UNIVERSITY OF CALIFORNIA
MERCED

Increasing synchronicity of global extreme fire weather

Cong Yin, John Abatzoglou

March 11, 2025

Why does synchronous fire danger matter?

Synchronous fire danger
(Concurrent extreme fire weather)

Widespread large fires

Greater fire suppression pressure

Degrade regional air quality

Coordination of firefighting resources

Research questions

- **Patterns, trends, and seasonality**
- **Link to climate variability**
- **Relationship with air quality**

How to quantify synchronicity?

Intra-regional

Inter-regional

How to quantify synchronicity?

Intra-regional

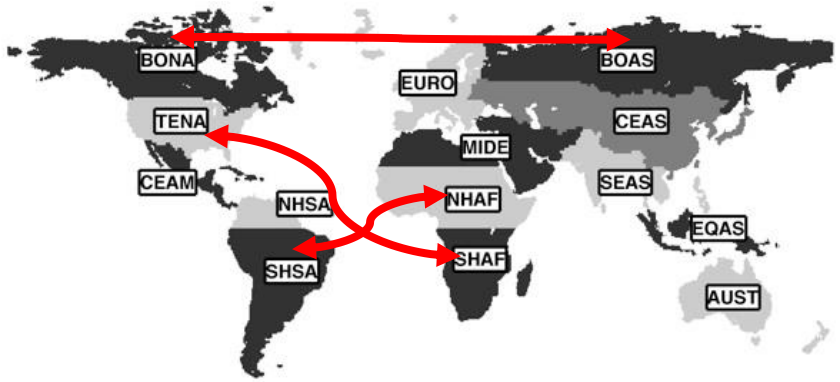
Inter-regional

BONA	Boreal North America
TENA	Temperate North America
CEAM	Central America
NHSA	Northern Hemisphere South America
SHSA	Southern Hemisphere South America
EURO	Europe
MIDE	Middle East
NHAF	Northern Hemisphere Africa
SHAF	Southern Hemisphere Africa
BOAS	Boreal Asia
CEAS	Central Asia
SEAS	Southeast Asia
EQAS	Equatorial Asia
AUST	Australia and New Zealand

How to quantify synchronicity?

