848	1277	991
1790	970	994	952		852	828	1365	1089
1791	1073	1081	724		769	775	859	636
1792	1195	1255	1298		562	806	1426	1207
1793	1429	1438	1310		1070	750	1198	1009
1794	935	980	990		1332	874	1205	1160
1795	821	811	1011		769	914	849	886
1796	823	809	983		723	803	1114	525
1797	894	963	637		1013	930	1048	650
1798	265	233	483		628	997	812	509
1799	214	133	728		426	943	997	654
1800	956	1006	1188		478	878	723	947
1801	766	812	611		899	981	1035	1030
1802	333	272	0		689	881	967	462
1803	804	758	999		493	1223	797	773
1804	1204	1233	1084		812	1119	1250	933
1805	1114	1015	989		1063	1030	1094	1038
1806	1935	1838	515		1196	1201	814	928
1807	1717	1786	938		1281	938	845	1158
1808	1852	1930	1115		963	872	1122	1061
1809	937	954	368		1114	1026	1373	678
1810	674	668	629		653	1046	913	781
1811	351	291	702		991	1057	1589	1208
1812	703	642	887		546	928	845	1409
1813	986	984	1110		557	989	811	1262

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1814	901	903	538		824	897	738	1047
1815	1143	1148	850		578	1222	993	1228
1816	693	690	464		730	1325	1057	639
1817	481	402	882		512	1046	1099	792
1818	1011	1005	148		669	1119	727	1412
1819	752	705	253		492	1113	581	907
1820	1020	999	733		516	959	895	1076
1821	2051	2090	1943		761	1187	806	1194
1822	1156	1198	926		1314	906	1172	1044
1823	1770	1755	1717		876	882	1047	1160
1824	1299	1362	1033		1246	1091	843	1317
1825	3061	3123	1495		850	1119	1015	1191
1826	1544	1576	590		1491	901	1342	1143
1827	1237	1250	1385		822	809	753	910
1828	1059	1062	1107		1546	931	1382	477
1829	1626	1668	1238		776	1044	1510	511
1830	534	507	823		1432	852	801	599
1831	564	482	1038		897	1008	1089	1078
1832	1042	1066	1223		1111	1009	1070	1116
1833	1555	1562	1787		1129	1122	905	852
1834	1633	1666	1134		1615	913	1376	954
1835	1329	1343	1718		1200	930	1129	1168
1836	1459	1454	1552		1442	968	792	1316
1837	1248	1304	681		1263	939	960	1009
1838	979	1002	1368		598	907	1036	1412
1839	626	631	307		1432	924	1173	394
1840	439	406	1156		486	715	1038	667
1841	721	704	954		1306	1084	893	1092
1842	761	751	1179		1123	978	1310	1020
1843	623	579	665		1493	1070	668	830
1844	935	958	562		978	1044	797	1071
1845	851	852	36		858	858	665	714
1846	814	818	711		613	1054	925	1301
1847	731	720	557		1157	1046	961	1510
1848	572	538	745		1339	1048	1347	858
1849	459	421	745		574	987	972	945
1850	362	323	761		964	1343	1064	572
1851	446	423	868		709	907	1091	842
1852	668	666	821		800	875	736	1260
1853	628	631	1115		964	936	1179	783
1854	463	445	1885		878	913	1096	1435

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1855	108	72	714		1239	1056	379	876
1856	506	497	719		950	1047	1166	1408
1857	673	677	566		588	926	835	2090
1858	649	647	1652		905	1029	516	1637
1859	1248	1304	1610		1325	913	627	1735
1860	584	575	1107		1114	859	905	761
1861	492	438	1702		1021	998	597	900
1862	1164	1202	2692		917	884	976	1016
1863	1381	1383	1642		2432	1124	941	998
1864	1011	1014	1840		1845	1005	1349	1220
1865	1284	1308	1755		1551	1053	510	1329
1866	1209	1229	1575		1100	1163	1438	1107
1867	1122	1131	972	935	1766	1084	1420	1003
1868	1258	1284	1364	1638	558	1108	755	1078
1869	1586	1671	1460	979	1267	983	530	1089
1870	1010	989	1213	1001	758	1244	1037	760
1871	1588	1608	1391	1067	1007	1043	1115	971
1872	871	876	875	907	1298	1020	523	993
1873	1175	1177	1729	971	971	855	883	799
1874	1215	1210	1025	1090	1212	966	1247	1323
1875	1012	1023	1148	972	1270	723	665	936
1876	1291	1282	1490	840	665	897	1592	541
1877	954	941	546	924	1152	1049	1648	970
1878	1296	1304	799	769	421	1027	517	1033
1879	965	972	502	991	851	967	469	963
1880	1129	1142	1077	812	553	799	1138	515
1881	990	1003	615	1037	1131	842	742	911
1882	984	953	768	890	826	985	920	575
1883	1042	1046	1009	971	1719	1066	775	822
1884	1049	1007	1120	749	781	1068	1216	562
1885	738	743	670	700	1479	1033	1218	614
1886	1145	1148	1951	752	614	972	770	988
1887	334	328	98	1233	1867	1115	1233	621
1888	582	552	1866	1131	359	1021	953	507
1889	781	802	1005	1157	1363	1111	578	572
1890	417	387	778	1279	565	1409	1288	435
1891	889	902	1004	1285	660	1057	1269	345
1892	573	570	1264	1346	832	1029	456	271
1893	984	1020	267	1302	1255	1206	687	676
1894	1037	1066	697	1126	651	968	1277	667
1895	955	961	1344	1061	816	818	794	965

