Motivation

- Monsoons and drought affect all aspects of life, especially agriculture.
- The most rapidly growing places in the U.S. are potentially most affected by changes to the monsoon system.
- Modeling is used to predict future changes in water availability.
- Does climate change mean changes in monsoonal patterns?
- Could drought be headed our way? And with it, possible stress for agriculture?

Data Sources

- Monsoon region of 18-33°N and 102-112°W was chosen.
- Data was averaged and plotted over this region.
- Plots shown was extracted from:
  - CMORPH: A method that produces global precipitation estimates from passive microwave and infrared data at high spatial and temporal resolution.

Introductory Information

- Monsoon, also generally known as ‘rainy season’
- North American Monsoon exists, but on a much smaller scale than the Asian Monsoon due to less pronounced seasonal reversals of winds.
- Can be dependent on El Niño and La Niña phenomena.

Methodology

Data Sources

The data that was used to create the maps and plots shown was extracted from:

- SP-CESSM – Model data from 2 SP-CESSM simulations were used. Specifically, we used Preindustrial and 4xCO2 runs, each with 10 years of simulated data.
- CMORPH – Observed data extracted from the database that was created using the “NOAA CPC Morphing Technique.” The technique produces global precipitation analyses with a very high resolution. It uses precipitation estimates from low orbiter satellite microwave observations exclusively (Joyce, 2004).

Data and modeling

- It is clear from the maps that the observed data shows significantly more precipitation than either model.
- Both models don’t really resolve the mountains in Mexico.
- 4xCO2 shows dramatic precipitation decreases relative to the control.
- Latitude vs. Time plots (Figure 4) show where and when during the season rainfall occurs.
- They clearly show that CMORPH has a well defined monsoon season.
- The preindustrial run has a stronger concentration of precipitation during late Fall and Winter.
- 4xCO2 shows dramatic lower precipitation, but also shows a concentration in winter.

Conclusions

- Sp-CESSM indicates that North American monsoon precipitation decreases strongly in a 4xCO2 climate relative to preindustrial.
- Some modest increases may occur late in the monsoon season (e.g. October).
- The peak rainfall amount occurs after the JAS season in the models relative to CMORPH, providing a caveat to the results.
- Rainfall is spread more evenly throughout the year (i.e. less of a seasonal cycle) in 4xCO2 climate.
- Supports the conclusion of Eric’s previous paper across multiple CMIP5 models.
- Drier early summer and wetter fall (Maloney, et al, 2013) Differs from research about Asian Monsoon:
  - Rising temperature/CO2 levels seem to decrease amount of precipitation.
  - Opposite of what was concluded about Asian Monsoon (Turner, n.d.).

Future Work

- Comparisons with other models.
- Looking at other variables, such as temperature and pressure.

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