Assessing impacts of climate change in a semi arid watershed using downscaled IPCC climate output

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H33E-0938

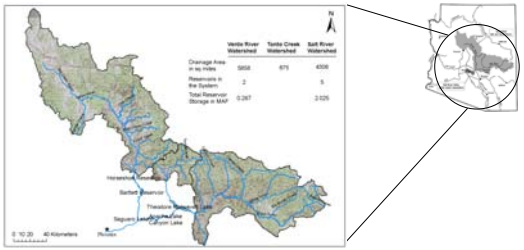
Abstract

This presentation discusses our research aimed at helping water managers at Salt River Project (SRP), Phoenix, assess long term climate change impacts for the Salt and Verde River basins, and make informed policy decisions. Our goal is to assess the future 100 year water balance by development, application and testing of a physically based distributed hydrologic model forced by downscaled IPCC climate information. The variable infiltration capacity (VIC) model is set up to simulate historical observed streamflow at the outlet of Salt and Verde River basins using gridded observed precipitation and temperature data. The model is calibrated using the Shuffled Complex Evolution (SCE-UA) method incorporating observed climate elasticities of the Salt and Verde River basins. The most appropriate models and emission scenarios from the Global Climate Model's (GCM's) participating in the IPCC fourth assessment were then chosen and statistically downscaled to incorporate ENSO variability. The forcing dataset created using the downscaled data was used to analyze the basin scale responses to climate change. In this poster, the scenarios based on future climate forcing data will be presented.

Background

- SRP is a water and power utility company for the City of Phoenix & the Salt River Valley
- It serves 930,000 retail customers
- Delivers more than 1 million acre-feet (1.2 billion cubic meters) annually
- Will global climate change and predictions of drying up of the southwest affect SRP operations?

Study Area

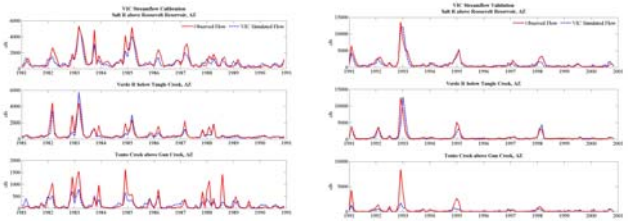


Data

Dataset	Model	Spatial Res	Time Res	Period
Observation	-	0.125	Daily	1949-2005
Reference	MPI-ECHAM5 UK-HADCM3	0.125	Daily	1961-2000
Scenarios (A1B, A2, B1)	UK-HADCM3 MPI-ECHAM5	0.125	Daily	2000-2098

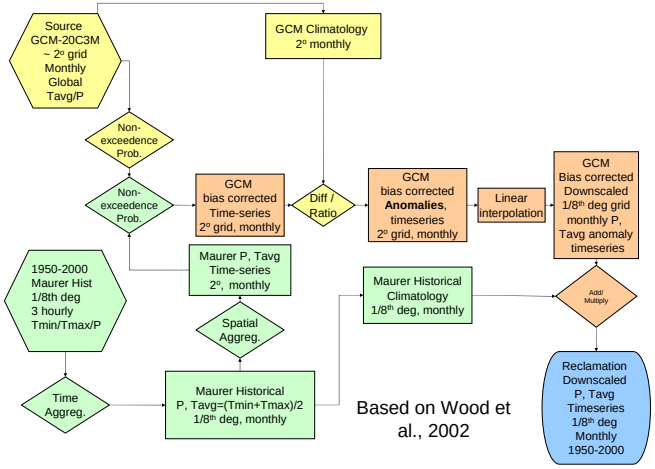
Methods and Results

VIC historical model Calibration and Validation



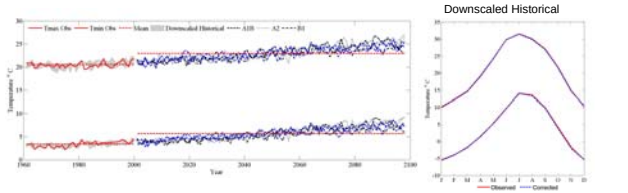
	Calibration		Validation	
	NSE	R	NSE	R
Salt R	0.78	0.9	0.83	0.9
Verde R	0.72	0.87	0.58	0.78
Tonto C	0.54	0.82	0.36	0.85

GCM Data Downscale and bias correction



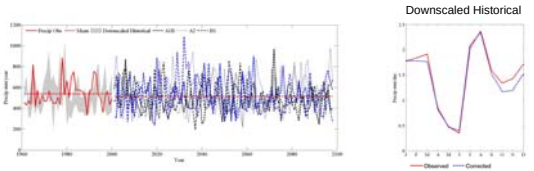
Based on Wood et al., 2002

Bias corrected and temporally downscaled GCM Temperature

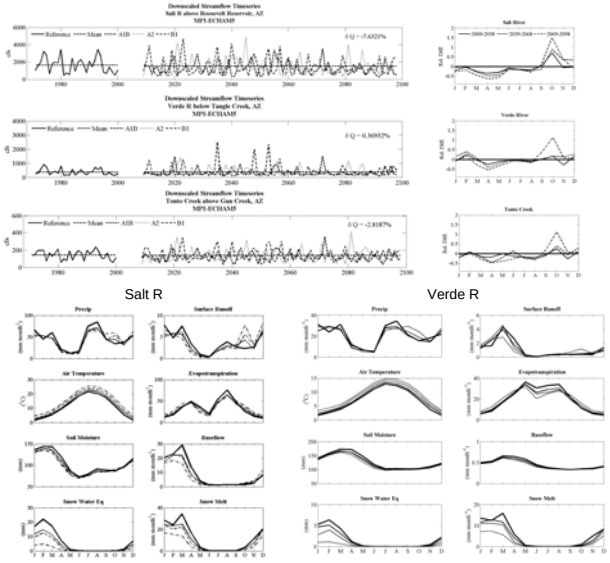


Results

Bias corrected and temporally downscaled GCM Precipitation



Comparison of historic and Future Streamflow



Summary and Future Work

- There may be an increase in temperature of about 2.5 deg C over the watershed
- There may be a drop in precipitation of about 4%
- This results in a net reduction of about 8% to streamflow
- Produce Flood frequency curves.
- Perform Spatial analysis
- Perform climate elasticity of streamflow analysis.

Acknowledgement

I would like to thank my advisers Dr. Gupta and Dr. Troch for their guidance and support. I also thank my co-authors for their help. I specially thank Dr. Francina Dominguez for her inputs to help with my research. Last but not the least, would like to thank SRP, AZ who are funding this project.