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1896	565	546	207	918	1638	848	1121	414
1897	1008	1053	749	1054	557	989	1097	532
1898	548	559	462	1056	961	899	1376	486
1899	189	115	830	1010	545	761	930	708
1900	1135	1079	1707	991	728	913	1310	1178
1901	971	1011	1517	1126	1281	860	668	1786
1902	1252	1325	1240	892	984	914	820	1543
1903	1883	1921	1905	859	910	857	950	1678
1904	509	514	226	797	1623	962	530	1015
1905	824	819	616	630	633	997	1044	836
1906	750	772	812	712	877	1070	774	1137
1907	903	903	1072	543	1102	1159	1501	1171
1908	1092	1158	1472	912	892	1261	1155	1360
1909	970	934	1773	1140	1177	1135	1919	1023
1910	730	695	736	937	1359	988	1434	1105
1911	550	546	293	955	947	1133	1046	1484
1912	1330	1338	1394	1049	397	662	1430	1909
1913	1299	1306	432	1316	1603	888	1043	1522
1914	481	488	381	1121	717	795	1192	1090
1915	706	725	756	1190	702	706	758	992
1916	745	622	515	982	1000	1012	997	892
1917	1155	1124	1302	732	1193	1040	989	1242
1918	1055	1094	488	1001	1238	1123	557	1198
1919	1754	1777	1265	1124	506	948	1206	1586
1920	1508	1530	1473	753	1380	921	1064	1582
1921	1166	1199	1039	868	1179	894	1135	1178
1922	916	905	1897	1055	716	893	1186	881
1923	1142	1116	1437	925	1993	1174	1578	1149
1924	833	837	1120	936	1279	1251	981	1270
1925	432	424	434	794	1256	1219	820	1335
1926	695	689	0	941	622	765	499	1015
1927	542	556	335	998	824	876	1070	622
1928	1122	1080	1376	1243	699	1114	780	1239
1929	1335	1323	1808	1022	1574	1210	1417	1561
1930	600	604	1210	1254	1791	1188	785	1039
1931	674	689	1355	1064	1078	975	935	806
1932	440	327	846	989	606	852	1370	410
1933	916	966	1228	1074	814	825	1344	1341
1934	475	467	2133	1302	1015	913	459	1113
1935	661	675	1164	1018	1322	1020	1353	867
1936	703	726	1436	813	835	1165	587	1004

Year	TRC							
	CHK	CHK_{EW}	EBE	$IOLA_1$	OCM_1	PC_1	SKY	SUWR
1937	871	849	1759	1283	934	697	1008	687
1938	940	971	1120	830	1086	1061	992	663
1939	1061	1003	1257	767	765	1306	1755	912
1940	854	816	640	937	778	993	1180	807
1941	385	368	134	888	731	1039	1087	471
1942	790	746	1242	1226	820	972	999	999
1943	863	878	1504	1125	702	1018	821	793
1944	1075	1116	1257	1137	1415	906	1025	1286
1945	970	1013	1255	996	773	894	1493	1046
1946	1459	1468	1510	1067	1016	1182	2084	1117
1947	1845	1928	1243	1112	1053	1241	1097	732
1948	985	981	1068	1015	1256	1104	1220	691
1949	1734	1767	1877	913	744	759	1515	839
1950	897	909	564	791	1193	971	1250	755
1951	917	920	1122	857	404	1108	1178	706
1952	767	772	835	980	713	1202	619	852
1953	1205	1185	1077	420	864	968	1397	989
1954	634	650	1012	902	1035	820	528	879
1955	459	417	481	941	682	924	1036	454
1956	625	600	337	1021	541	1010	534	868
1957	1310	1270	899	1148	622	979	1161	731
1958	1046	1012	1272	1099	1461	827	1020	898
1959	1293	1311	1035	1166	1128	999	874	839
1960	1088	1110	1058	952	1150	904	992	890
1961	1490	1465	989	958	1093	936	1229	904
1962	1010	1028	928	952	1076	1007	1118	654
1963	604	578	1334	910	841	820	786	640
1964	1057	1068	1185	943	1514	948	1028	1077
1965	1076	1057	1220	569	518	1017	1026	1157
1966	950	965	1011	646	923	1091	594	1504
1967	319	301	423	837	1077	866	752	724
1968	518	508	651	782	530	1003	1081	441
1969	591	567	909	1001	802	973	791	779
1970	1153	1142	506	1233	747	897	1154	1195
1971	1525	1506	657	1099	1130	986	759	1010
1972	950	930	810	1062	1111	1055	599	1538
1973	1520	1522	2047	1123	1101	1102	1339	1606
1974	1017	1015	695	1065	1613	1145	922	897
1975	1357	1373	1067	1290	986	1148	1175	1617
1976	1134	1124	1403	1039	1210	1045	607	1128
1977	871	897	565	1106	1157	1187	393	1067

Year	TRC							
	CHK	**CHK_{EW}**	**EBE**	**$IOLA_1$**	**OCM_1**	**PC_1**	**SKY**	**SUWR**
1978	1766	1788	861	967	746	974	931	1072
1979	994	1023	719	1336	1033	991	1217	809
1980	994	1020	712	1063	1039	883	1145	1113
1981	552	561	110	1057	1072	785	844	876
1982	670	683	490	1009	680	1059	842	1144
1983	1078	1085	1279	1080	1308	1068	982	1413
1984	925	949	1837	1157	874		882	1331
1985	557	567	358	813	1422		690	698
1986	408	396		1006			865	1239
1987	767	737		979			671	615
1988	529	514		1043			823	1237
1989	1683	1653		953			1550	617
1990	991	1002		1246			520	993
1991	1612	1639		1065			1379	1413
1992	1220	1207		958			555	1163
1993	829	819		1015			955	1291
1994	1407	1421		898			888	
1995	938	950		1070			1105	
1996	984	977		1178			1151	
1997	1292	1284		1197			1359	
1998	952	961		661			904	
1999	951	933		828			1018	
2000	267	246		741			741	
2001	535	501		751			1025	
2002	406	386		967			1584	
2003	1967	2020		740			1410	
2004	912	894		926			1417	
2005	1399	1425		789			1311	
2006	606	592		928			1028	
2007	456	425		1242			1244	
2008	390	359		943			1530	
2009	1678	1710		1087			1609	
2010	652	650		1222			1658	
2011	452	437		1043				
2012	377	353						
2013	736	723						
2014	2224	2313						

Tree Ring Chronology abbreviations: CHK=Choctawhatchee Ringwidth Standard, CHK_{EW}=Choctawhatchee Earlywood Standard, EBE=Ebenezer Creek, $IOLA_1$=Iola Lake +1, OCM_1=Ocmulgee River +1, PC_1=Piney Creek +1, SKY=Sky Lake, SUWR=Suwannee River

Table A3. Standardized streamflow deviation values for each downstream streamflow gage.

