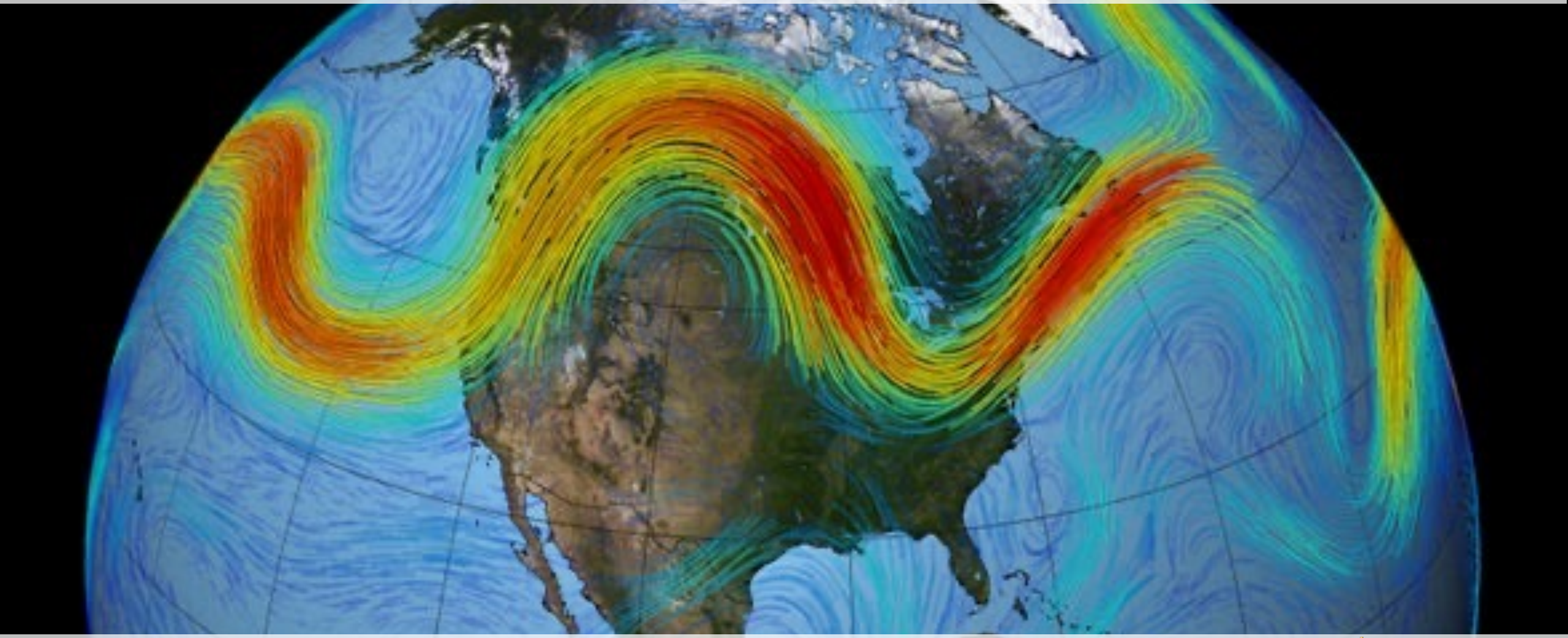
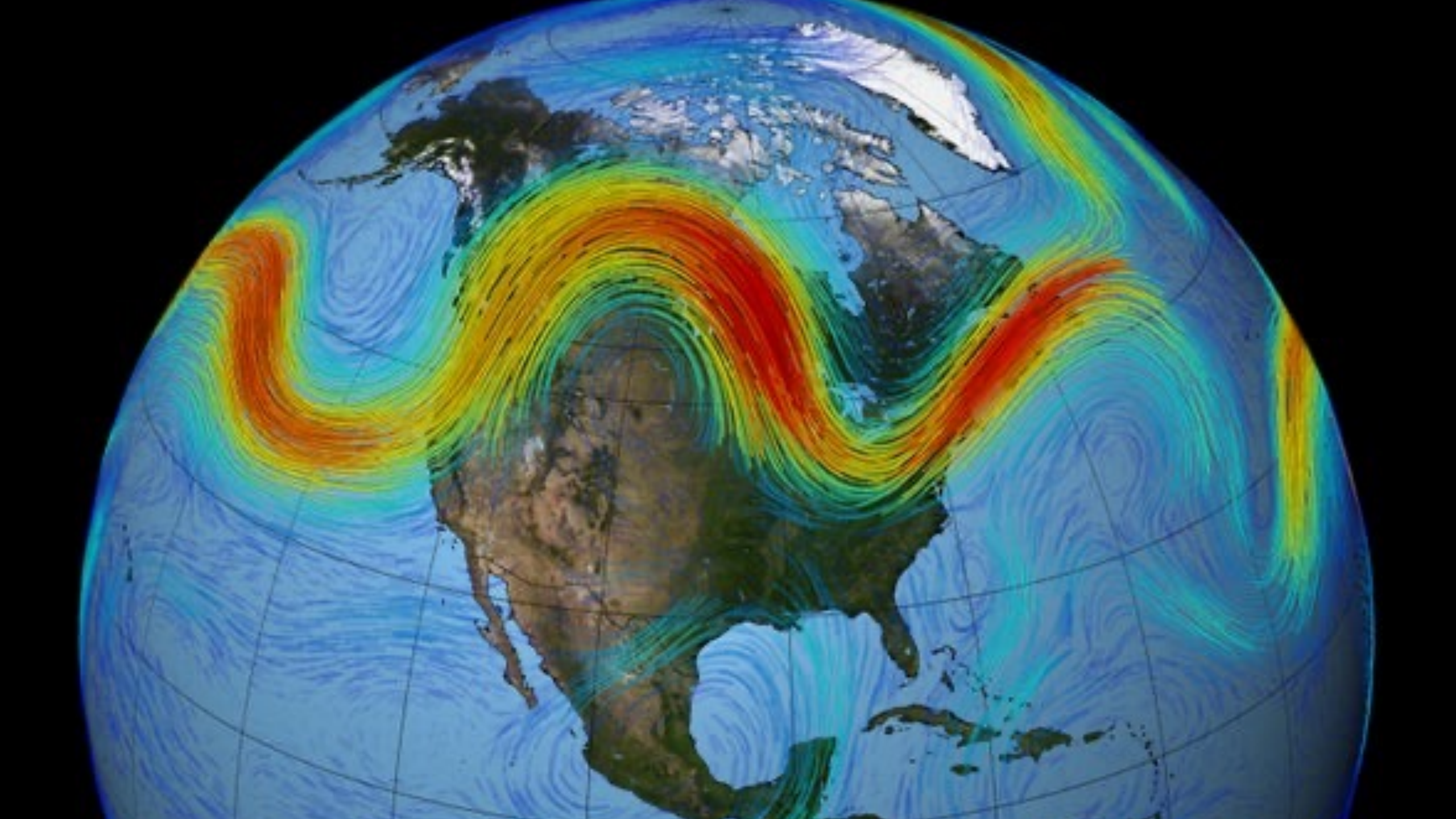
