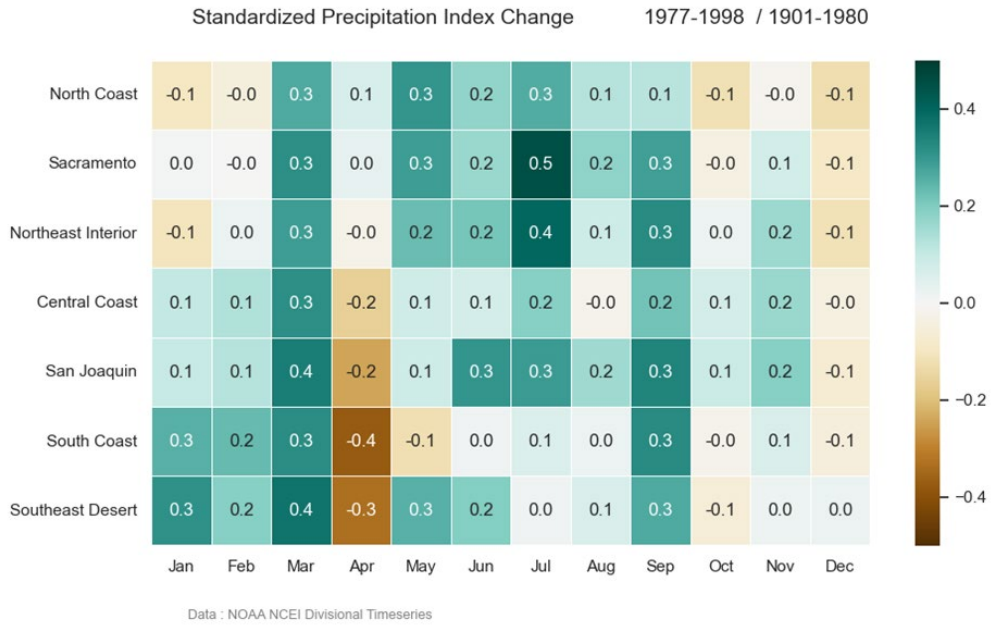
From: Deirdre Des Jardins <ddj@cah2oresearch.com>
Sent: Friday, June 21, 2024 2:30 PM
To: Delta Council ISB DeltaCouncilISB@deltacouncil.ca.gov

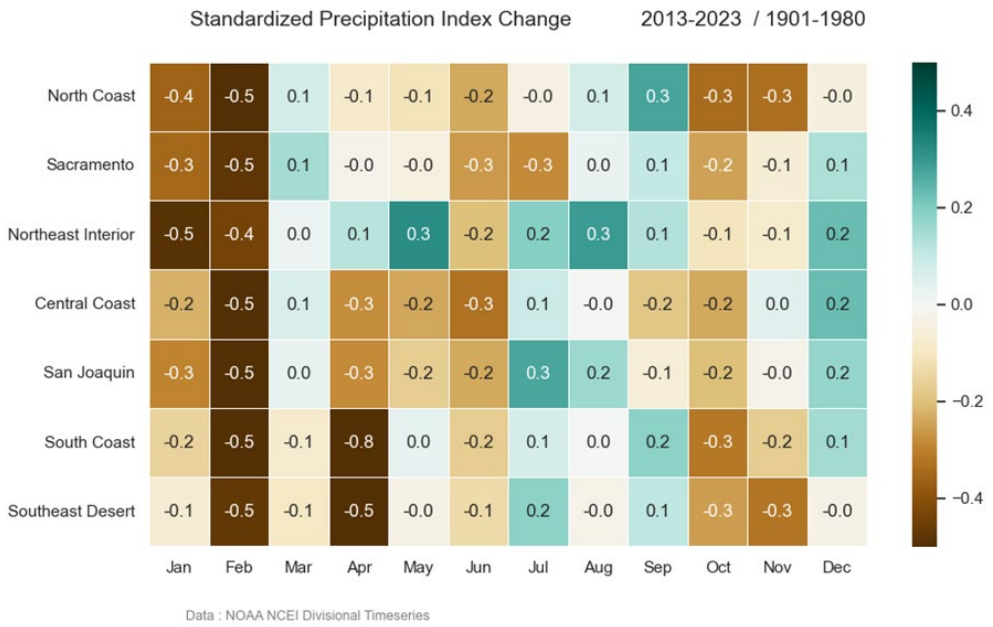
Subject: Could we see the western NA hydroclimate shift towards a wetter pattern?

Dear Delta ISB members.

