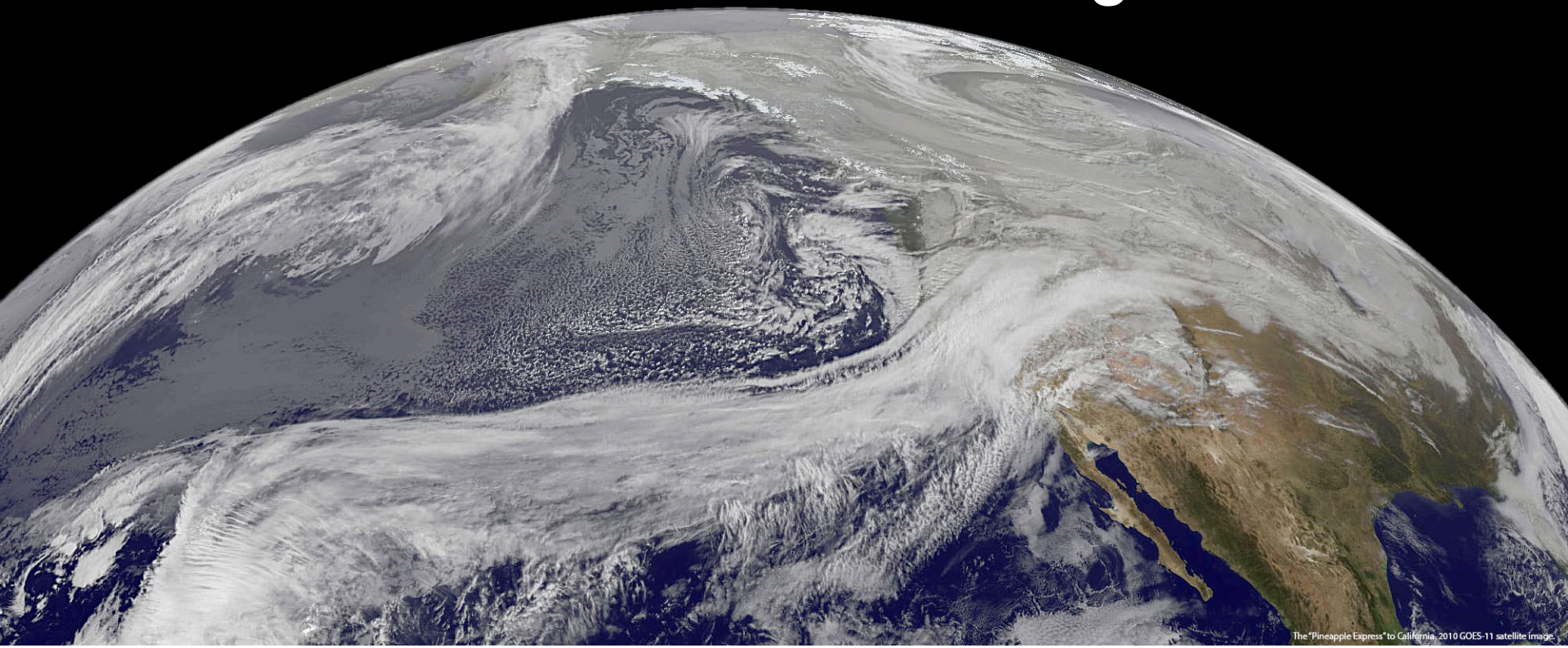
Understanding the Impacts of Correlated Extremes on Flood Risk and Water Resource Management



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NCAR

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Summary

1. Flood risk and water management practice is vulnerable to correlated extremes.

2. Water managers want to know that scientists understand the causes of correlated extremes.

3. Framing extremes as connected events promises significant advances in process-level understanding and predictive capacity.

