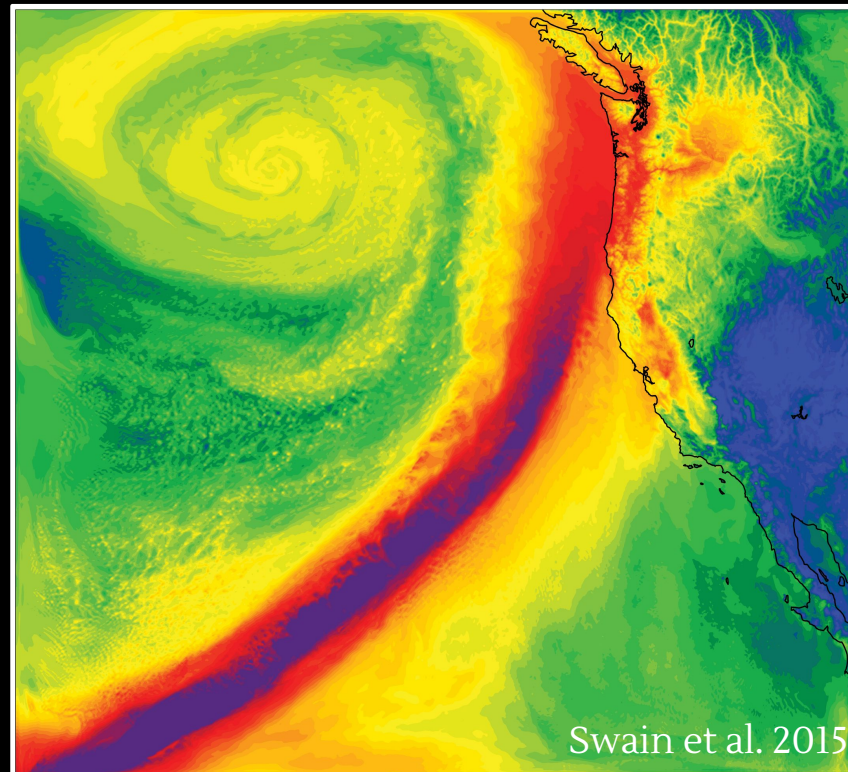


Atmospheric rivers as a scientific (& conversational) bridge between weather & climate