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1238	1.071064817			0.46484593
1239	1.859763159			1.109211459
1240	0.071396073			0.336628813
1241	1.52807263			1.055575145
1242	0.217728188			-0.01263538
1243	0.73851395			1.887222914
1244	0.132919765			0.932415694
1245	-0.546764254			0.082142505
1246	-0.392873336			-0.080604501
1247	-0.533007544			-0.632584076
1248	-1.800545415			-1.72438661
1249	-0.777336447			-0.70346655
1250	1.002258672			0.722215421
1251	1.051230126			2.448132672
1252	0.151742907			0.15029549
1253	-1.003314958			-0.786957044
1254	2.066258067			1.660196008
1255	0.141429285			0.145305562
1256	1.389686906			1.229793406
1257	1.109660079			1.178609363
1258	1.944776672			1.533438982
1259	-0.623534169			0.19503179
1260	0.447626015			0.767680344
1261	-0.134949363			0.158464034
1262	-1.143136316			-0.576089626
1263	-0.79763346			-0.158646832
1264	-0.079395892			-0.277020142
1265	-0.920729509			-0.146211291
1266	-0.75067815			-0.508941913
1267	-0.755403923			-1.324240639
1268	-0.89974944			-1.437873916
1269	-0.522334145			-1.063831994
1270	-1.777799482			-1.707995444
1271	-1.320037352			-1.721960524
1272	0.007920545			-0.321205991
1273	0.277194021			0.035516339
1274	-0.528028015			-0.617433846

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1275	-0.618718017			-0.886851797
1276	-1.364262177			-1.254929827
1277	-0.786054534			-0.100109961
1278	-1.397594607			-0.951877965
1279	-0.878181908			-0.188058147
1280	-0.79581893			-0.177362761
1281	-1.320157278			-0.935635369
1282	0.754971599			0.478136465
1283	-1.234243452			-1.107927334
1284	-0.560833814			-0.242669563
1285	-0.091014793			0.020505002
1286	-0.472365046			1.200783404
1287	-0.107270827			1.101167008
1288	-1.849436919			-0.70444336
1289	-0.50619456			-1.053765615
1290	1.695296172			1.249470206
1291	-0.936620551			0.838503048
1292	-0.329880987			-1.091061425
1293	-1.021149147			-0.67448501
1294	-1.557560029			-1.593219709
1295	0.721632216			-0.402317076
1296	0.816107704			1.459426277
1297	0.301304329			0.755421835
1298	0.046917298			-0.837241693
1299	0.330189074			-0.224563286
1300	-0.313835258			0.615775017
1301	-0.497671136			0.910577503
1302	-0.331919726			-0.075131292
1303	-1.213383309			-1.410478269
1304	-0.904414381			-1.609853939
1305	-0.209951675			-0.966038863
1306	0.335975062			-0.725665068
1307	0.103624838			0.303198689
1308	0.129224659			-1.133134267
1309	2.009300247			0.909458953
1310	0.846909525			0.268875432
1311	0.426581638			-0.183931182
1312	-0.368285064			-0.920025765
1313	0.891005734			-0.607629884
1314	1.769471171			1.231333191

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1315	0.418261565			0.942207132
1316	0.065352854			-0.933921398
1317	0.564892625			-0.119998517
1318	0.918287992			0.458899116
1319	0.627212347			0.453468599
1320	-1.808964556			-1.310470807
1321	0.863662643			0.91852803
1322	0.027922089			0.224041792
1323	0.486202158			0.544748526
1324	-0.275658867			-0.457995242
1325	-0.314297581			-1.141417228
1326	-0.441900408			-0.857380713
1327	-1.183488753			-0.858260753
1328	-0.943953408			-1.281563267
1329	-1.061301707			-0.920039996
1330	0.424975674			-0.280642194
1331	-0.203072451			0.225505869
1332	1.292797259			0.571659184
1333	-0.19770186			2.131896152
1334	1.218867326			0.278740302
1335	-0.423589992			0.179904898
1336	-0.673609289			-1.506639968
1337	-0.047672901			-0.596763728
1338	0.2662182			-0.123166318
1339	0.008233395			0.704702289
1340	-0.269219371			-0.839530593
1341	0.896119093			0.476485679
1342	2.292761472			2.117472837
1343	1.565129713			0.407472009
1344	1.883197362			1.884281099
1345	1.127403889			1.494528818
1346	0.427928631			0.385015627
1347	0.10005661			-0.432402366
1348	-0.304300285			-0.301863333
1349	-0.862596764			-0.432546952
1350	-0.458554457			-0.520272566
1351	-0.771108994			0.017416894
1352	-0.992804936			-0.929675463
1353	-0.593059103			-0.31847024
1354	-0.109066239			0.395940984

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1355	0.009067662			-0.219926286
1356	-0.970191095			-0.364568724
1357	0.515118189			0.795851292
1358	-1.264563832			-0.374468886
1359	-1.333495117			0.327741322
1360	-1.527854921			-1.537528451
1361	-0.174053875			-0.190324277
1362	-0.991967193			0.644555617
1363	-0.353073601			-0.009189222
1364	0.128440796			0.439052114
1365	-0.420397184			0.401788182
1366	0.045123625			-0.297336195
1367	-0.432751283			2.153891453
1368	0.082444893			-0.647962571
1369	-1.215097032			0.860969107
1370	0.197677978			-0.511563816
1371	0.006978519			0.034361928
1372	-1.072374859			0.814304802
1373	-0.565300617			-0.758533925
1374	-0.634245806			-0.104504467
1375	-0.31514749			-0.200008129
1376	-0.425173361			-0.647064885
1377	0.263329552			-0.386636317
1378	0.237917441			0.090645192
1379	-0.080866287			0.340561668
1380	0.185963484			0.135033119
1381	-0.258153171			0.54977147
1382	0.659938195			0.337471283
1383	-0.300375756			0.47600012
1384	0.366370178			0.634489238
1385	1.193670734			1.974269428
1386	1.057532316			0.745463042
1387	1.643264002			1.213455179
1388	2.466959831			2.163187085
1389	1.718937204			1.749688532
1390	2.479320882			0.753961174
1391	1.890267772			2.455223651
1392	0.398932649			2.389130734
1393	0.467879576			0.949852548
1394	0.267547813			1.525287515