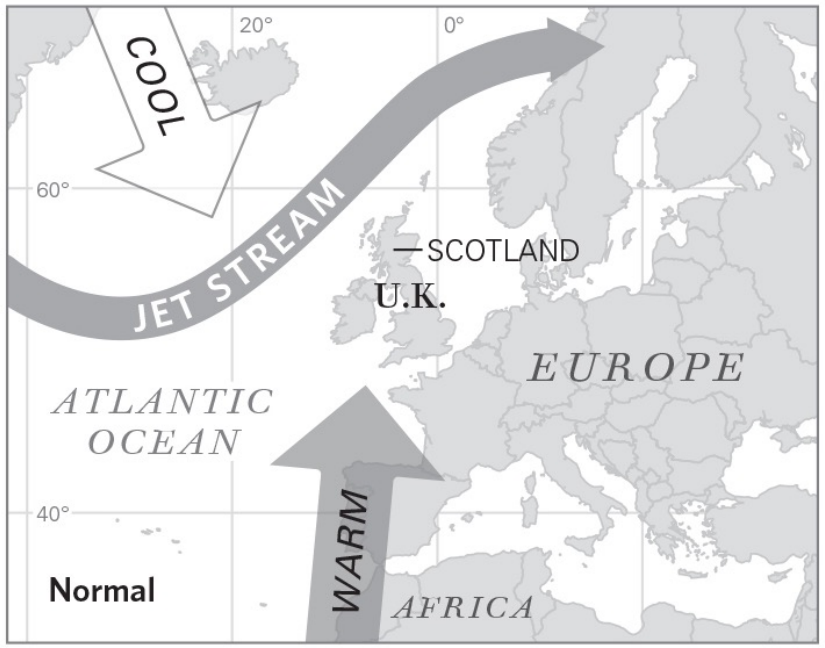
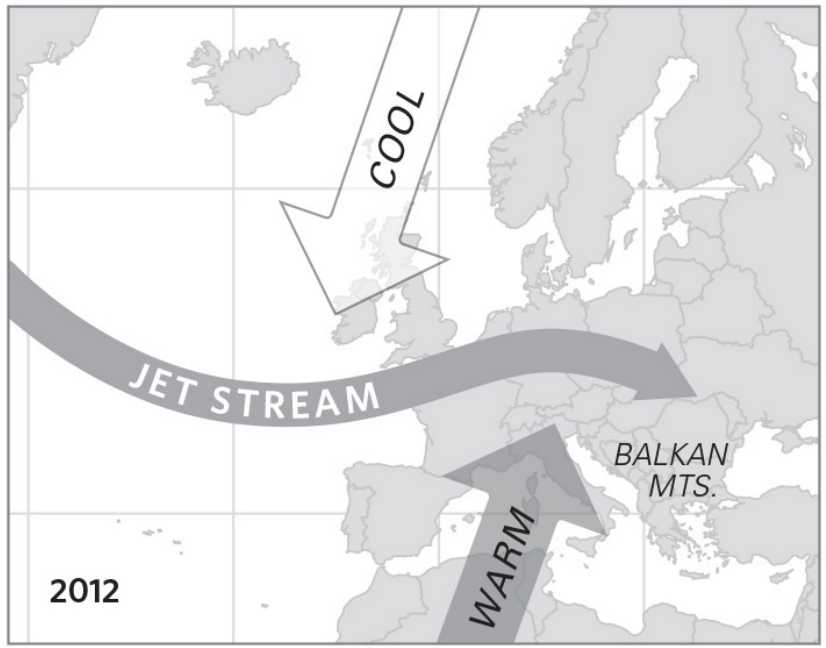
800 years of summer