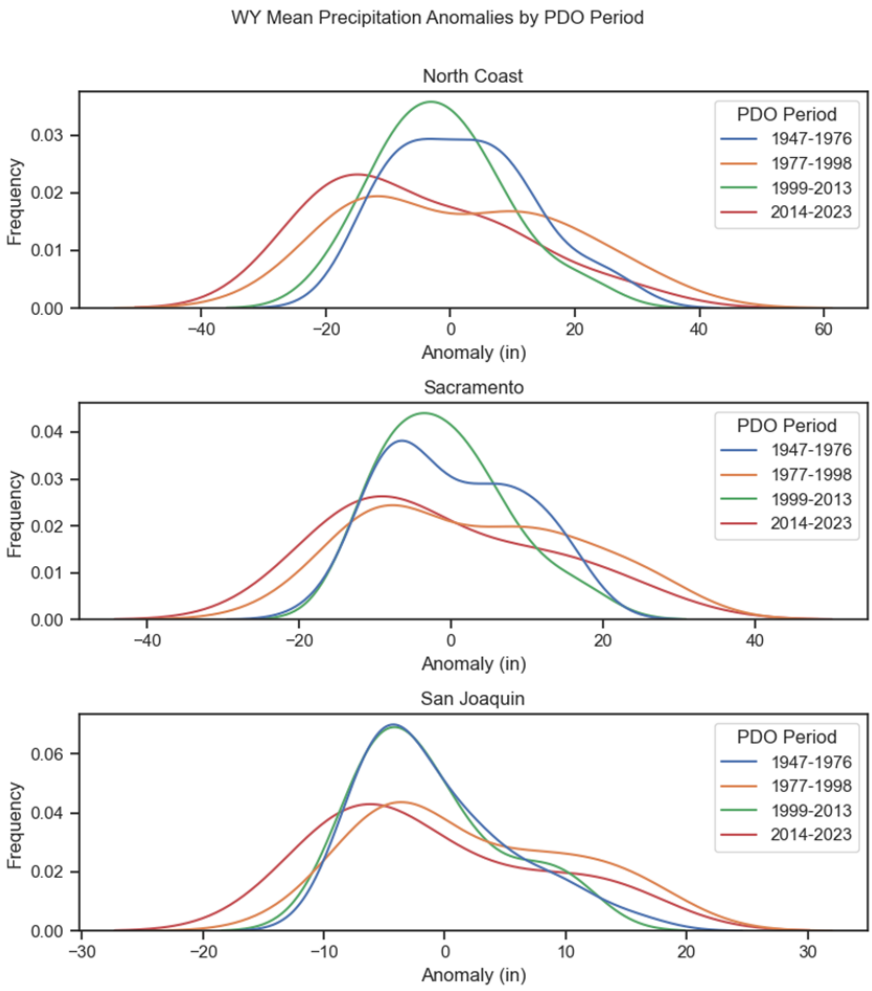
This is the briefing I have been sending to climatologists. It's a bit technical -- but the key takeaway is that we could see a decadal-scale El Nino-like, warm Pacific Decadal Oscillation pattern in the Pacific Ocean. This could be a much wetter pattern, perhaps closer to the pluvial during the warm PDO from 1977-98.



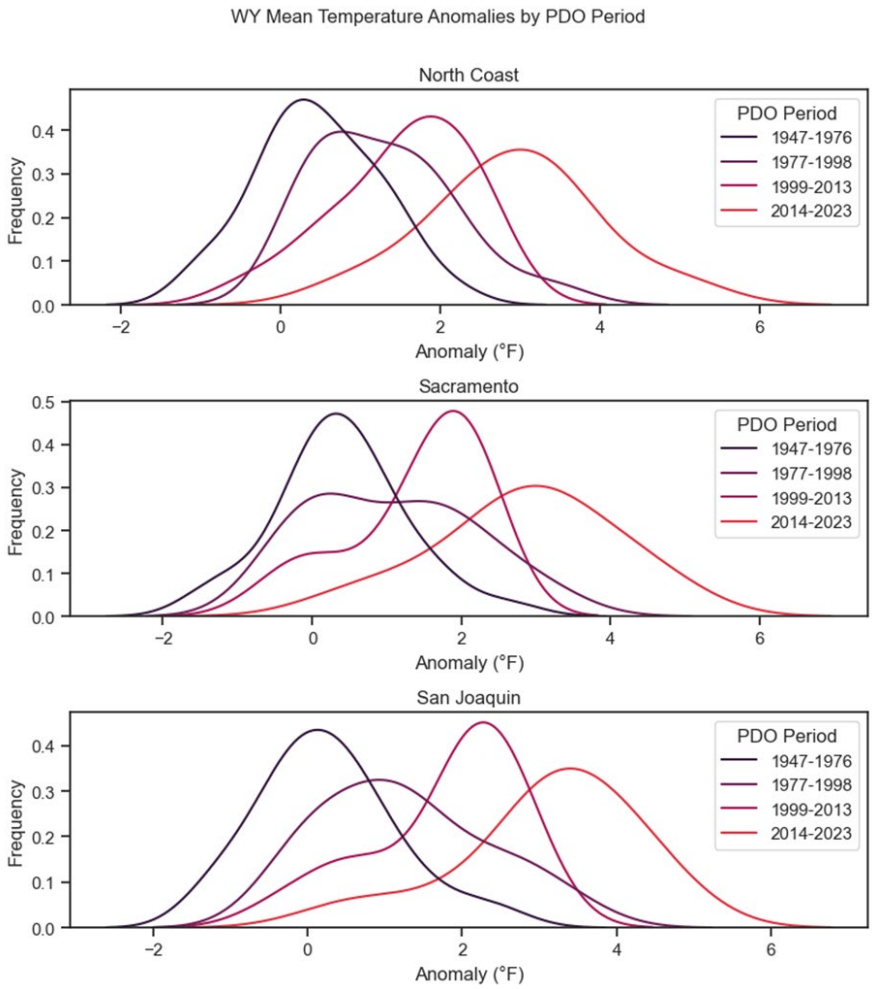
In contrast, this is the pattern we've seen since 2013. It has been a *very* droughty decade.



