

**Tropical modulation of precipitation patterns over the western US during the past 1000 years: Inferences from paleo-proxies**Nicholas E. Graham<sup>1,2</sup>

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Tree-ring reconstructions of Sacramento river flow and Southwestern US drought severity are related to tropical proxies for El Niño (Laguna Pallcacocha alluvial sediment record, Ecuador) and Pacific decadal variability ( $\delta^{18}\text{O}$  from the Quelccaya ice cap, Peru). One interesting result is a robust positive relation between El Niño activity and precipitation in Central and Northern California over the past 1200 years. This finding establishes the multi-century stability of the response to El Niño forcing in this region and provides support for the quality of both proxy records. In contrast, the relationship between proxy El Niño activity and indicators of precipitation over the Southwest US appears transitory rather than the positive relationship seen in the instrumental record. Consistent agreement is found between proxy for Pacific variability (Quelccaya  $\delta^{18}\text{O}$ ) and Southwestern US precipitation at multi-decadal time scales as far back as about 500 AD. The signature of this low frequency variability is also found in a variety of other paleo-records and reconstructions including indices of Northern and Southern Hemisphere temperature, central Asian precipitation and western Pacific coral  $\delta^{18}\text{O}$ . Composite analyses using the proxy data show the multi-decadal variability modulates the El Niño-related precipitation signal over the Southwest US in a way similar to that seen in the instrumental record. The findings support the hypothesized key role of the tropical oceans in generating and/or amplifying Pacific multi-decadal climate variability.

These results represent a collaboration with David Meko, Donald Rodbell, Lonnie Thompson, and their co-workers, and discussions with Lonnie Thompson and Malcolm Hughes.