Intra-regional

Inter-regional



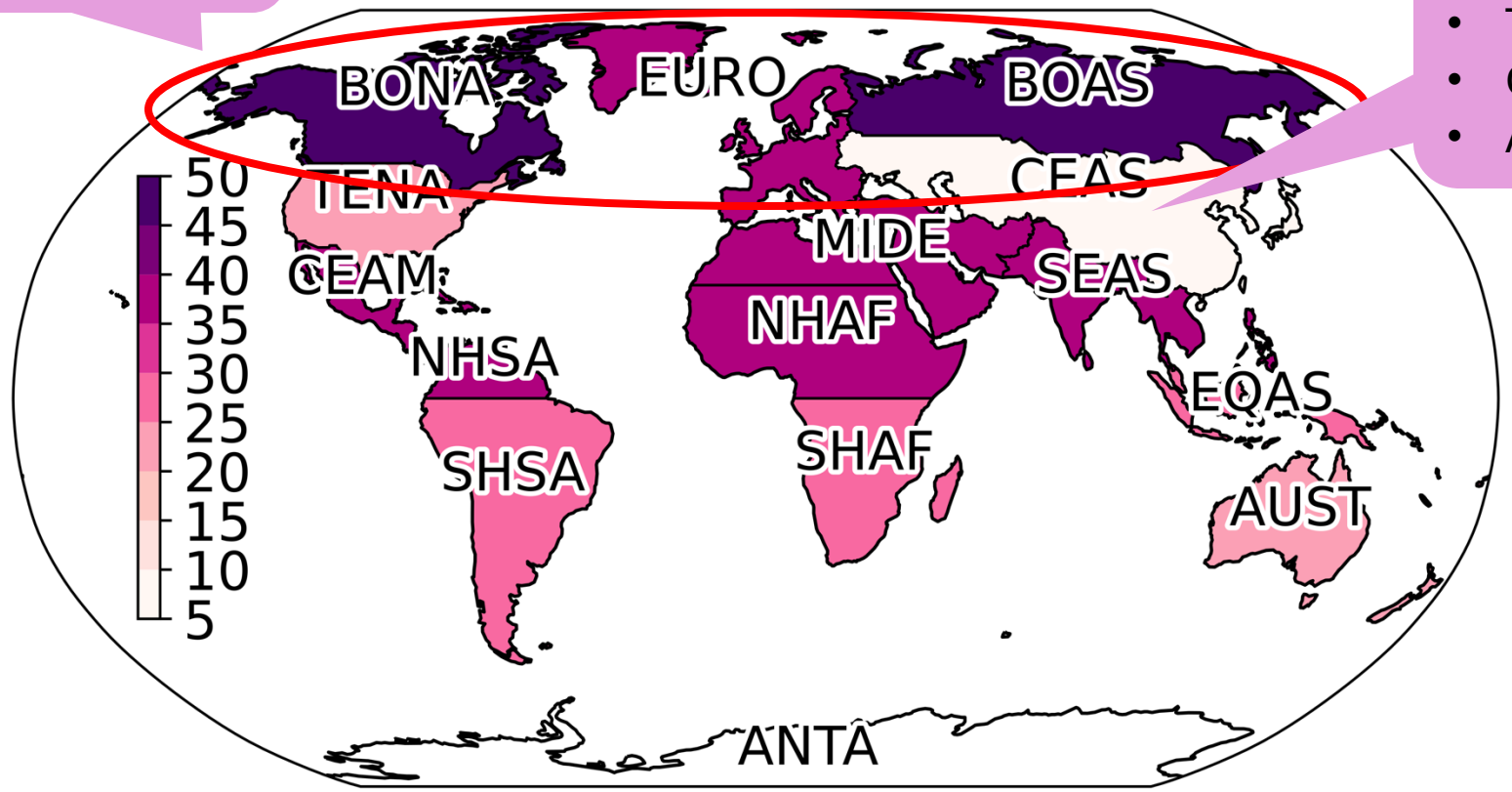
BONA	Boreal North America	NHAF	Northern Hemisphere Africa
TENA	Temperate North America	SHAF	Southern Hemisphere Africa
CEAM	Central America	BOAS	Boreal Asia
NHSA	Northern Hemisphere South America	CEAS	Central Asia
SHSA	Southern Hemisphere South America	SEAS	Southeast Asia
EURO	Europe	EQAS	Equatorial Asia
MIDE	Middle East	AUST	Australia and New Zealand