Understanding Decision-Climate Interactions on Decadal Scales

Atmospheric and social science

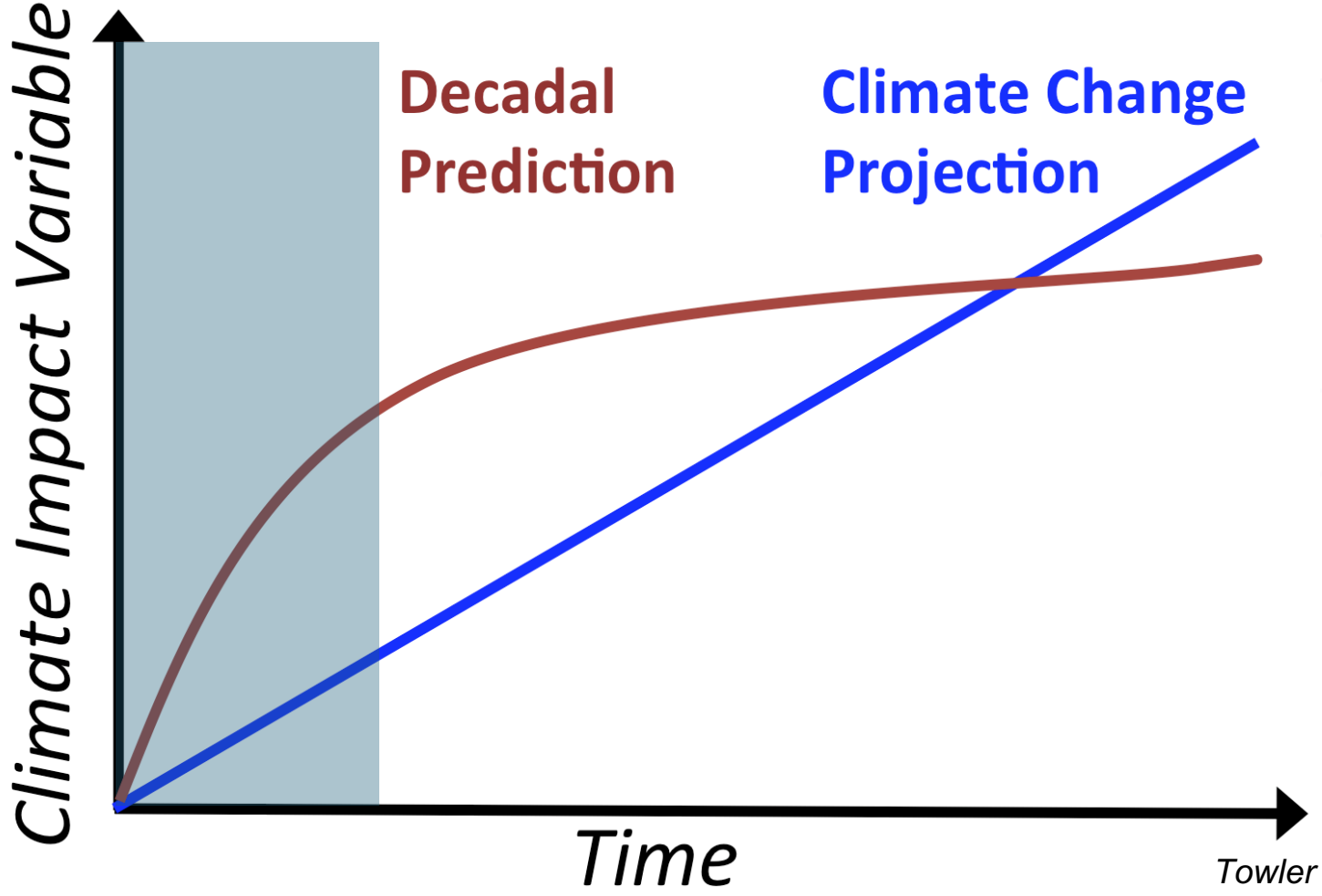
Statistics

Risk perception and policy

Engineering

Morss et al. (2018)

Potential Value of Decadal Prediction



Towler et al. (2018)

The Decadal Prediction Large Ensemble

- Community Earth System Model
- 2015-2024
- 40-member ensemble
- Drift corrected

Yeager et al. (2018)