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1395	-0.79450496			0.92614043
1396	0.373683916			0.14937788
1397	-0.216971682			0.248808136
1398	-0.447102408			-0.531990301
1399	-0.802268854			-1.32555956
1400	-1.156524559			-0.976997236
1401	-1.081591768			-0.714610494
1402	-0.770554554			-0.905731096
1403	-0.50148443			-0.052860481
1404	-0.812351315			-1.05097351
1405	-0.804483137			-0.057488374
1406	-1.062916361			-1.005985038
1407	-0.687887416			-0.555588571
1408	1.320922474			0.363488239
1409	0.66083677			0.207351777
1410	0.323153425			-0.274393685
1411	-0.423273666			-0.73290348
1412	0.977613044			-0.18686275
1413	0.608630794			0.145751844
1414	2.211211903			0.409286166
1415	1.372843409			0.308257494
1416	-0.053271178			0.328331052
1417	0.312240174			-0.739465639
1418	0.526731877			0.002071415
1419	-0.239326553			0.726883161
1420	-0.176473249			-0.418572764
1421	-1.408822446			-1.388740263
1422	-0.515510538			-0.838047732
1423	-1.280971077			-0.992642702
1424	-0.522786039			-1.067152351
1425	0.542463018			0.363017481
1426	0.06566049			0.54495459
1427	0.671047847			0.314245293
1428	1.265129152			0.106993665
1429	1.744722997			1.221158657
1430	2.894664027			2.410826047
1431	0.558526128			0.960567857
1432	1.884843301			0.498631827
1433	1.229212233			2.140207575
1434	0.768113037			0.419974721

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1435	-1.135426302			-0.448272681
1436	-0.50406718			-0.275349433
1437	0.019428211			-0.097766983
1438	-0.193905946			-0.370556523
1439	-0.183623609			-0.345992258
1440	-0.829641492			0.228186404
1441	-0.044271526			-0.674015959
1442	-0.500556308			-0.207294926
1443	-0.107641033			-0.750813369
1444	-1.293855283			-1.017270721
1445	-0.208215358			-0.938572061
1446	-0.952459452			-0.985055917
1447	1.452260383			0.017009321
1448	1.252888026			2.16090217
1449	0.448135265			1.694318324
1450	0.777592392			0.811273048
1451	0.062903934			-0.055279737
1452	0.916756765			0.716973321
1453	-0.821547367			-0.229285673
1454	-0.625378246			-1.297828063
1455	-0.0690197			-0.326717339
1456	0.31046562			-0.337654081
1457	0.359129438			-0.78675098
1458	0.721074301			0.680649199
1459	1.381010532			1.290517854
1460	0.717584285			0.450234766
1461	1.50332098			1.100309168
1462	1.375704248			2.160054008
1463	0.558199373			1.613120715
1464	0.214102604			-0.599243322
1465	0.139084648			0.95766475
1466	-0.174168587			0.562664677
1467	0.308539854			1.068585615
1468	-0.379384287			-0.812115592
1469	-0.730713105			-0.408357815
1470	-0.610043382			-0.918164361
1471	-1.274938286			-1.579734495
1472	-0.875917222			-1.817295692
1473	-0.046294623			-1.349325186
1474	-0.459041112			-0.780039681

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1475	0.057752337			-0.4304015
1476	1.719724544			0.735571987
1477	0.542174501			1.055686146
1478	0.077905091			0.828839119
1479	0.851630084			0.992269779
1480	0.285736565			1.243813133
1481	1.807117455			2.548896649
1482	0.009018996			0.301939537
1483	0.240880826			0.916499271
1484	-0.405526381			0.32230739
1485	-0.035635128			0.424306042
1486	-0.594550354			1.207940415
1487	-0.287595833			-1.655829468
1488	-0.948303761			-0.285958864
1489	-0.600765641			-0.639593086
1490	-1.648356053			-2.704105329
1491	-2.411148677			-2.414627482
1492	-0.976159578			-1.799526973
1493	0.920429277			-0.212650873
1494	-0.531815238			0.483787276
1495	0.869114924			1.164945979
1496	0.0946669			-0.021549056
1497	0.356291193			-0.35215709
1498	0.092791538			0.488380446
1499	-1.210913532			-0.920530108
1500	0.03821833			0.036144777
1501	-0.508605244			-0.181206815
1502	-0.796097019			-1.159357287
1503	0.007432151			-0.646242907
1504	0.30204474			1.370434681
1505	-1.326473372			-1.59274895
1506	-0.631325873			-1.088608584
1507	-0.096390599			-0.189537023
1508	-0.611044502			0.090954287
1509	-0.863331961			-0.33517221
1510	-0.402338787			-0.91656936
1511	0.257804273			-0.130577778
1512	-0.221855618			0.037929902
1513	0.596278433			0.316045788
1514	0.726198088			0.97535833

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1515	0.724296656			0.40745607
1516	1.087560702			0.469934905
1517	2.012652957			2.523244004
1518	-0.691264458			-0.515973123
1519	0.275603701			0.247251844
1520	-0.71204465			-0.720016533
1521	-0.243562194			-0.385938433
1522	1.350000144			0.483991632
1523	0.645574904			0.205774992
1524	0.615897605			0.722895659
1525	1.260660611			0.200150934
1526	1.144817468			-0.030959105
1527	1.606537149			1.005915517
1528	0.680674936			0.409100026
1529	-0.697570123			-1.149503803
1530	-0.515081239			-0.685162179
1531	0.855180932			-0.614323537
1532	-0.596323171			-0.073952972
1533	0.130078044			1.070149308
1534	-0.114454211			-0.165407086
1535	-0.851756511			-0.575428742
1536	-0.249890455			-0.738418243
1537	0.062585869			-0.21513616
1538	0.010581508			-0.059585442
1539	-0.07634908			-0.105930974
1540	0.07130048			0.446858055
1541	0.494231975			-0.345787902
1542	-1.367847786			0.940860318
1543	-0.566581564			-1.585413768
1544	-0.228425468			-0.63820358
1545	0.364091587			-0.360787285
1546	0.111258378			-0.262959999
1547	-0.033467773			-0.470542923
1548	-1.017233308			-1.147831955
1549	-0.487851122			-0.411466985
1550	0.055576291			-0.449740173
1551	-0.997023197			-0.025846791
1552	-1.327206832			-1.001226789
1553	0.020399784			-0.980767858
1554	-0.083541154			0.240002047