Results 1: **Patterns**

- Extensive Subarctic climate
- Short warm season

Intra-regional

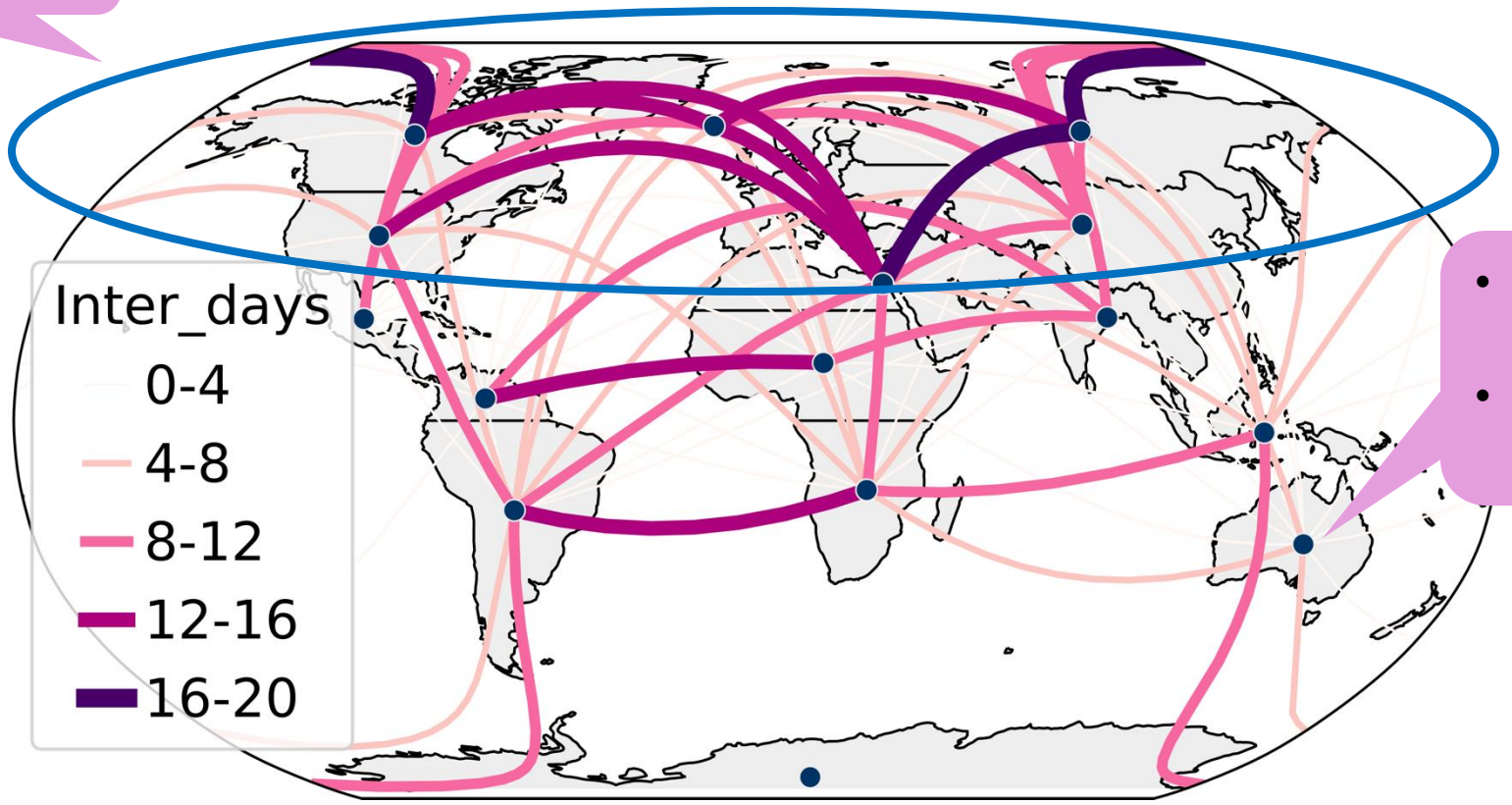
- Humid subtropical
- Temperate
- Continental
- Arid



Results 1: **Patterns**

- Concurrent heat extremes in NH

Inter-regional



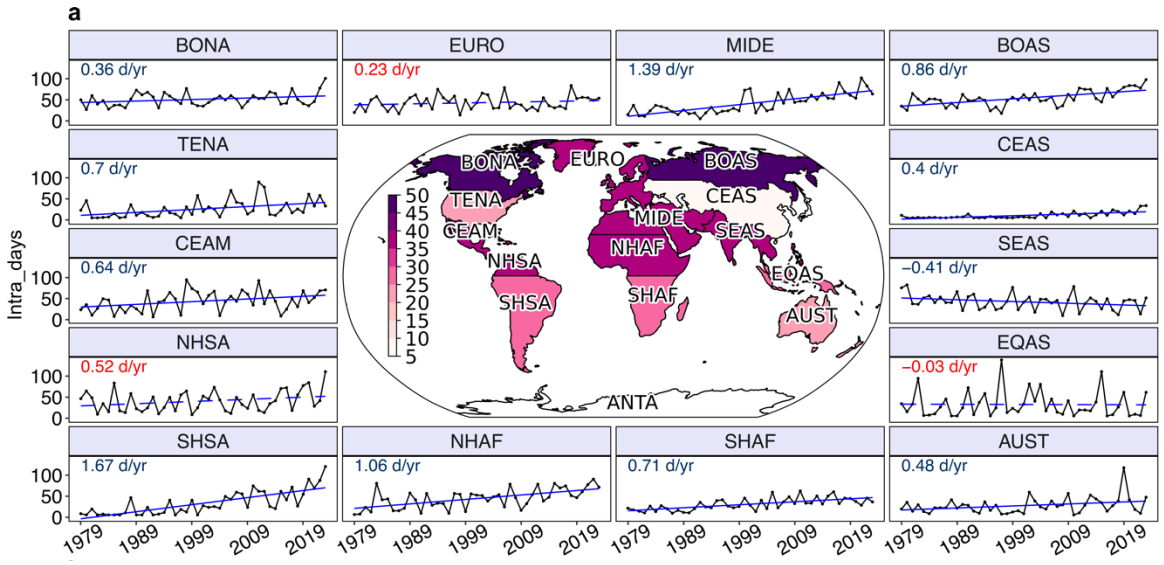
- Distinct fire seasonality
- Firefighting resource allocation