This shows changing distributions of precipitation by Pacific Decadal Oscillation period.

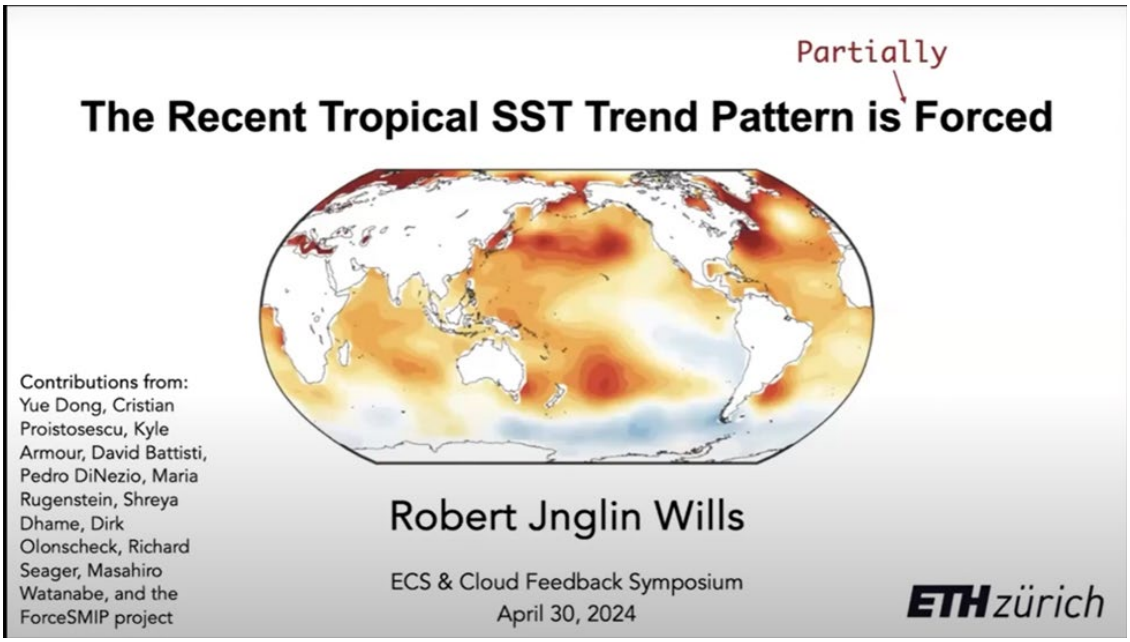


There has also been a significant shift in the temperature distribution.