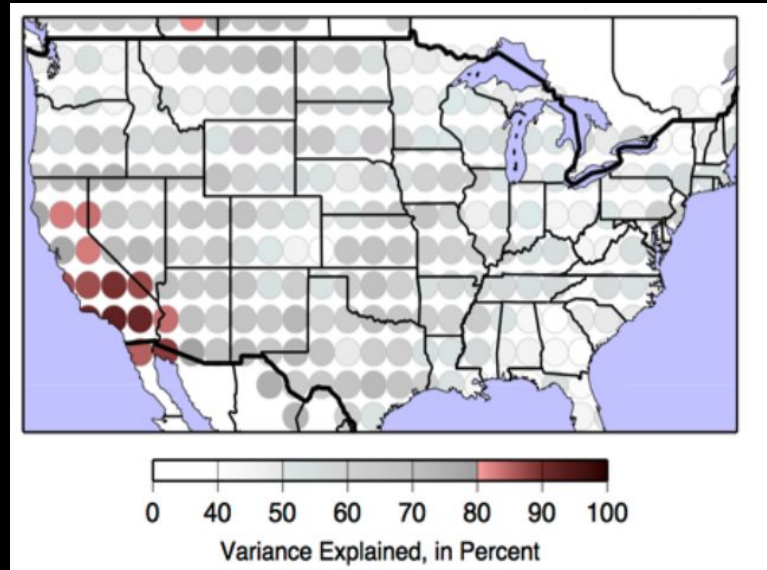


Daniel L. Swain

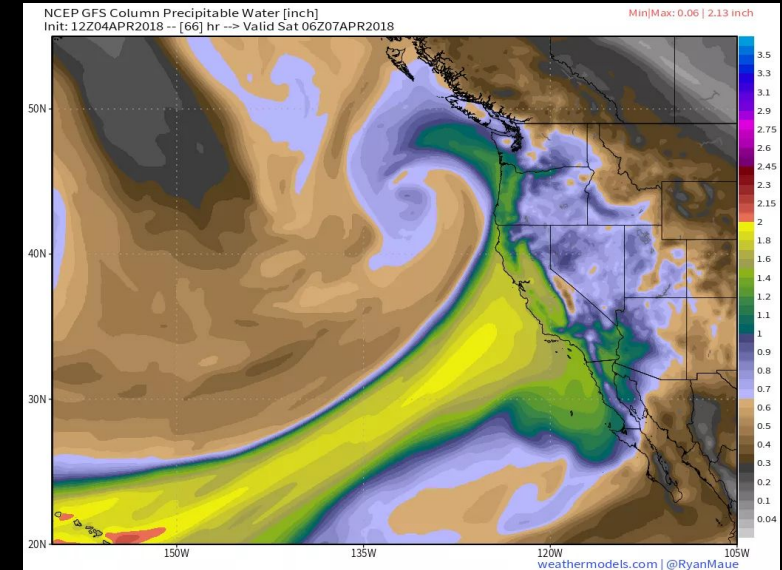
University of California, Los Angeles

June 25, 2017

Atmospheric rivers as *physical* link across temporal & spatial scales



Variance in annual precip explained by wettest 0.2% of days (Dettinger & Cayan, 2014)

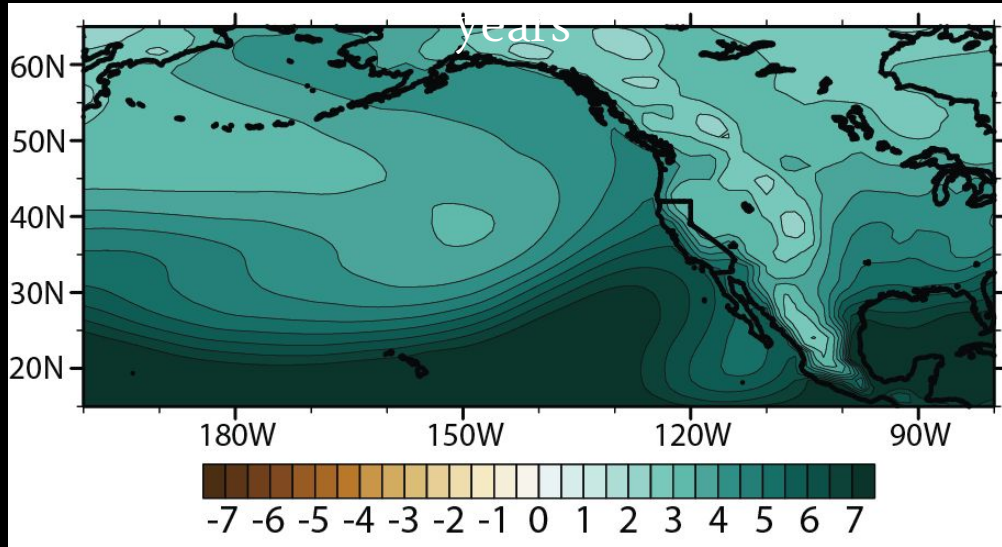


Extremely warm April 2018
“Pineapple Express” AR

- Intrinsic aspect of mid-latitude climate, yet spatiotemporally transient
- “Filaments” responsible for >90% of transport, yet cover <10% of area
- Primary cause of extreme weather in some regions, yet occur infrequently