Results 2: Trends

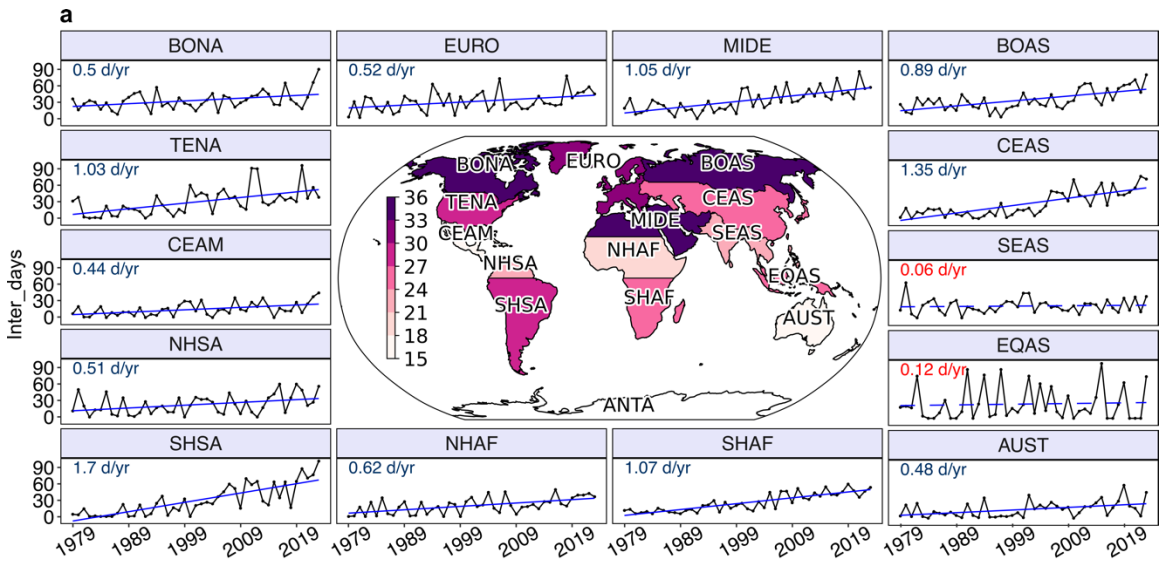
- Significant increase across most regions.
- South America experiencing the most pronounced.

