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Sent: Wednesday, October 4, 2023 11:05 AM
To: Delta Council ISB <DeltaCouncilISB@deltacouncil.ca.gov>

Subject: Research brief: Atmospheric Rivers Have a Quasi-Decadal Frequency

Dear Delta Independent Science Board members,

I wanted to forward you this brief on research funded by the US Department of Energy / Earth and Environmental Systems Modeling (EESM). This is from the EESM website.

Atmospheric Rivers Have a Quasi-Decadal Frequency

[EESM Atmospheric Rivers Have a Quasi-Decadal Frequency:](https://climatemodeling.science.energy.gov/research-highlights/atmospheric-rivers-have-quasi-decadal-frequency)

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In Northern California, much of the precipitation and surface water comes from atmospheric rivers—corridors of moisture transport from the tropics. The frequency of atmospheric rivers is cyclical, with periods of water surplus and deficit in the region that repeat every 10–17 years. This pronounced wet/dry cycle in this area of the Western United States is mainly attributed to regular fluctuations in sea surface temperatures in the tropical Pacific Ocean.

IMPACT

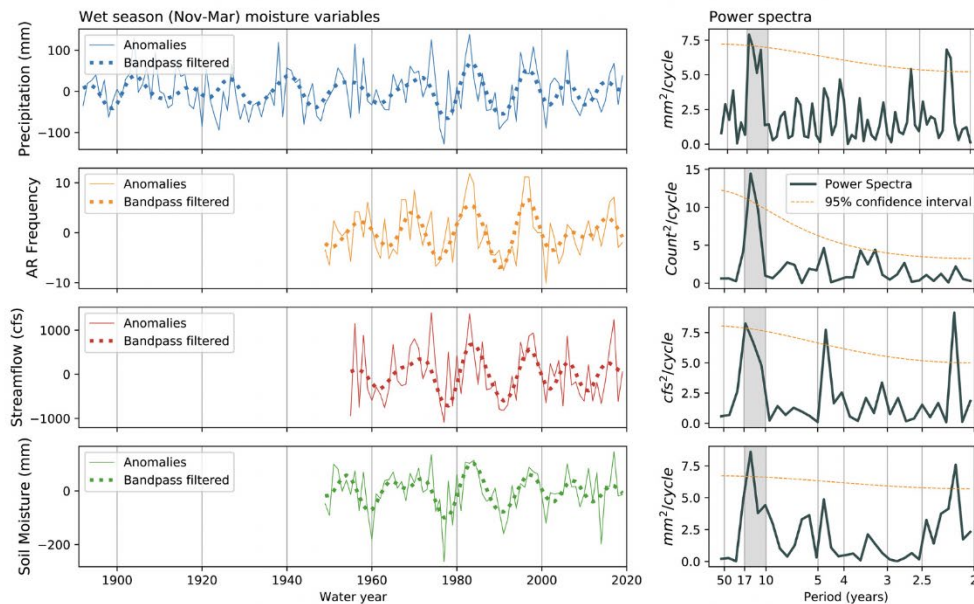
While many social and political factors influence water resource distribution, understanding the climate factors that regulate water availability is important for managing water in the future. This analysis provides a potential source of predictability for atmospheric river frequency, and thus water availability, years before a winter season.

SUMMARY

The observational analysis highlights three important features for AR frequency on quasi-decadal scales:

1. A warming of the Central Pacific that accentuates the Aleutian Low 2–3 years before the peak of quasi-decadal AR frequency
2. A transition from central Pacific warming to eastern Pacific-type ENSO, and the associated eastward shift of the Aleutian Low to a position that facilitates positive IVT anomalies over Northern California
3. A consistent oscillation of the Aleutian Low over 10- to 17-year periods in tandem with the tropical Pacific warming/cooling, modulating AR frequency and wet-season moisture transport.

Atmospheric Rivers Impacting Northern California Exhibit a Quasi-Decadal Frequency



(Left column) Anomalies of precipitation, atmospheric river (AR) frequency, streamflow, and soil moisture along with the bandpass filtered time series. (Right column) Power spectra of the respective moisture variables with the 95% confidence interval represented by the power spectra of a first order Markov process. The gray shaded rectangle highlights the period of interest, the quasi-decadal frequency, from 10 to 17 years.

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POINT OF CONTACT

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Here is a [link to the research article in AGU](https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020JD034196): <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2020JD034196>

Understanding this quasi-decadal cycle was proposed as a "grand challenge" question by Mike Dettinger and Dan Cayan in a 2014 article in *San Francisco Estuary and Watershed Sciences*:

[Drought and the California Delta—A Matter of Extremes.](#)

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California Water Research
Integrative scientific synthesis