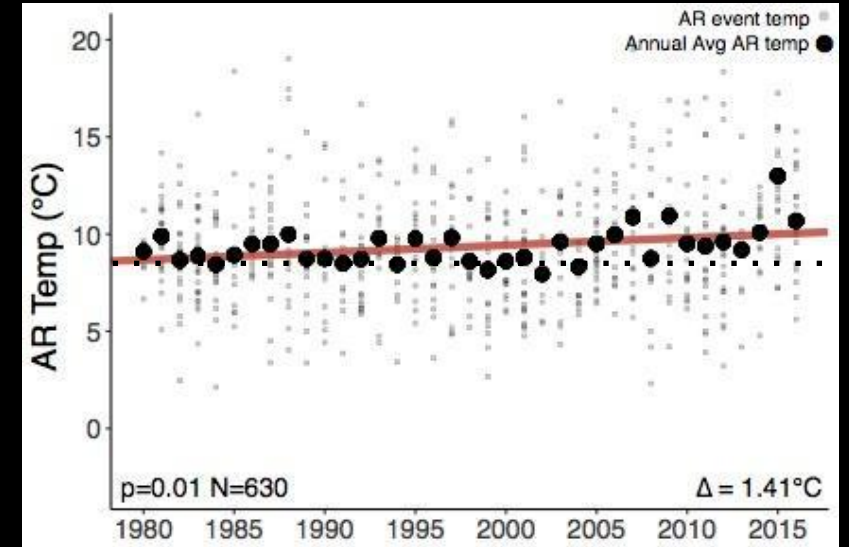
Atmospheric rivers as *physical* link across temporal & spatial scales

Future increase in column Q, California wet years



Swain et al. 2018

Observed S. California AR warming



Katerina Gonzales (see Thursday talk!)

- Climate change in California largely a story of stronger, warmer, and (perhaps) more sporadic atmospheric rivers
- ARs act to concentrate future increases in water vapor
- Less snow accumulation, heavier precip rates, more runoff, bigger floods

Atmospheric rivers as *conversational* link between weather and climate



Thomas Fire,
Ventura
County
Dec 2017

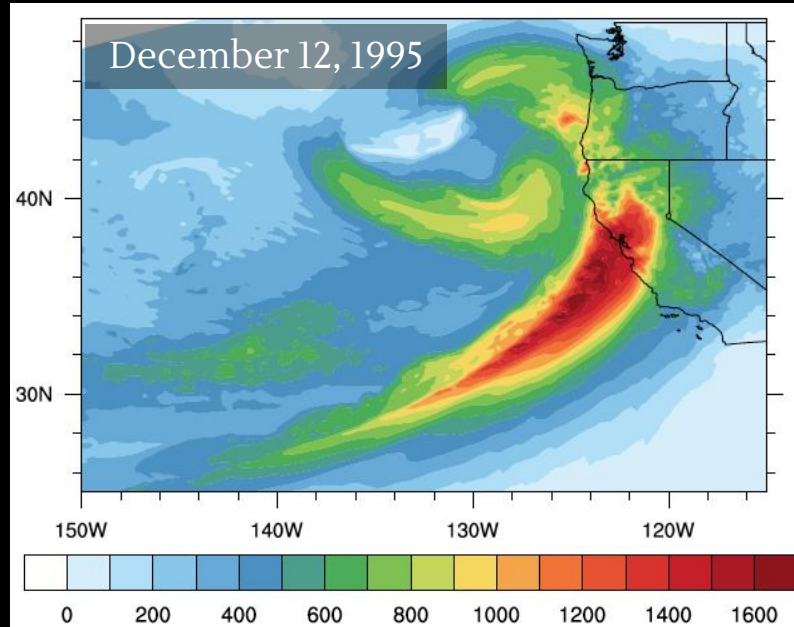


Debris flows,
S. Barbara
County
Jan 2018



- Much of California experiences quiescent weather most of the time
- Perception: “It never rains in Southern California.”
- Reality: Major storms, big floods much more common in CA than realized.

