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Decadal forecasting derived from the mysterious coherence between Pacific climate oscillations and the Great Salt Lake level

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A series of studies identified a pronounced lagged relationship between the Great Salt Lake's (GSL) elevation and the Pacific sea surface temperatures (SST) at the decadal timescale. The lake level variation of the GSL features a pronounced 10-15 year signal and is highly coherent with the NINO4 SST anomalies at this same frequency. Pronounced quasi-decadal signals in precipitation, streamflow, and drought conditions were observed throughout the western U.S. Recurrent atmospheric circulation patterns developed during the warm-to-cool and cool-to-warm transition phases of the so-called Pacific Quasi-Decadal Oscillation (QDO) modulate the synoptic transient activities and, in turn, cause the QDO in the GSL's hydrological cycle. As the GSL integrates the hydrological responses, the quasi-decadal signals are then transferred to the lake elevation with a time lag. Using this relationship, a statistical model was built to predict the GSL elevation tendency out to eight years. The model was able to replicate and forecast turnarounds in the GSL elevation, that is, where prolonged increasing trends (wet periods) were followed by persistent decreases (dry periods), and vice versa. The current generation of climate models has shown increased potential in capturing such decadal trends in climate.