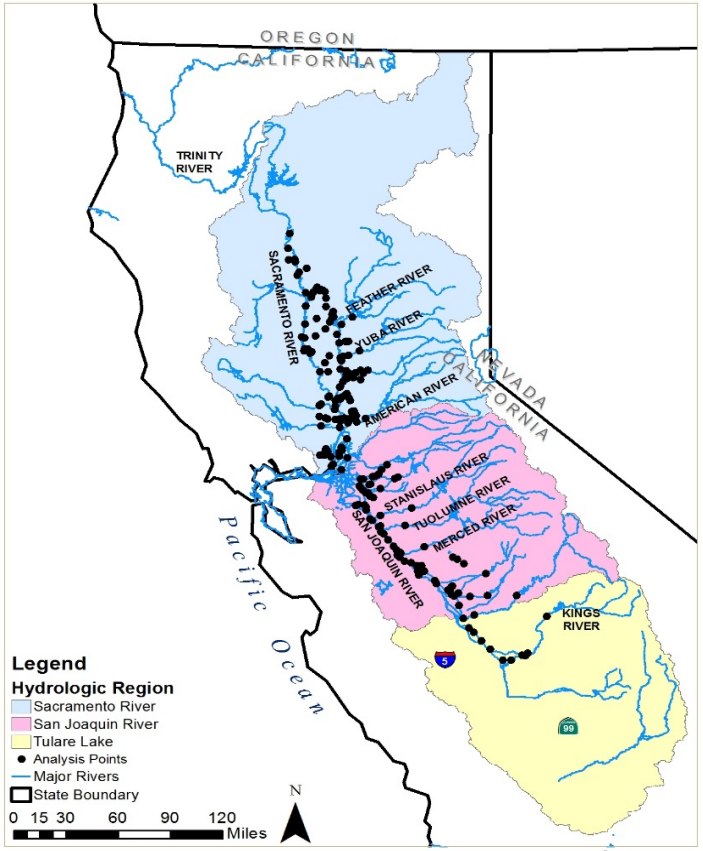
"... whether the CESM prediction system shows any evidence of predictable shifts in the likelihood of extreme climate phenomena that inhabit the tails of climate PDFs."

Interviews with water managers

To understand the key characteristics of useful decadal climate information for water management decisions.

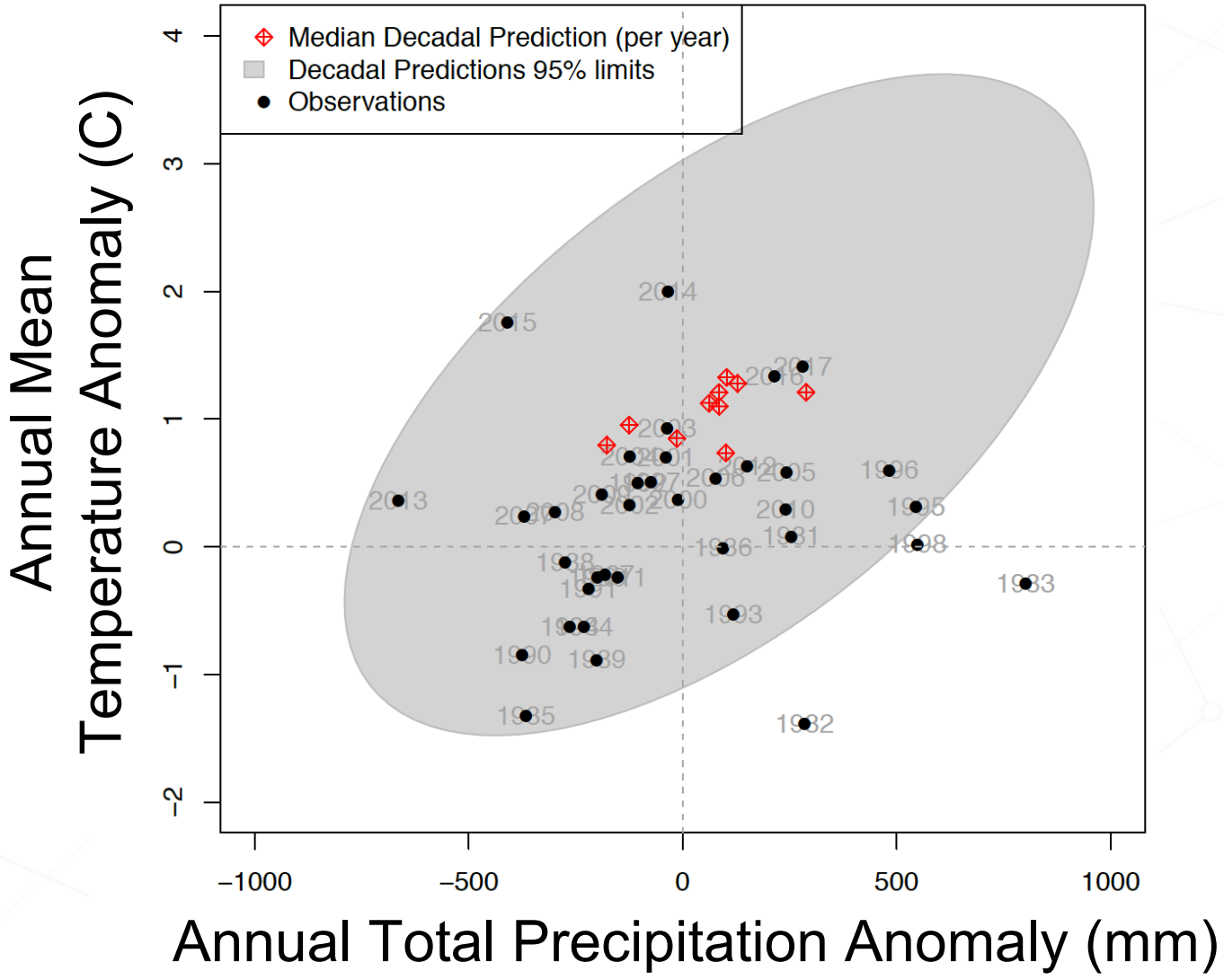
Identify how images of climate predictions may be useful.

