Long Term Perspectives of Drought in the American West:

Introduction

Water has long been considered the most important resource of the Western United States (The West). As regional populations grew over the last century at double the rate of the rest of the country, so has the importance of taming the arid expanses of desert with irrigated farmland and smoothing the peaky nature of the precipitation in Mediterranean coastal valleys (Hobbs and Stoop 2002, Cadillac desert). The history of water management of the West has been one of public works projects that rival that of the Great Wall of China and that sought to control some of the earth’s wildest watersheds. Unfortunately, despite the hopes of the engineers that their works would provide continuous water for the burgeoning populations, the water history of the West is also one of periodic, extreme droughts (Dettinger et al. 2015, Colorado River Management).

Multi-decadal oscillations between wet and dry periods are normal occurrences that may be changing due to anthropogenic warming (Barnett et al. 2008). Winter precipitation accounts for the majority of rainfall with interannual variability explained the El Niño Southern Oscillation, a two to seven year cycle of cooling and warming of eastern equatorial sea surface temperatures. Since 1950, mountain precipitation has fallen more as rain than snow, which, combined with earlier springs, reduces summer runoff and strains water resources (Cayan 2001, Dettinger et al. 2015).

Drought forecasting is increasingly important to water managers as climate models predict longer and more severe droughts (cook, others). Agricultural sensitivity and vulnerability of increasing populations Current droughts covering the West have been some of the most severe for the last 700 years, but pale compared to records of elevated aridity from 900 to 1200 AD (Cook 2004).

What is drought, what are the dangers, why is a look back necessary for a view ahead

Expected increases in temperatures, particularly in high elevations and latitudes, are thought to

Questions:

Several questions will be investigated in this work: When and where were multiyear severe droughts in the last century? What were the effects of vegetation on drought severity? Are there hot spots of drought? Is drought frequency increasing? What have been the effects of climate on drought?

To address these questions, we developed a simple drought index based upon multiyear moisture deficit. Alternative indices exist, but issues arise from their use in multiyear drought quantification. The Palmer Drought Severity Index, a common measure, has been criticized for how it treats spatially diverse regions and factors such as soil moisture, runoff, and precipitation. In addition, the index does not have minimum or maximum limits, leading to a somewhat arbitrary interpretation of severe, moderate, or extreme drought (Heim 2002). concluded that the central problem of drought monitoring is that a quantitative definition of drought is not universally accepted. A variety of alternative indices exist, of note is the Palmer Drought Severity Index (PDSI) and the Standardized Precipitation Index (SPI). PDSI has been criticized for how it treats spatially diverse regions and factors such as soil moisture, runoff, and precipitation. In addition, the index does not have minimum or maximum limits, leading to a somewhat arbitrary interpretation of severe, moderate, or extreme drought.

The preliminary issue that must be addressed in any drought-related work is which drought index to use?

To

Outline:

Start with population growth over the last century, population density, the growth of agriculture, dams, reliance on irrigation, water, and the utter devastation droughts can have on humans and vegetation.

Specific vegetation effects, dessication, etc.

Literature regarding expectations of future droughts

Literature regarding past droughts (cook et al)

Need for perspectives on multiyear droughts

Questions

Rational for use of moisture deficit vs established drought indices