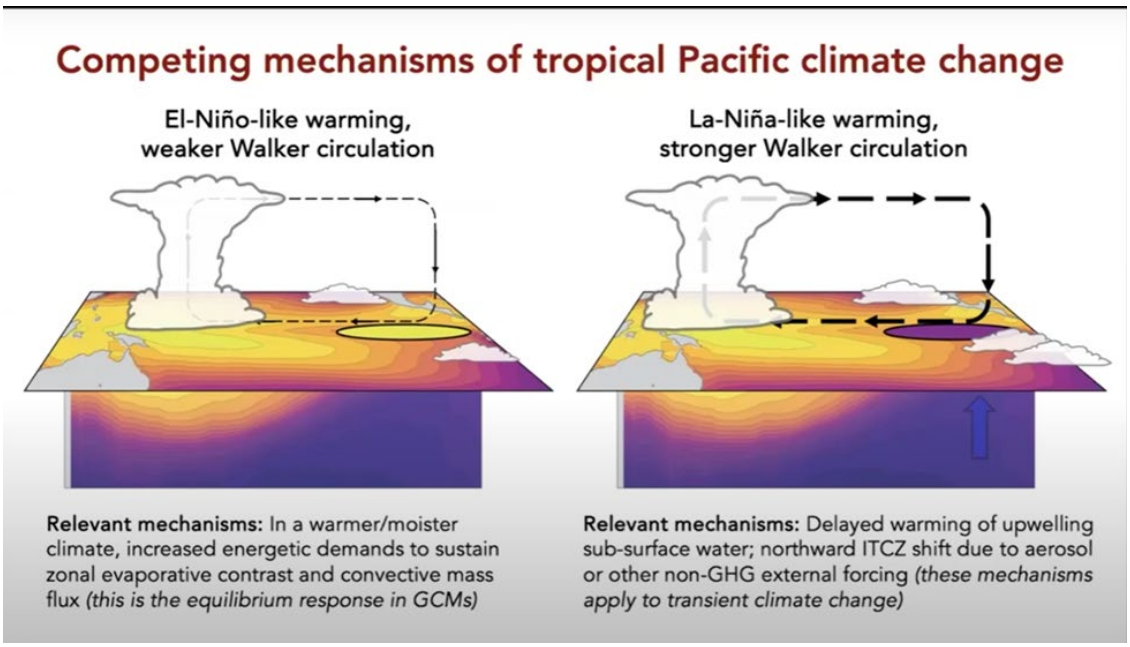
Here's the briefing I've been sending on new high resolution climate modeling showing forcing towards an El Nino-like, warm PDO pattern.

The Equilibrium Climate Sensitivity and Cloud Feedback virtual symposiums feature presentations by leading researchers on climate dynamics. The April 30 symposium was a panel discussion, "Can we rule out internal variability as the main driver of recent tropical SST trends?" Robert Jngln Wills presented a synthesis of recent research showing that the pattern of recent tropical SST trends is partly forced.



Wills also presented the results of new high-resolution CESM1 modeling which showed a dramatic reversal in forcing this decade towards an El-Nino like, warm Pacific Decadal Oscillation pattern in the eastern Pacific.

These are a few key slides from Wills' presentation -- shared with permission. Wills showed two competing mechanisms of tropical Pacific climate change -- a transient response with La-Nina like warming, and an equilibrium response with El-Nino like warming.



The transient response was found in a forcing experiment with the CESM1 model by Yen Ting Hwang et al. with Clara Deser. The experiment suddenly switched on a forcing by constant sulfate aerosol emissions representative of 1980s levels for the first 30 years, followed by an abrupt return to 1850 levels for an additional 30 years.The modeling showed a fast response to an El Nino-like pattern when the aerosol forcing was abruptly increased,, and a slow component with a La-NIna like pattern. See [Contribution of anthropogenic aerosols to persistent La Niña-like conditions in the early 21st century (pnas.org)](#).