Restrict firefighting cooperation

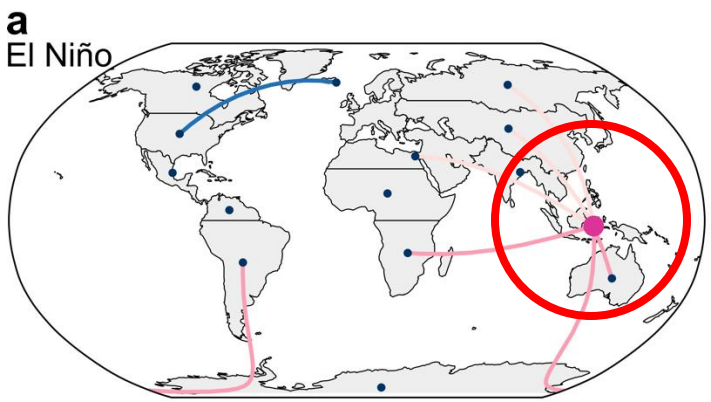
Intra-regional

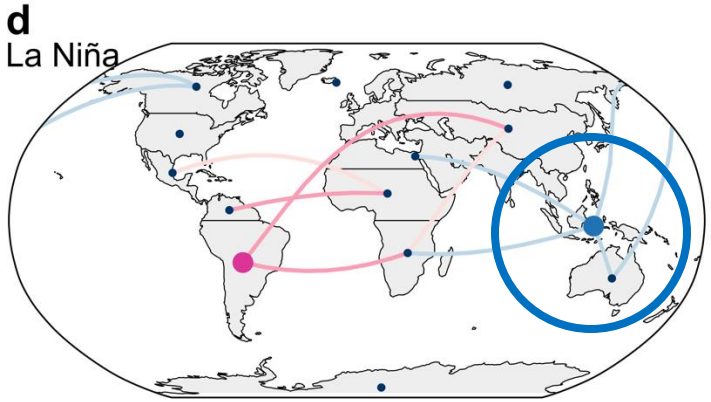


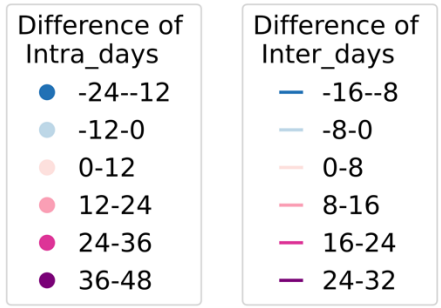
Inter-regional

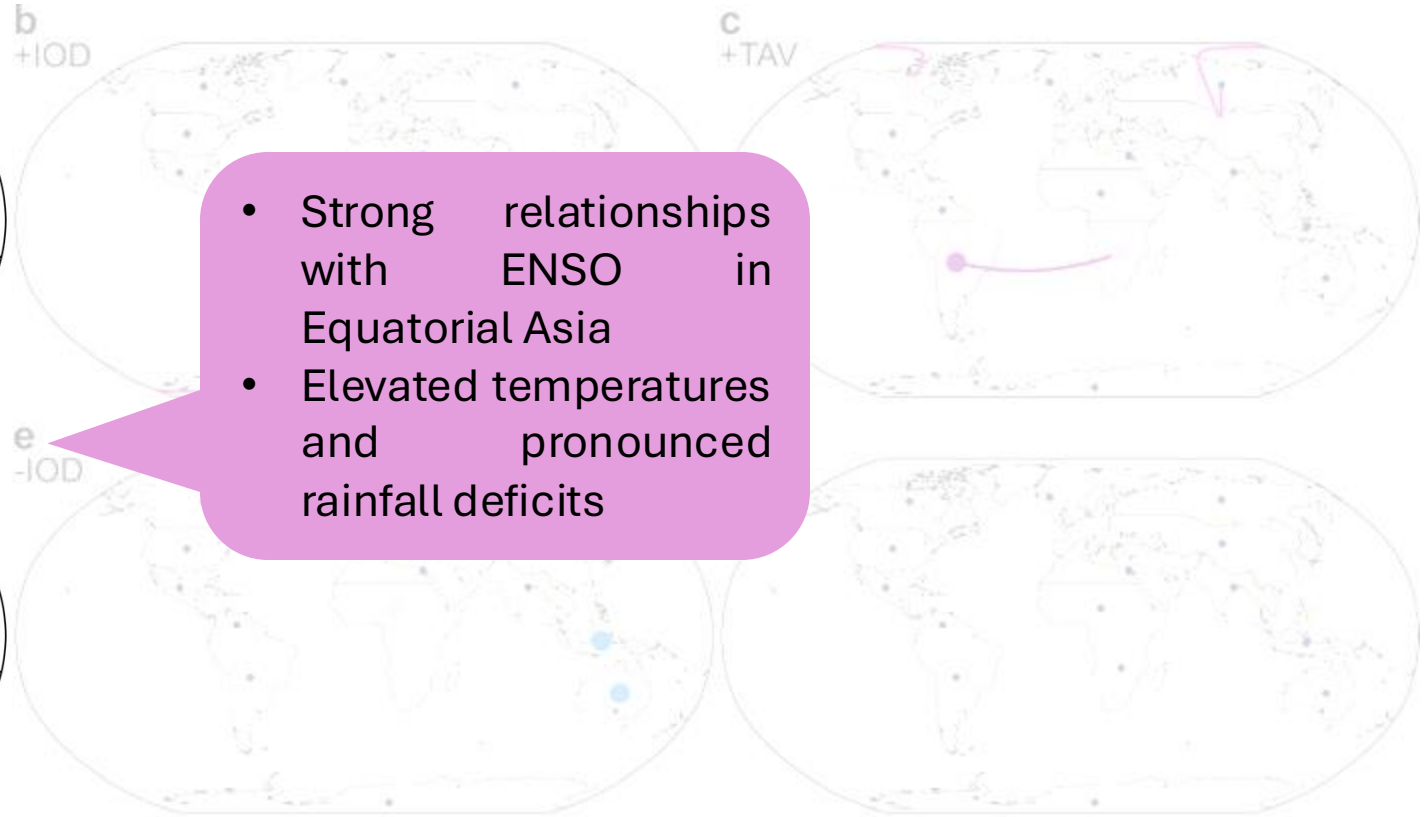


Results 3: **Link to climate variability**



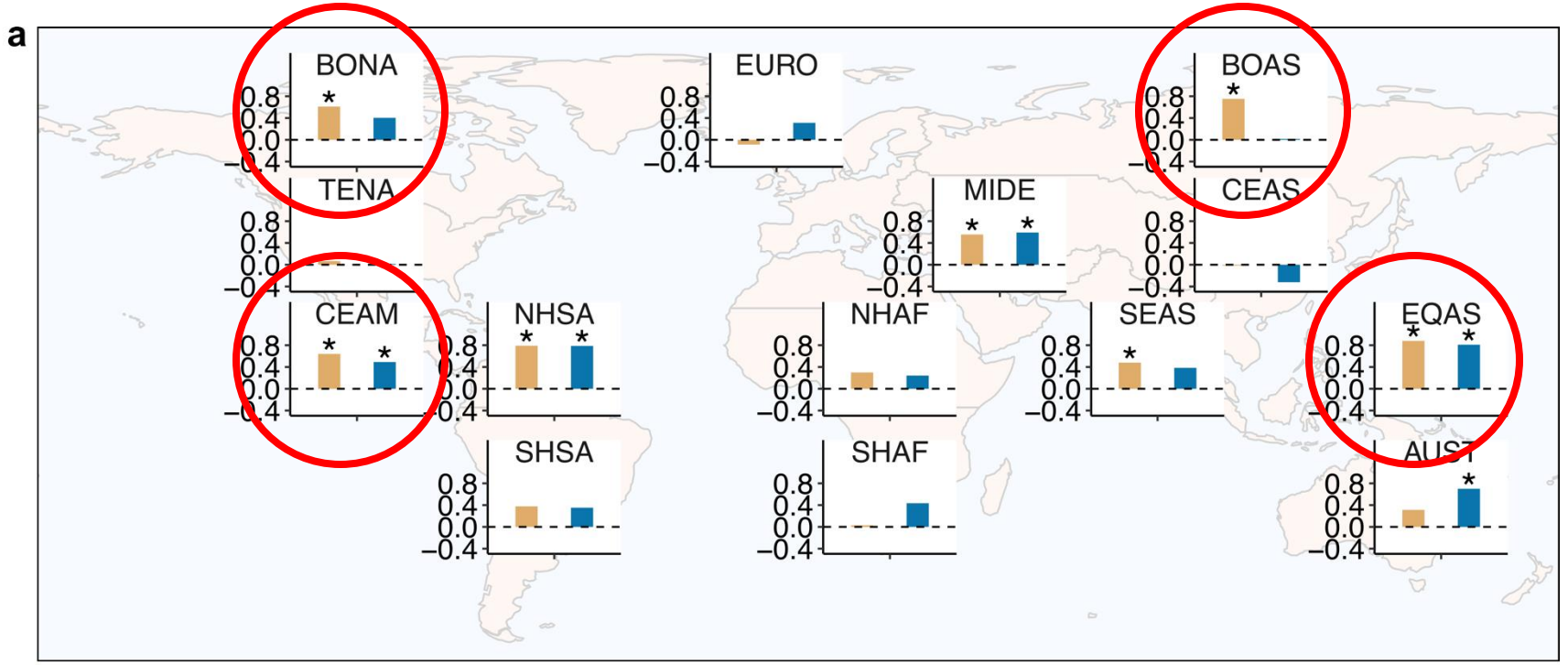






- Strong relationships with ENSO in Equatorial Asia
- Elevated temperatures and pronounced rainfall deficits

Results 4: **Relationship with air quality**



Dominant vegetation: **Forest**

- Links between FWI and burned area is more direct in forested lands.
- Unit emissions from woodland and forest fires is higher.

UNIVERSITY OF CALIFORNIA
MERCED

Thanks for your attention!

Cong Yin
congyin@ucmerced.edu
March 11, 2025