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1555	-0.004972351			-0.278992547
1556	-0.944118523			-0.980442255
1557	-0.136789963			0.378852503
1558	-0.914359535			-1.081363911
1559	-0.333694281			0.1657218
1560	-0.259427166			0.087662961
1561	-1.085992525			-0.448444591
1562	0.54870959			0.574285072
1563	-1.020050696			-0.519602575
1564	-0.045879228			0.454641227
1565	0.402368785			-0.116415173
1566	-0.632542512			-0.006328809
1567	-0.187393452			-0.805684927
1568	0.591071219			-0.25040378
1569	0.085625534			0.30713439
1570	0.150675741			-0.396332123
1571	-0.484046518			-0.253352425
1572	0.313526336			0.772047527
1573	0.322652865			1.387777042
1574	0.163210598			0.217997639
1575	-0.130784981			1.215361552
1576	0.234187574			0.193507944
1577	-0.76363014			0.826950961
1578	-0.564570634			0.138502047
1579	-0.708681513			-0.006707351
1580	-0.122517051			0.055884762
1581	0.400215334			0.921782925
1582	1.387476099			1.45613552
1583	0.131013118			0.864373711
1584	0.979038249			0.020403109
1585	0.413579244			0.251935522
1586	0.504969683			-0.430326361
1587	-0.885791116			-0.804607931
1588	-0.339810499			-1.149832822
1589	-1.024397573			-1.146132784
1590	0.13320133			-0.832532968
1591	-0.694603263			-0.970385553
1592	-0.157186046			-0.214253843
1593	-0.478451717			-0.714194382
1594	-0.286290553			-0.810961749

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1595	-0.684758916			-0.536454254
1596	0.274918907			-0.435867309
1597	-0.093720946			0.234099633
1598	-0.508641743			-0.48631476
1599	-1.823425179			-2.46477836
1600	0.581477152			-0.374409685
1601	0.534848596			0.56955187
1602	1.495543181			1.711998242
1603	1.210722798			1.433511783
1604	-0.44572413			0.170428817
1605	2.566293184			2.08479012
1606	2.628809306			3.928815416
1607	2.835552756			2.788369911
1608	1.500788633			1.418381475
1609	0.203841123			0.152657252
1610	-0.923110645			-0.68224655
1611	-0.37041592			-0.423196104
1612	-0.422187382			-1.194763232
1613	0.290909018			-0.35660852
1614	-0.180434277			0.321007254
1615	1.04278839			0.274080531
1616	-0.550777424			-0.053965369
1617	-0.11798594			-0.525306895
1618	-0.173786215			-0.111052395
1619	-0.774857979			-1.415029315
1620	-0.11104067			-0.389341898
1621	0.558788574			-0.330978644
1622	1.411181439			0.98348589
1623	-0.803600205			-0.575902916
1624	0.861537001			1.667594376
1625	-0.282969129			-0.764136351
1626	-0.054148896			0.341672249
1627	-1.408580856			-0.897269964
1628	0.283522282			-0.239608208
1629	0.602076587			0.443216649
1630	0.332799634			0.292466303
1631	-0.066702872			0.485706742
1632	-0.856475332			0.003167765
1633	-0.58102133			-0.272326218
1634	-1.698010564			-1.794236489

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1635	-0.786593331			-1.311439078
1636	-0.65857337			0.220143661
1637	-0.158397471			0.204751504
1638	-0.768143871			-0.27048246
1639	-0.09696242			-0.650345395
1640	0.566733226			1.296892165
1641	0.239069772			1.262309906
1642	0.718088321			-0.061294859
1643	-1.39968375			-0.502760573
1644	-1.262120126			-1.883849122
1645	-2.158833409			-2.39988767
1646	-0.070898538			-0.836509086
1647	0.615548255			2.004466858
1648	-0.062190879			0.347052103
1649	1.13845097			0.275868503
1650	1.105930212			1.334046804
1651	-0.691167127			-0.227011573
1652	0.547857942			1.004597735
1653	-0.181871649			-0.566377881
1654	-1.582546317			-0.659726983
1655	1.670999893			0.587490222
1656	-0.434548433			2.080034149
1657	-0.174168587			-0.749777359
1658	-0.658336995			-0.584501803
1659	0.040872341			-0.353858538
1660	1.316721594			0.431208035
1661	-0.800065			-0.686068404
1662	0.524976441			0.63831223
1663	-0.858418478			-0.594933063
1664	-0.609386397			-0.358689649
1665	0.04228538			-0.205688541
1666	-1.371257851			-1.026223105
1667	0.789442455			0.423335493
1668	0.355232717			0.616045973
1669	0.5160915			1.232954946
1670	1.212698967			1.702041725
1671	-0.53100878			0.09508296
1672	-1.974623849			-1.391226688
1673	-1.62624451			-2.072339852
1674	-0.097064965			-0.199480447

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1675	-1.026695282			-0.055204028
1676	-1.774241682			-0.72546925
1677	-0.572758613			-1.073440707
1678	0.1869142			0.756622355
1679	0.368921643			0.207300545
1680	0.489281993			0.590995581
1681	1.735318378			2.787143776
1682	0.301000169			0.125972581
1683	0.52559345			0.500632124
1684	1.268787759			0.547856558
1685	-0.57340517			-1.43129468
1686	-0.108219806			-1.021211546
1687	-0.297674817			-0.248580515
1688	2.267410193			0.680434597
1689	0.931627569			0.798680967
1690	2.056059157			1.990575779
1691	0.72006449			0.806474954
1692	0.228945598			0.292656428
1693	0.978374312			1.243950889
1694	1.718271529			0.756910389
1695	1.236475567			0.113272344
1696	0.288727758			0.112508429
1697	0.349283353			-0.590840822
1698	1.445648819			1.147128875
1699	-0.179365373			0.403321136
1700	0.497042411			-0.336289052
1701	0.680636699			0.301734043
1702	0.079780453			-0.243197245
1703	-0.882339337			-0.630967444
1704	-0.462324299			-1.076097903
1705	0.841003612			0.005902946
1706	-0.321840742			0.450875727
1707	1.318913282			0.715653262
1708	-1.066748773			-0.948979413
1709	-0.895032357			-1.109302041
1710	-1.144359908			-1.160988719
1711	1.037151876			0.480994033
1712	-0.288435314			0.754673858
1713	0.48319706			0.752774316
1714	-1.661346281			-1.07890424