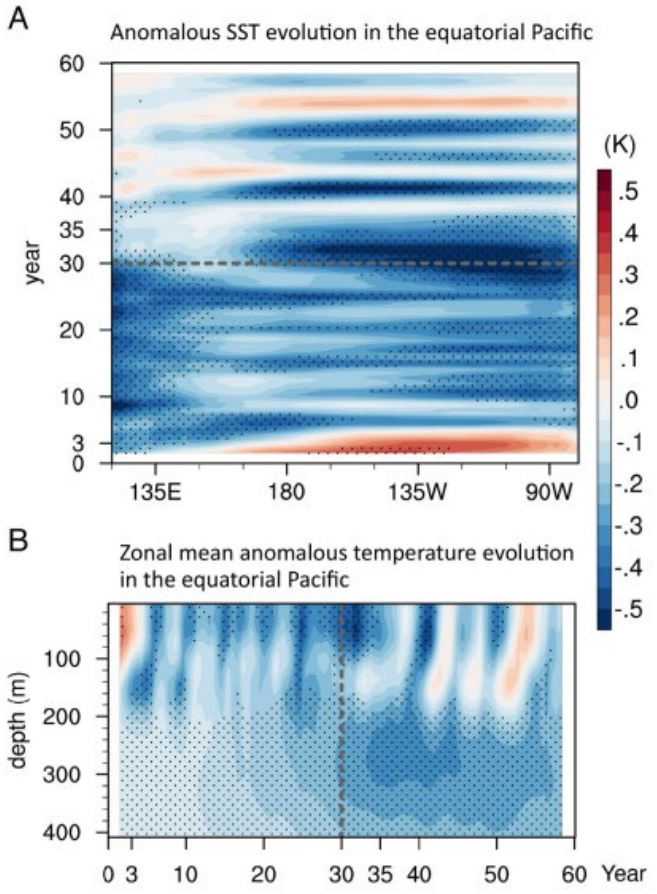


Fig. 1. Temporal evolutions of anomalous oceanic temperature in the idealized aerosol experiments relative to the climatology in the control simulation. (*A*) The 3-y running mean of meridionally averaged SST anomalies in the equatorial Pacific (5°S–5°N). (*B*) The 3-y running mean of the equatorial Pacific temperature response which is zonally and meridionally averaged (5°S–5°N; Pacific basin). Dotted region indicates statistically significant values of temperature anomalies at the 95% confidence level based on two-sided *t* test.