Sacramento
River Valley Focus:



(Jacobs)

More extreme warm and wet seasons predicted

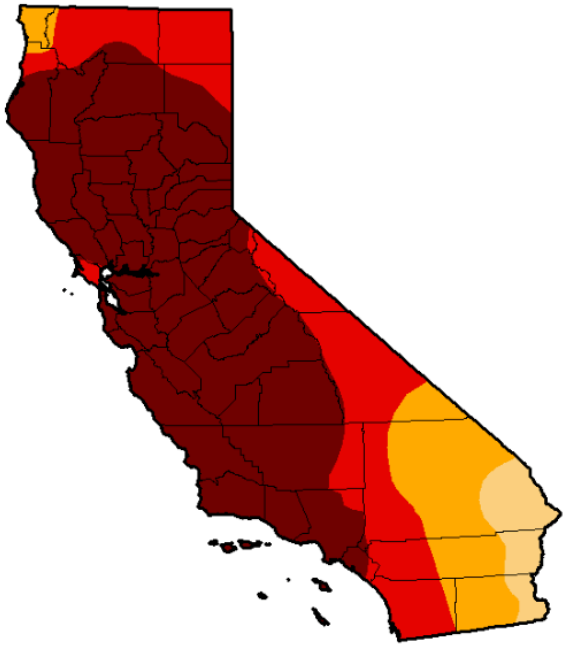


Vulnerabilities to Correlated Extremes

Compound Extremes:
Flood control and water supply is vulnerable to bivariate temperature and precipitation extremes.

Needed Science:
Mechanisms and predictability for seasonal bivariate extremes.

Vulnerabilities to Correlated Extremes



Concurrent Extremes:
State water supply is vulnerable to multi-basin, multi-year drought.

Needed Science:
What connects extreme dry conditions in space and time?

Vulnerabilities to Correlated Extremes

Sequential Extremes:
Drinking water quality is vulnerable to heavy rains on burn scars.

Needed Science:
What controls back-to-back extreme dry and extreme wet years?

(Swain et al. 2018)

Water managers want to know . .

The signposts in the Earth system for correlated extremes,

That scientists understand causality for correlated extremes,

How soon conditions will return to normal operational climate.

(Done et al. in prep)

COEXIST: Connected Extremes in Space and Time

NSF-funded 3-year project. PI James Done, with Co-PI Daniel Swain (UCLA) and Co-I Danielle Touma (UCSB).