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1715	-1.77776472			-1.560135681
1716	-0.01111464			-0.594869309
1717	1.270586646			2.033729032
1718	-0.482680406			0.869016404
1719	1.439362272			-0.156971569
1720	-0.523041533			0.700430738
1721	1.368230609			0.321715954
1722	-0.156452586			1.00257296
1723	1.172094512			0.327650245
1724	-1.007027445			-0.445675255
1725	0.227763721	0.070719087		-0.110801931
1726	0.381685924	1.157939075		-0.624606226
1727	-0.334551143	0.399698286		0.061536711
1728	0.50001101	1.890355847		0.302691499
1729	0.486408987	0.926945925		0.540082494
1730	-1.209799439	-0.56747618		0.211037014
1731	-0.147685834	0.364779293		-0.21463694
1732	-0.313197392	0.074244521		0.161409264
1733	0.352921104	0.518925872		0.766889105
1734	-1.247005995	-1.155870695		0.991689727
1735	-0.513289303	-0.762343117		-0.175333433
1736	-0.072061297	-0.193274334		-0.609107622
1737	0.287368599	0.704697832		1.403226122
1738	-1.095770826	-1.388027325		-0.340158722
1739	-1.109221638	-1.49059148		-1.432095596
1740	-0.063228499	-0.822791612		-0.493215046
1741	-1.02975426	-1.220627567		-0.867069688
1742	0.29989998	-0.452641535		0.332976591
1743	-1.028038799	-1.389081456		1.091602695
1744	-0.045524664	-0.179086579		0.101713996
1745	-0.993852984	-0.813959075		-0.695001433
1746	-0.943699652	-0.706684137		-0.572845547
1747	1.434095964	1.395682745		0.356869157
1748	0.261681875	0.558465253		-0.149643218
1749	1.101638953	1.159668258		0.308337187
1750	-0.601102824	-0.388227292		-0.262325301
1751	0.123885352	1.260794829		-0.379630723
1752	-0.287771376	0.142504956		-0.217230381
1753	0.399735631	0.24804488		-0.406108192
1754	0.993542323	0.861691877		0.874564183

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1755	0.981322054	1.03393947		-0.223530122
1756	-0.801747437	0.838334788		-0.867746511
1757	-0.668031869	-0.341527695		-1.393375556
1758	-0.526256936	-0.437854545		-0.736669549
1759	0.734707609	0.879097427		-0.225417711
1760	-0.741650689	-0.407876698		-0.96293937
1761	0.322536416	0.422550908		-0.888742801
1762	-0.423765536	0.030864779		-0.38940053
1763	0.584346681	0.396996621		-0.319108354
1764	-0.705094166	-0.902628532		-1.041346581
1765	-0.608932764	-0.755690283		-1.87998116
1766	0.175929689	0.720463138		-0.744350257
1767	-0.338461768	0.337027806		-0.095966488
1768	-0.062182189	0.237973046		-0.337286924
1769	-0.004478744	-0.119447271		0.874489613
1770	-0.518811106	-0.885278385		0.480211332
1771	1.697866756	1.085046588		2.306219153
1772	-0.551465694	-0.522851311		0.732828267
1773	-1.129098041	-1.02247285		-0.979384614
1774	-0.234089791	-0.254991285		-0.2880269
1775	-0.400943128	-0.341532069		0.103765525
1776	0.632678531	0.573363052		0.174479504
1777	-0.04801356	-0.045047217		0.47488954
1778	-1.481765163	-1.864313646		-1.241699062
1779	-0.140825728	-0.410916619		-0.445389498
1780	0.076759713	0.072911913		-0.330050789
1781	-0.974560567	-0.72531732		-1.053124655
1782	0.81347455	1.09220243		-0.076756462
1783	0.153142042	0.560827206		-0.048373189
1784	-0.539208926	-0.160074317		-0.721766367
1785	2.233366898	2.375293914		0.535764266
1786	-0.043661469	0.660188144		1.044522279
1787	0.325739652	0.120436736		0.663433778
1788	-0.18439183	-0.230772521		-0.612071637
1789	1.097511071	0.822987927		0.661872931
1790	0.435815927	0.626442837		0.228254143
1791	0.175649862	-0.480164117		-0.380863689
1792	1.020947984	1.233785462		0.148367485
1793	1.341264677	0.943951985		1.071613954
1794	0.195946875	0.548514434		0.895068084

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1795	-0.422022266	-0.480470296		-0.781708683
1796	-0.155284613	-0.760729116		-0.562353948
1797	-0.05495014	-0.424114394		0.110142113
1798	-1.755467205	-1.900581285		-1.913842196
1799	-1.691466784	-1.622264515		-2.211373602
1800	-0.231746893	-0.248348658		-1.174343578
1801	-0.366362774	-0.062601483		-0.329589707
1802	-1.443571392	-1.756314084		-1.567995699
1803	-0.513099855	-0.782284122		-1.419306558
1804	0.86788438	0.597317918		0.36753608
1805	0.50368526	0.293024042		0.328989658
1806	2.141736607	0.971433743		1.43408785
1807	1.663915579	1.285612829		1.549227897
1808	2.252739265	1.626451364		1.499027494
1809	0.366756026	-0.052827081		0.655566359
1810	-0.701602412	-0.773165818		-1.124691351
1811	-0.786457762	0.069558523		-0.274518917
1812	-0.701209612	0.085479834		-1.434938932
1813	-0.074744855	0.297925823		-0.961073412
1814	-0.345198471	-0.221620683		-0.677260038
1815	0.47144259	0.663812721		-0.476473229
1816	-0.514876148	-0.810128921		-0.786995183
1817	-0.967823863	-0.930085504		-1.54965262
1818	-0.099505195	0.469714148		-0.824339947
1819	-0.848002311	-0.876087181		-1.746771838
1820	0.087631251	0.120678763		-0.916972949
1821	2.404391568	1.721616191		0.998308809
1822	0.678787408	0.637759799		1.138634727
1823	1.987305154	1.45746239		1.002180756
1824	0.68696496	0.940188899		0.87200945
1825	4.966878185	3.368406121		2.890531934
1826	1.751908119	1.492368261		2.201225179
1827	0.453345956	0.064506568		-0.163253095
1828	0.660218022	-0.202819831		1.606127074
1829	2.109314918	0.823912296		1.229380141
1830	-1.138911103	-1.393760164		-0.071505255
1831	-0.78411834	-0.389723196		-0.746733082
1832	0.312012489	0.458557566		0.461994624
1833	1.345392559	0.567238012		1.019466763
1834	1.993122426	1.362083238		2.59539189