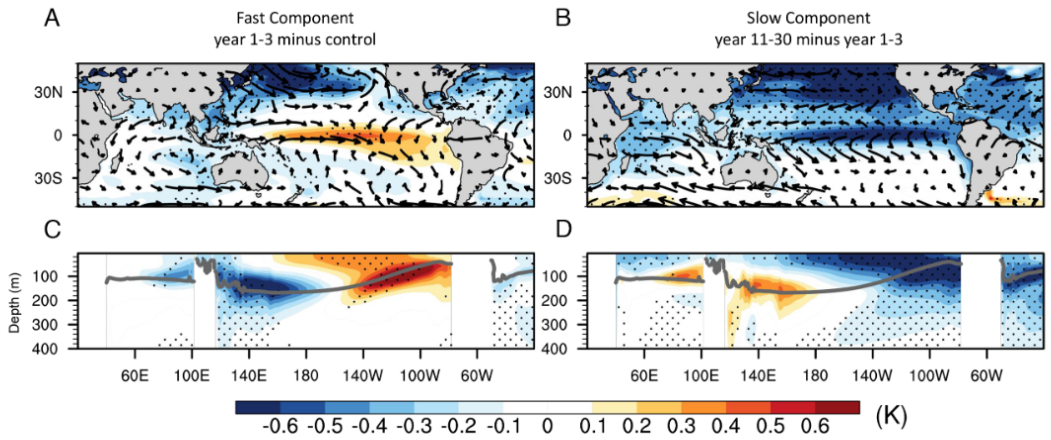
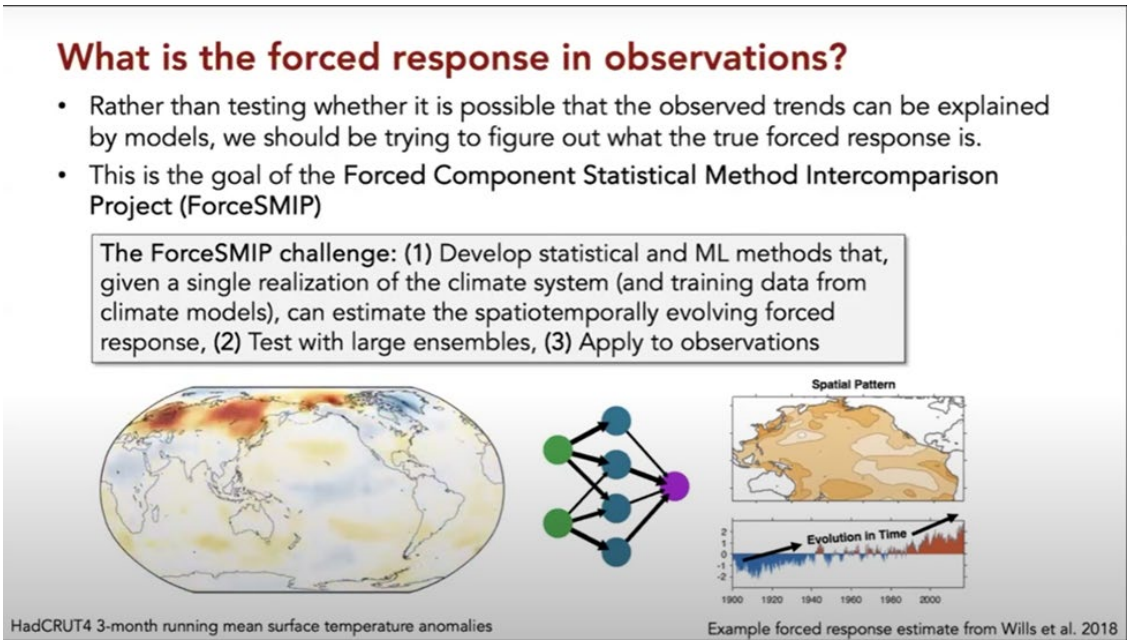
