Geophysical Research Abstracts
Vol. 19, EGU2017-10821, 2017
EGU General Assembly 2017

Climate and drought over the past 1000 years in the Last Millennium Reanalysis

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The North American Drought Atlas shows large variability in droughts over the past 2000 years. Because drought frequency and severity over the coming century is an area of vital interest, better understanding the causes of these historic droughts is crucial. A variety of research has suggested that a La Niña state was important for producing past droughts, and other work has indicated the potential roles of the Atlantic Multidecadal Oscillation, internal atmospheric variability, and more. Correlations between drought and large-scale climate patterns also exist in the instrumental record, but understanding these relationships is far from complete.

To investigate these relationships further, a data assimilation approach is employed. Proxy records – including tree rings, corals, and ice cores – are used to constrain climate states over the Common Era. By using general circulation model (GCM) output to quantify the covariances in the climate system, climate can be constrained not just at proxy sites but for all covarying locations and climate fields. This "Last Millennium Reanalysis" is used to quantify relationships between North American droughts and SST patterns in the Atlantic and Pacific. Results suggest that the association between a positive Southern Oscillation index (La Niña conditions) and drought in the southwest United States is robust through time. However, not all drought events conform to this relationship, indicating that the Southern Oscillation alone is not enough to fully explain drought in this region.