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1835	1.039779816	0.984468223		1.091082982
1836	1.009723621	1.012750421		1.301725552
1837	0.683716534	0.508658667		0.9542499
1838	0.131442418	0.789478815		-0.601054633
1839	-0.556433057	-1.147188331		0.536516797
1840	-1.1261138	-1.180758678		-1.661481987
1841	-0.611755367	-0.26584023		0.089898922
1842	-0.106062879	0.125719053		0.306516199
1843	-1.062852053	-1.078031228		-0.010383481
1844	-0.207546206	-0.04659415		-0.250236993
1845	-0.534015616	-0.881076442		-0.773286828
1846	-0.363189085	0.247253188		-0.967198398
1847	-0.521181814	0.470590404		-0.079133594
1848	-0.510308538	-0.380015861		0.434315497
1849	-1.144735328	-0.801532579		-1.556211364
1850	-1.280001242	-1.414714476		-0.883174529
1851	-1.057371963	-0.832445001		-1.170878635
1852	-0.890642029	-0.224697054		-1.064873128
1853	-0.545834394	-0.542544457		-0.306384779
1854	-1.012775195	0.115444559		-0.82650703
1855	-2.549882012	-2.013215815		-1.53610479
1856	-0.843252205	0.219395267		-0.540018244
1857	-0.781073266	1.171030417		-1.319745378
1858	-1.152528769	0.098228547		-1.15544834
1859	0.354394975	1.276297696		0.682603957
1860	-0.919436396	-0.941265414		-0.430902997
1861	-1.438621409	-1.240291553		-1.152698928
1862	0.503612261	0.394770261		0.19735086
1863	0.975145005	0.581358699		3.168980823
1864	0.515623963	0.838903406		2.041783729
1865	0.322656342	0.53468972		0.963757289
1866	1.065470016	1.056496119		1.101659967
1867	0.844743908	0.741773201	0.2002275	2.148952756
1868	0.504305745	0.372161124	1.7133398	-0.591309873
1869	1.046841536	0.68981024	1.2655125	0.994529648
1870	0.20473796	-0.2303949	0.0561651	-0.328106846
1871	1.630044351	1.034206283	1.3045967	1.106564509
1872	-0.62779762	-0.567503882	-0.3154925	-0.103547011
1873	0.43729675	-0.071171581	0.3475477	0.152053292
1874	0.890574696	1.162174552	0.6166727	1.057257239

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1875	-0.158487849	-0.302498612	0.0675094	0.221410212
1876	1.409031464	0.420808604	0.3098887	0.565870048
1877	0.678370275	0.666579997	-0.166734	1.023131508
1878	0.357568664	0.081178748	0.2256019	-1.08586031
1879	-0.461948879	-0.537148415	0.0075169	-0.839125866
1880	0.582186278	-0.289229395	0.0045982	-0.363213941
1881	-0.133652773	-0.287965313	0.1449311	0.029013381
1882	0.02838615	-0.687526076	-0.2044164	-0.391535167
1883	0.020271168	-0.330648132	0.1078411	1.196819241
1884	0.472727013	-0.322352137	-0.3529376	-0.053850384
1885	-0.250693437	-0.606320098	-0.9219625	0.835275477
1886	0.255570872	0.060877618	-0.0896704	-0.668408979
1887	-1.178177255	-1.15524813	-0.7463899	0.958759962
1888	-0.876631563	-1.313536875	-0.5154307	-1.779659479
1889	-0.783327524	-1.260028438	-0.0123681	-0.028753313
1890	-0.930189746	-1.30188749	-0.5577407	-1.256963709
1891	0.15194626	-0.746166656	0.395142	-0.363813347
1892	-1.389133752	-2.17259514	-0.1053571	-1.468261471
1893	-0.202040046	-0.683523878	0.6408811	0.215231149
1894	0.505063538	-0.015089782	0.4163269	-0.134457694
1895	-0.163863655	-0.208627027	0.1101775	-0.543542957
1896	-0.750139353	-1.288793232	-0.9000382	0.728025618
1897	0.259410237	-0.42946378	0.2662422	-0.531585004
1898	-0.537608177	-0.892702499	-0.6341813	-0.188340488
1899	-1.816038443	-1.634396496	-1.5273117	-2.098546933
1900	0.766281126	0.823541965	0.2033077	0.062185072
1901	-0.251152283	0.991465144	0.3156867	0.227543736
1902	0.554592908	1.212405415	0.4797855	0.31636513
1903	2.15494583	2.382725317	1.5124729	1.191348877
1904	-1.465229302	-1.028258176	-1.1708415	-0.027273298
1905	-0.222178896	-0.341868866	-0.9056848	-0.792131974
1906	-0.661799201	-0.227083793	-0.8478482	-0.728366664
1907	0.41403809	0.768966276	-0.9045887	0.707932137
1908	0.512697078	1.050543124	0.2092878	0.295049498
1909	0.983696238	1.022486915	0.1993482	1.371126303
1910	-0.055739217	0.308806844	-0.5940664	0.797391646
1911	-0.859297934	0.278442629	-0.8351355	-0.613275003
1912	1.33978733	2.4328687	0.7789707	-0.02695908
1913	0.884755686	1.387529634	1.1887677	1.670296541
1914	-0.875851176	-0.254970873	-0.6500805	-0.946091676