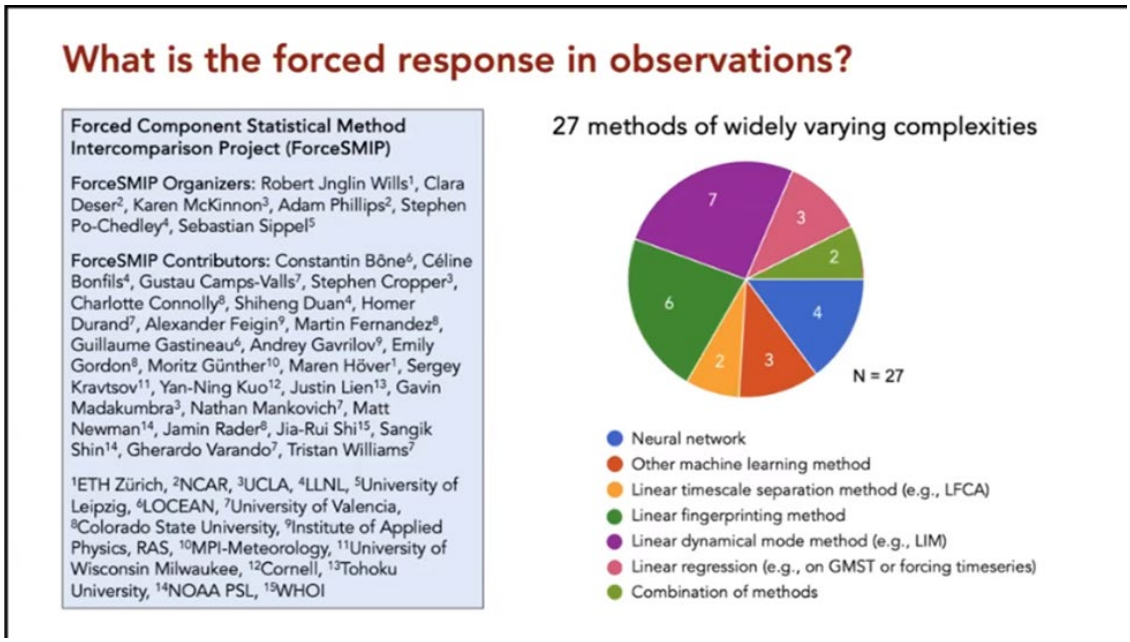
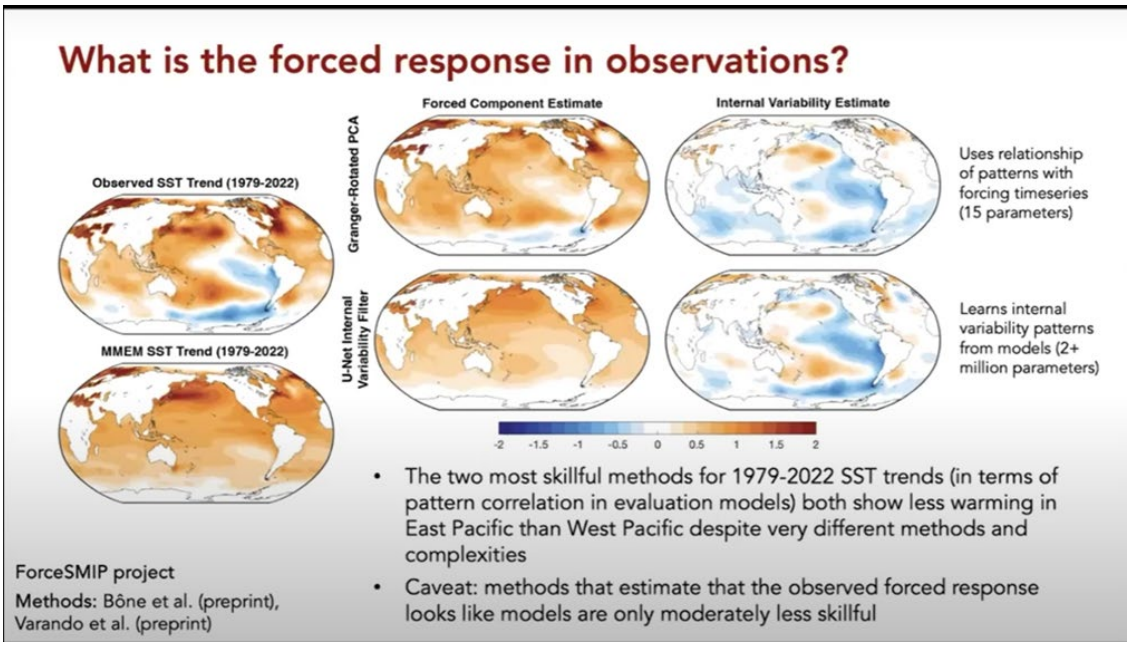


