The Laboratory of Tree-Ring Research

presents a talk by

Dr. Eugene R Wahl

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Late winter post-volcanic temperature response in western North America: relationships with ENSO phases — AND – Recent California and western Nevada precipitation deficits in the context of the last half-millennium

Wednesday, March 11, 2015 - 1:10pm to 2:00pm
Room: PAS 220

Dr. Wahl will discuss his most recent published work in western North America paleoclimatology, done in conjunction with Drs. Henry Diaz, Jason Smerdon, and Caspar Ammann

Abstract for post-volcanic component

February–March temperature reconstructions in western North America from 1500-1980 in the Common Era (CE) are used to evaluate, from a regional perspective, the hypothesis that radiative forcing by large tropical volcanic eruptions induces a tendency in the climate system towards an early post-event El Niño (EN) response followed by a delayed La Niña (LN) response. Post-event spatial composites using superposed epoch analysis (SEA) detect indications for an EN-like pattern in post-event Years 1–2; this result, however, is sensitive to the set of eruptions evaluated. Highly significant LN-like patterns are also observed for two eruptions during Year 1. In contrast, a clear and unique LN-like response is found in both evaluated eruption sets during Years 3-5; Year 3 in particular represents the time of strongest post-event response, and no significant EN-like patterns occur during these years. Spatial signal-to-noise ratios are most highly significant in the portions of the domain with the strongest anomalies in Years 1–5, especially Year 3. The signal-to-noise ratios tend towards uniformly low and insignificant values beyond the first half-decade after the eruption, indicating generally reduced coherence across events.

Important conclusions for post-volcanic component

- Western N. America winter temperature reconstructions can clearly detect both El Niño and La Niña pattern
- Detection of an early post-volcanic El Niño-like response, which is the focus of much attention in the paleoclimate literature, is conditional on the set of eruptions evaluated
- A clear and statistically significant La Niña-like response is observed in years 3-5 after eruptions
- The results argue against the hypothesis that a later La Niña-like response requires an early El Niño response

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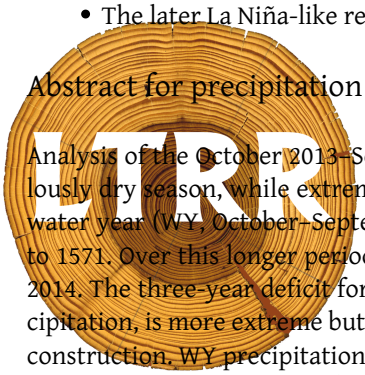
- The later La Niña-like response is consistent with the restored planetary heat balance ~2 years after the eruption



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Abstract for precipitation component

Analysis of the October 2013–September 2014 over the California-western Nevada (CANV) region suggests this anomalously dry season, while extreme, is not unprecedented in comparison with the ~120-year long instrumental record of water year (WY, October–September) totals, and in comparison with a 407-year WY precipitation reconstruction back to 1571. Over this longer period nine other years are known or estimated to have been nearly as dry or drier than WY 2014. The three-year deficit for WYs 2012-2014, which in the California-Nevada region exceeded the annual mean precipitation, is more extreme but also not unprecedented, occurring three other times over the past ~ 440 years in the reconstruction. WY precipitation has also been deficient on average for the past 14 years, and such a run of predominantly dry WY's is also a rare occurrence in our merged reconstructed plus instrumental period record.

Important conclusions for precipitation component

- Western N. America streamflow reconstructions provide strong skill for spatial WY precipitation reconstruction in the region
- The WY 2014 dryness in CANV is extreme but not unprecedented over the past half-millennium, similar dryness is known or estimated to have occurred ten times between 1571-2014
- The WY three-year 2012-2014 dryness in CANV is similarly extreme but not unprecedented over the past half-millennium, similar loss of one year's mean precipitation is known or estimated to have occurred four times between 1571-2014
- Exceptional drought in California associated with the current dryness is enhanced by strong temperature increases during the past century-plus
- This work acts as nearly-independent confirmation of the recently published work on the California dryness and drought published by Griffin and Anchukaitis in late 2014.

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