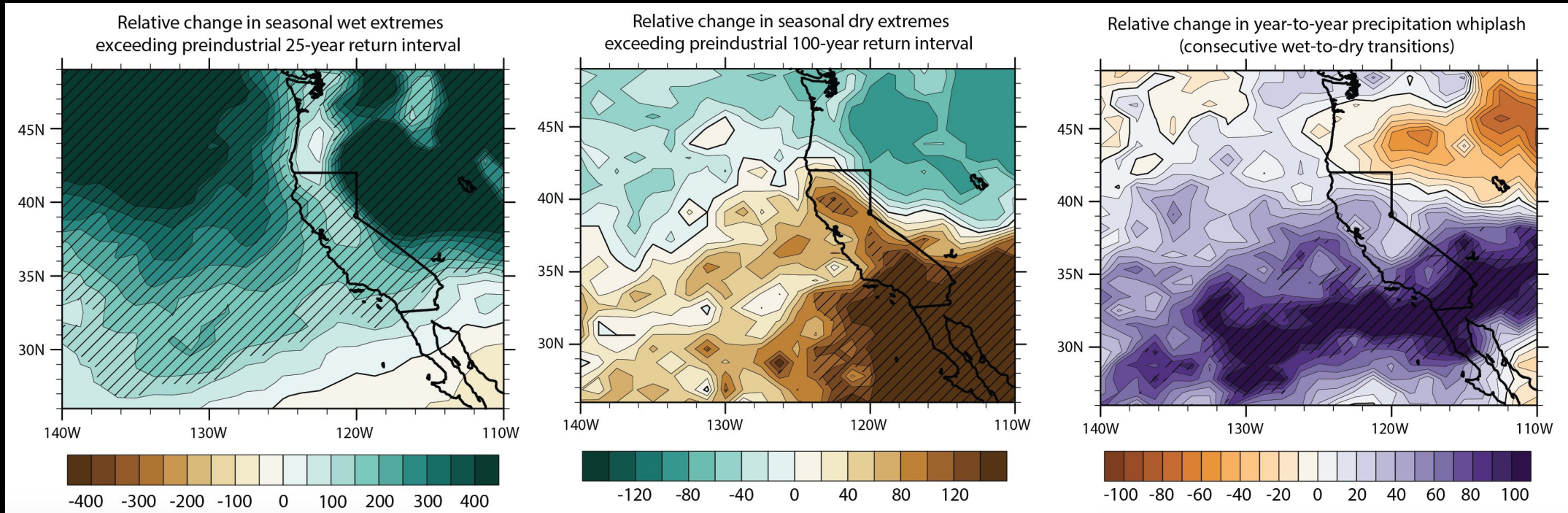
Atmospheric rivers as *conversational* link between weather and climate



Xingying Huang, 2018
(see Wednesday poster!)

- “Atmospheric river” originally an (esoteric!) scientific descriptor that has now entered common public/media usage
- Arguably a science communication success! (with some caveats)
- Useful frame for describing nuance of “low frequency, high-impact” events to general public, decision-makers, and fellow scientists!

Embracing complexity in research: thinking beyond the mean



Increase in wet years

Increase in dry years

Increase in "whiplash" years

Swain et al. 2018

- Large increase in both wet & dry extremes despite little mean precip change

- *Critical difference between unchanged precip distribution and compensating changes at opposite ends of wet/dry spectrum!*