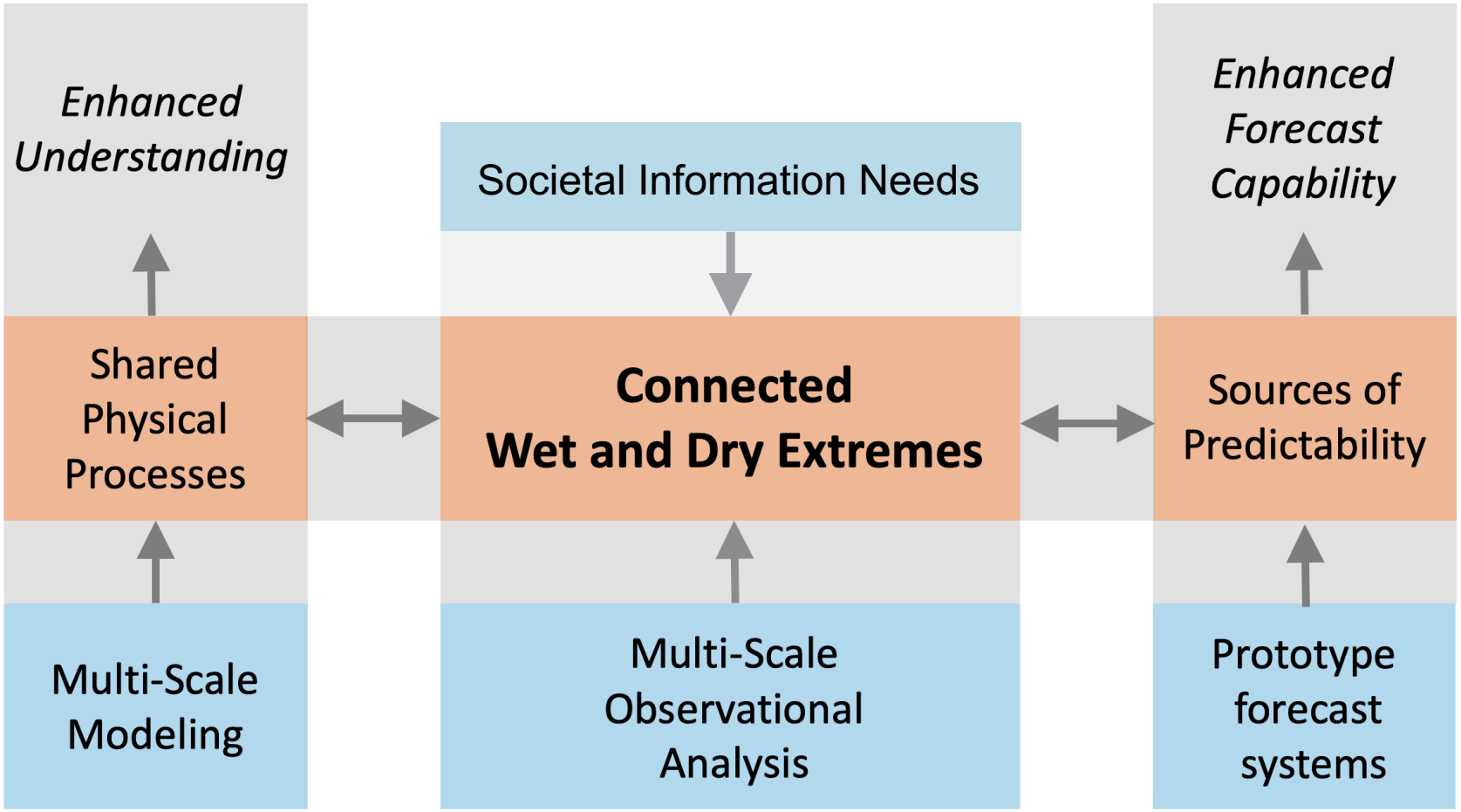
Conceptualizing extremes as spatiotemporally connected events promises significant near-term advances in our understanding of the physical processes underlying extremes and sources of their predictability.

Why?

1. We lack a comprehensive understanding of the physical processes connecting extremes.

2. Our predictive capacity for connected extremes across planning timescales is largely unknown.

COEXIST Project Approach



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