Understanding and Explaining Causes for Trends in Regional Precipitation

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Got Forcing?  What Forcing?  What’s Next?
Characterizing Observed Precipitation Trends

“Its Getting Drier”

Hoerling, Eischeid, Perlwitz 2010 J. Climate
Characterizing Observed Precipitation Trends

“Its Dry….Again”
Characterizing Observed Precipitation Trends

“Its Getting Drier”

Assessment of Climate Change in the Southwest US, CH3: Hoerling et al. 2013; Nowak et al. J. Climate 2012
Characterizing Observed Precipitation Trends

“It’ll Get Wetter Again”
Observed Precipitation: 1901-2014

Extended Dry & Wet Regimes are Symptoms of the Semi-Arid West
Observed Precip & SST – 1901-2013
Observed Precip & SST – 1901-2013

Are Wet and Dry Regimes Determined by Warm and Cold Ocean Regimes?
Historical Simulations (AMIP) : 1871-2013

Hoerling, Quan, Eischeid 2009 GRL ; Seager and Hoerling 2014 J Climate
Historical Simulations (AMIP) : 1871-2013

SST-Forced Dry and Wet Regimes Most Prevalent in the Semi-Arid West
Historical Simulations (CMIP) : 1921-2013

What’s the Nature of the Forcing?
Historical Simulations (CMIP) : 1921-2013

Shin and Sardeshmukh 2011 *Clim Dyn*; Hoerling et al. 2012 *J Climate*
Southwest US Precipitation Regimes of Last Century Have Not Been Strongly Forced
Southern Great Plains Precipitation Regimes of Last Century Have Been More Strongly Forced
We’re Getting Smarter 😊: Improved Situational Awareness
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It’s likely that sea surface temperatures have forced multi-decadal trends in NA precipitation during the last century, especially over the southern GPlains.

The consequential SST forcing has mostly been due to natural internal variability.  
(Contrast with Hoerling et al. 2012 for Mediterranean Pcpn trends)

The particular history of SST variations has very likely been more important than the particular history of external radiative forcing.  
(Is this true for East Africa drying? See Liebmann et al. 2014)

Appreciable precipitation trends arise without forcing, via atmospheric noise/land coupling alone.  
(Is this the paradigm for Mega-droughts of the American Southwest?)