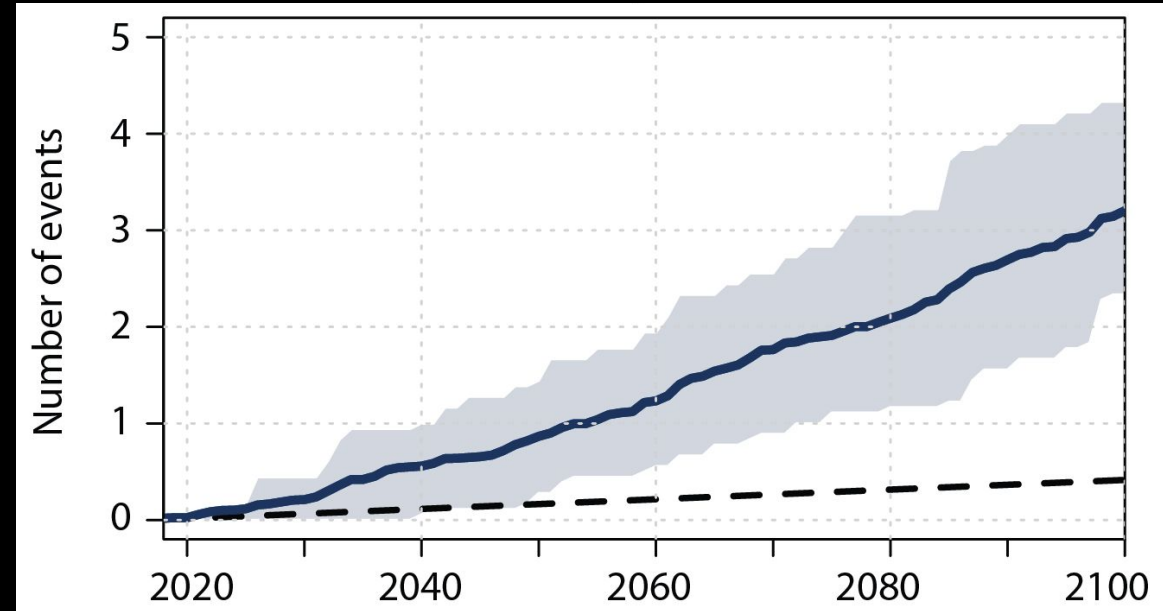
California's "Other Big One": Month-long atmospheric river deluge

Downtown Sacramento, Jan 1862



San Francisco Chronicle

Cumulative likelihood of "1862-like" event

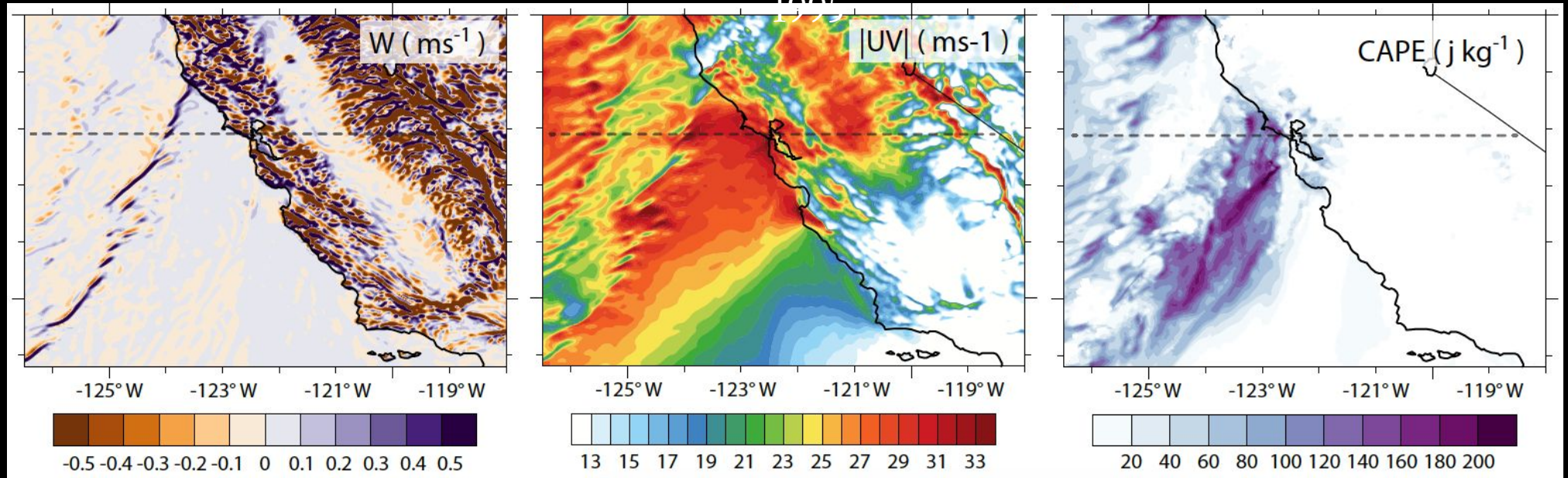


Swain et al. 2018

- California "great floods" have occurred every ~200 years
- Modern day repeat would be disastrous for California
- An 1862-level event *more likely than not* in next 40 years