Fig. 3. The fast and slow responses in the idealized aerosol experiments. (*A* and *B*) Spatial patterns of SST (shaded) and surface wind stress (vector) anomalies. (*C* and *D*) Vertical structure of potential temperature anomalies along the equator (5°S–5°N mean) as a function of depth (m). Dotted region indicates statistically significant values of temperature anomalies at the 95% confidence level based on two-sided *t* test.

The Forced Component Statistical Method Intercomparison Project, conceptualized by Robert Jngln Wills and Clara Deser, is trying to estimate the forced response using statistical and Machine Learning methods. From the April 30 presentation by Robert Jngln Wills.

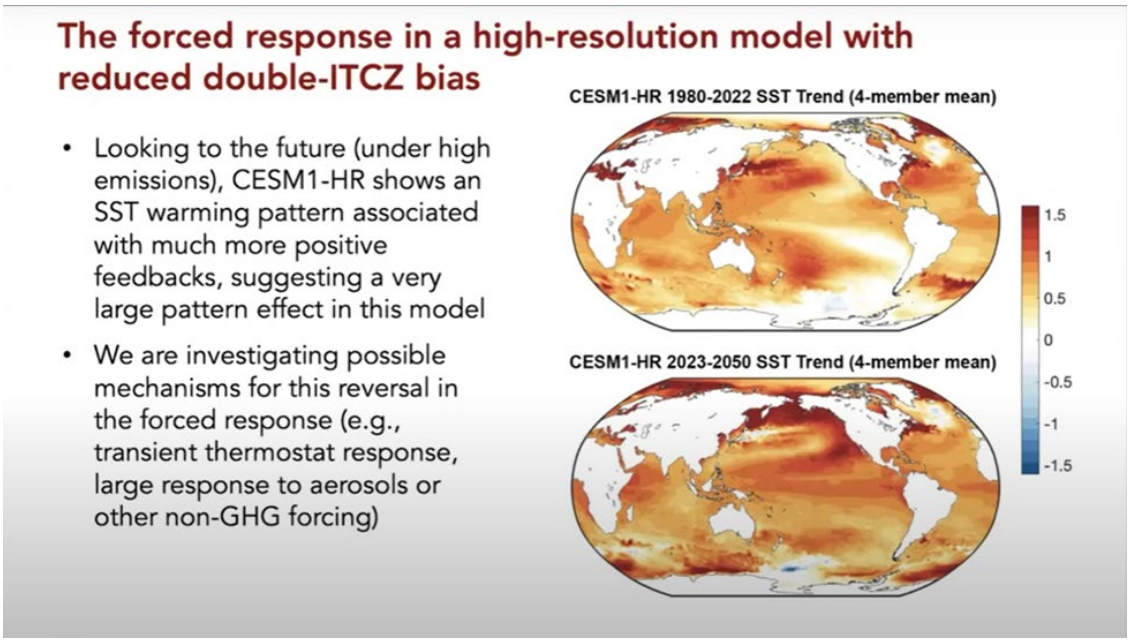




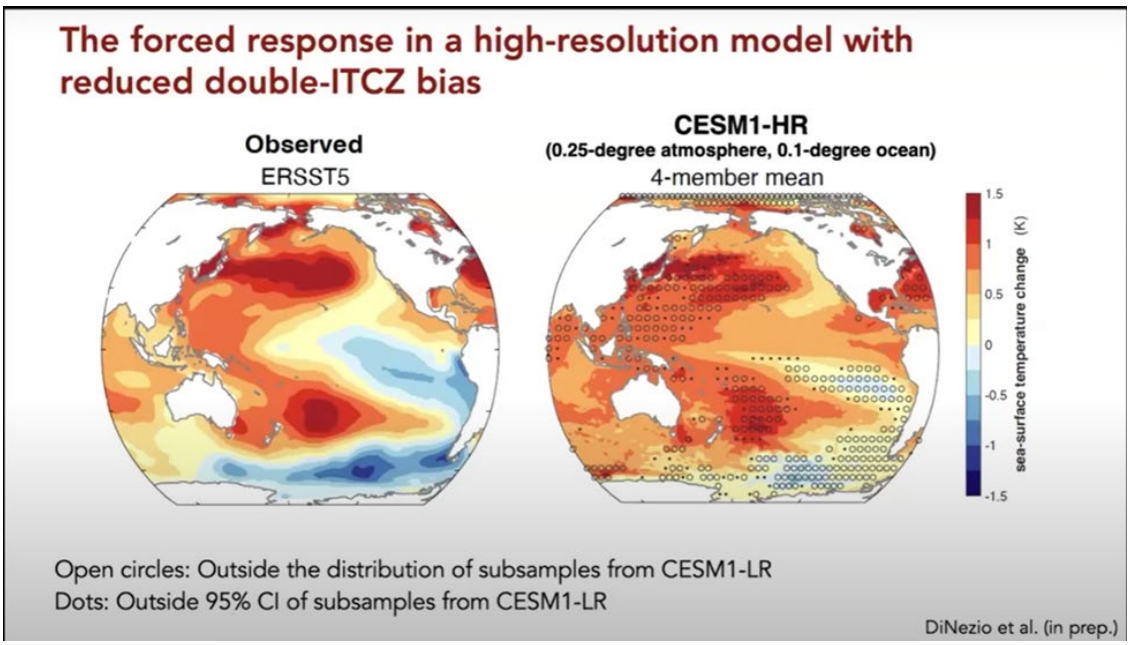


More about ForceSMIP is here: [Advanced Techniques Help Decipher Past Climate Change | Earth & Environmental Systems Modeling (energy.gov)](). It was jump-started in late 2023.

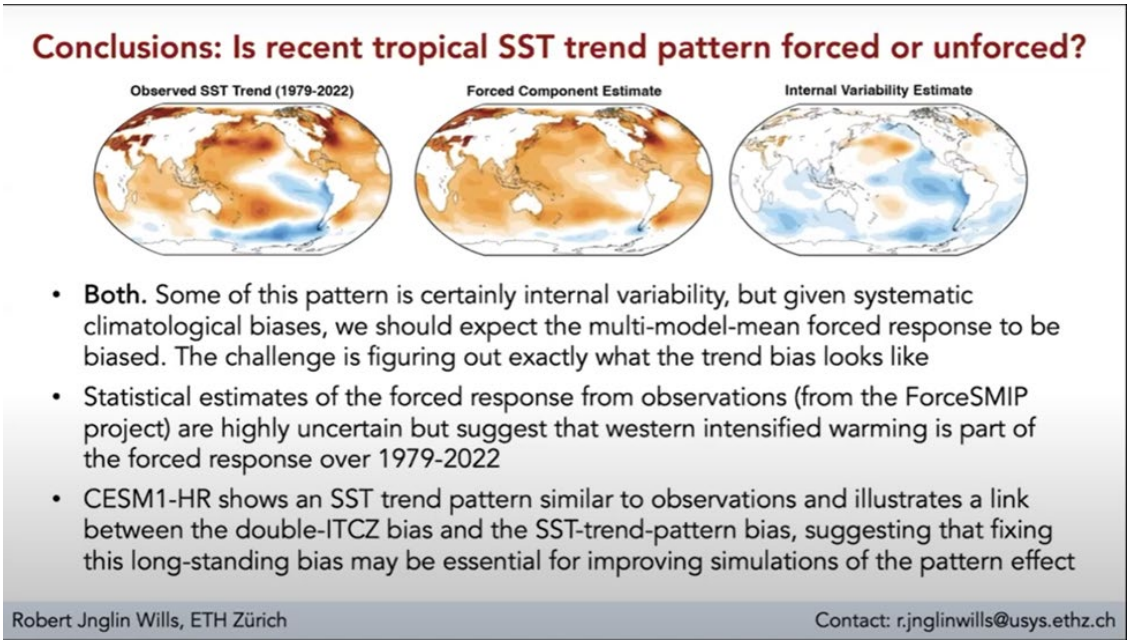
Wills concluded with a slide showing results from a high res version of CESM1, indicating a dramatic reversal from the forced response in recent decades.



The high res model with reduced double-ITCZ bias does a much better job of capturing the recent pattern of warming in the Pacific bettern than the CESM1 low resolution model.



These were Wills' conclusions about the recent pattern of sea surface temperatures in the Pacific.



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"The future enters into us, in order to transform itself in us, long before it happens" -- Rainer Maria Rilke

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