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1915	-0.780251166	-0.532061469	-0.0953782	-1.132372629
1916	-0.452924895	-0.578151624	-0.6487078	-0.463989872
1917	0.495476423	0.64787683	-0.1686686	0.601063098
1918	-0.164998606	0.085734984	0.2482963	0.141060765
1919	2.107229251	2.309913019	1.7138217	0.545493088
1920	1.393010068	1.81242307	0.6110755	1.612569694
1921	0.66552083	0.806476127	0.207129	0.852242711
1922	0.132839814	-0.004548475	-0.0028172	-0.353568227
1923	1.047647994	1.111181158	0.1552389	2.72183299
1924	-0.26349074	0.284618698	-0.3359859	0.334178249
1925	-1.358032986	-0.356822068	-1.3407878	-0.48885014
1926	-1.062047333	-0.818108531	-0.5980288	-1.628394543
1927	-0.854222812	-1.008448391	-0.74141	-0.794515367
1928	0.211813584	0.36315946	0.647177	-0.600569643
1929	1.338593285	1.863154025	0.704162	2.073685453
1930	-1.000791302	-0.599235697	-0.2045226	0.701790644
1931	-1.439415701	-0.682530983	-0.3822715	-1.165673116
1932	-0.685099575	-1.337574847	-1.1762262	-0.893931738
1933	0.790509621	0.953227753	0.1421303	0.619097987
1934	-1.017068192	-1.017113259	-0.3710102	-0.66916502
1935	-1.136125	-0.391750577	-0.4885787	0.209681719
1936	-0.169766092	-0.870621595	-0.7548534	-1.444795213
1937	1.597836443	0.498083504	0.2946532	-1.027863138
1938	-0.39918943	0.030871431	-0.276727	0.667573943
1939	2.13489562	1.252164101	-0.3286826	-0.045674931
1940	-0.230598038	-0.104662679	-0.372658	0.911730765
1941	-1.17957639	-1.218968442	-1.2783701	-1.028468948
1942	0.634084618	0.152055248	0.4940507	-0.25896468
1943	-0.334012345	0.358441922	0.1131135	-0.090379545
1944	2.163573538	2.733349384	1.9043814	1.804189432
1945	-0.82501305	-0.742276899	-0.9308908	-0.122736771
1946	2.894425913	2.076885022	1.9179684	0.897822199
1947	1.983684784	1.18734879	2.2149068	1.185066747
1948	2.523351045	0.273542265	0.3572408	0.791425219
1949	1.112918933	0.500257629	1.1796369	2.230190972
1950	-0.327929151	-0.88274604	0.5502879	-0.574973374
1951	-1.474176812	-1.098073557	-0.4866451	-0.464027944
1952	-0.82501305	-0.431501923	-0.8939656	-1.451170703
1953	-0.084601368	-0.482227336	-0.7495645	0.274735984
1954	-1.719242651	-1.611714517	-1.7416944	-1.624366124

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1955	-1.524580425	-0.727049109	-0.4249393	-1.330592752
1956	-1.06138861	-1.057478601	-0.880311	-1.02627132
1957	-0.497389571	-0.348225279	0.0876081	-0.858520392
1958	-0.126314702	-0.632554054	-0.5043277	0.82392032
1959	0.308199195	0.35860779	1.1261064	-0.149136169
1960	0.521111005	0.676097762	-0.0147927	-0.370841804
1961	0.749665315	1.231651708	1.6616608	2.151459324
1962	-0.641648185	-0.400737791	0.0294442	-0.560716641
1963	-0.996211525	-1.569883574	-1.1750057	-2.20878814
1964	2.772762022	0.886331513	0.5182081	0.724522885
1965	0.057050162	-0.376066203	-0.0542644	-1.442830577
1966	-0.322714984	-0.769536392	-0.6652451	-0.413557689
1967	-1.685350567	-1.395434595	-1.3607785	-1.862520551
1968	-2.058163491	-1.889373241	-1.9968106	-1.603026286
1969	-0.732027076	-0.795702579	0.3273317	-0.19936967
1970	0.2864735	0.456562896	-0.0356789	-1.129565437
1971	0.739236982	0.324267679	-0.5156567	0.389502893
1972	-1.310799587	-1.253483518	-1.6151878	-1.271634191
1973	2.074932703	2.18027098	0.2742108	2.082772984
1974	-0.925820274	-0.339658979	0.2788157	1.160217389
1975	4.007650519	3.918136736	2.7074672	1.983083089
1976	0.199570721	0.592797933	-0.097716	-0.152892192
1977	-0.494782487	-0.086390401	-0.316345	0.955871348
1978	1.677787	0.78269586	1.0793249	-0.766018052
1979	0.856555734	0.701800232	0.8901295	2.56108867
1980	1.038182543	1.773115756	2.4017961	3.599764847
1981	-1.856549042	-1.49762202	-1.1691613	-1.13680452
1982	-0.819798883	-0.918052826	-1.2670409	-1.29196713
1983	-2.61403811	1.373520921	1.5622623	2.659328799
1984	-2.429176047	-0.037764204	-0.0191644	-0.299260109
1985	-1.591460558	-0.951383459	-0.193058	-0.965925662
1986	-1.524808756	-0.978885511	-1.1179885	-1.701150823
1987	-0.576088433	-0.778411243	-0.5297477	-0.158968398
1988	-0.621617211	-0.857089943	-0.3698613	-1.094764079
1989	1.001885362	0.416406689	0.1881641	0.651577769
1990	0.283464457	0.515883146	0.5796842	0.361131479
1991	0.707160192	-0.128346191	1.3500047	2.390747382
1992	-0.099352329	-1.093851938	-0.8977692	-1.234482011
1993	-0.755050507	-0.726046765	-0.397849	0.065521179
1994	3.307577594	0.592268224	-0.2856524	-0.239559257

Year	Streamflow Gage			
	Choctawhatchee (Bruce, FL)	Escambia	Perdido	Pascagoula
1995	-0.19092866	0.33644563	2.2455068	-0.505771747
1996	0.245294187	0.51801625	1.5066216	-0.897881342
1997	-0.741305128	-0.699566676	0.6059179	0.141172248
1998	2.037695899	1.808609812	2.9035238	-0.183792689
1999	-0.921746983	-0.470891211	-0.3704543	-1.2970058
2000	-2.448747001	-2.074019204	-2.1030079	-2.242443751
2001	-0.310703748	0.966979231	-0.8866219	0.969421999
2002	-1.784236047	-1.273542716	-0.9096093	-0.736795718
2003	1.68307787	1.403614444	2.8159938	1.725843553
2004	-0.769454984	-0.126999625	0.047011	-0.545835994
2005	0.994101629	1.222521811	2.4670385	0.523898051
2006	-2.05487438	-1.678092201	-1.4959964	-1.645367543
2007	-2.051483215	-1.579251037	-1.6007087	-2.215904251
2008	-1.220052543	-1.25505463	-0.74234	-1.3407063
2009	1.366681138	0.705233529	0.6379711	0.438152932
2010	-1.128446446	-0.946088154	-0.7831401	-1.299019179
2011	-2.400490408	-1.753251458	-1.637657	-0.826973697
2012	-1.579932724	-1.554527369	-1.3606325	0.613712544
2013	1.739928248	-0.780351725	-0.963886	0.291523193
2014	1.235965026	0.156205525	0.4046029	0.73633688
2015	-0.886525645	-1.307704474	-0.832664	-1.040557299
2016	-0.144245397	-0.718449635	-0.2009021	0.276121688
2017	-0.447068966	0.383885779	1.8786712	1.265535051
2018	-0.416584628	-0.720512467	-0.06238	-0.437220495
2019	-1.712832363	-0.92451	-0.60391	0.628238061