Storytelling in atmospheric science

A storm with a personal story: December 12, 1995

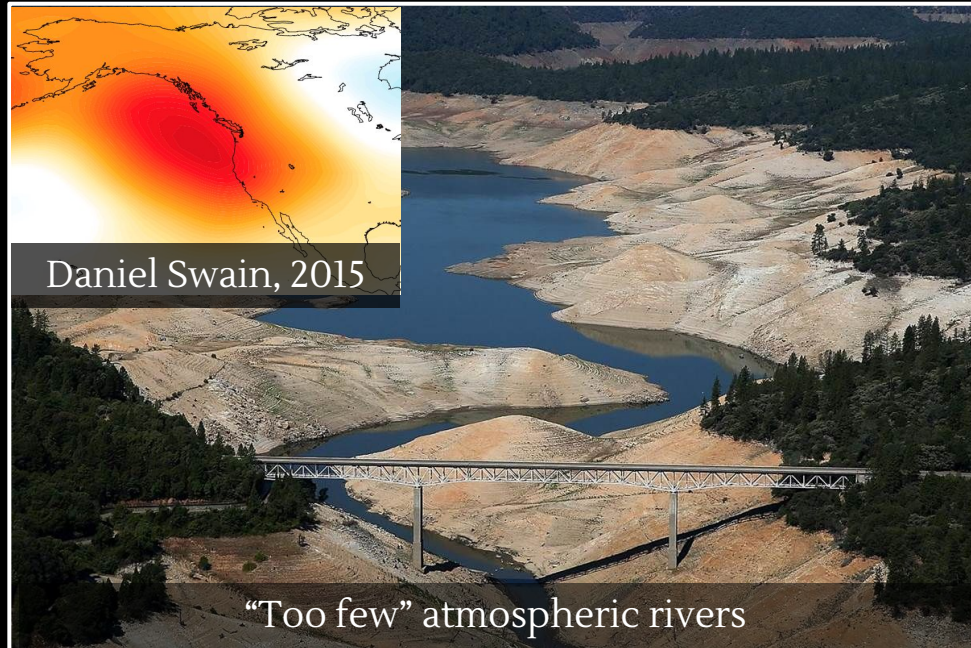


Daniel Swain, 2018

- Narrative is important: how does research connect with society?
- How can societal needs inform physical science research?
- Keep it colloquial, but don't "dumb it down"
- Trusted media partners (esp. individual journalists) can be great allies

Case study: Oroville Dam Crisis of 2017

Lake Oroville, September 2015



Oroville Dam, February 2017



- Atmospheric river event did not “cause” crisis. *However...*
- “Extreme” AR (per CW3E) in early February turned an engineering issue (failure of primary spillway) into crisis (erosion on emergency spillway)
- “Compound extremes” pose big risks to water infrastructure. What about the future? (Huang et al 2018 (temperature) Swain et al 2018 (precip))

Strategic engagement as a scientist-communicator



Weather West blog
(www.weatherwest.com)



On Twitter as @Weather_West

- Social media and blogs can be powerful tools (yes, really!)
- Recognize that substantive engagement in traditional or social media requires sustained investment of time & energy
- Target toward *specific* audiences (e.g., journalists, policymakers, emergency managers, scientists in other disciplines, weather geeks, etc.)

Tying it all together

- Scientific engagement is a two-way street: science informs society, but society should also inform science
 - Public policy? Emergency management? Climate adaptation? Reservoir operations? Environmental protection? Etc.
- Embrace complexity in research
 - Need consider spatial/temporal nuance, seasonality, and greater-than-first order statistics (let's move past the mean!)

A novel partnership between:



- University of California, Los Angeles
(Institute of the Environment and Sustainability)



- National Center for Atmospheric Research
(Capacity Center for Climate and Weather
Extremes)



- The Nature Conservancy