European-North Atlantic jet stream variability and its impact on climate extremes and human systems

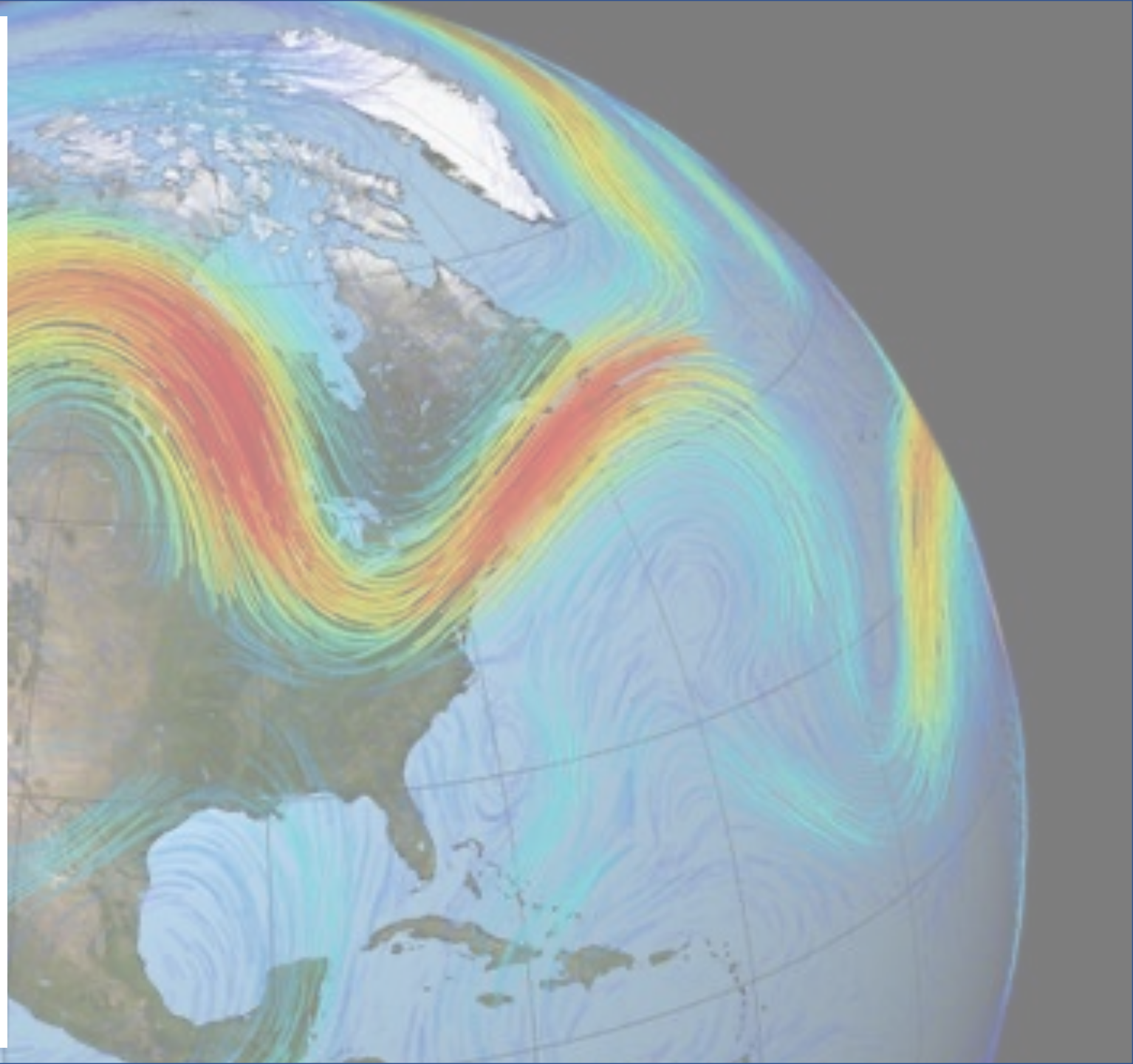


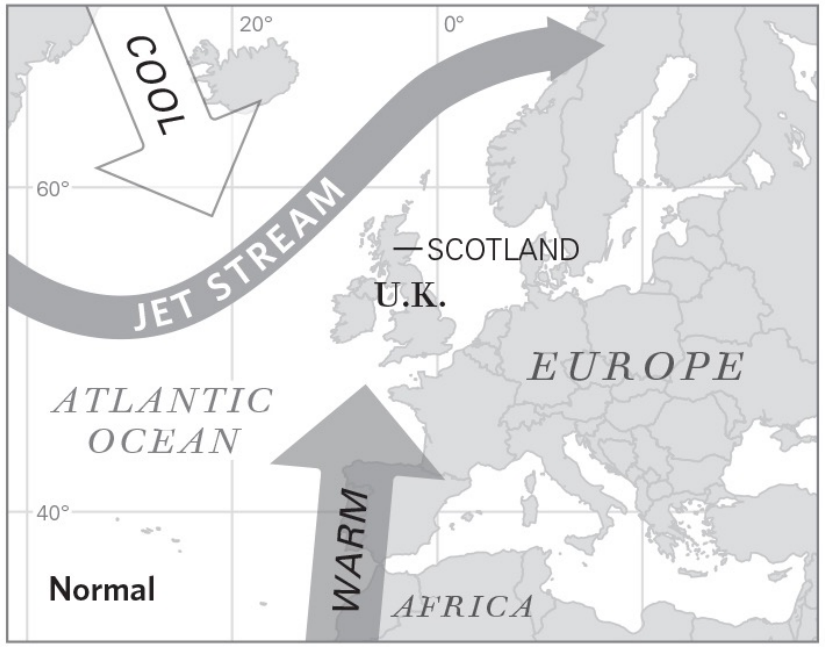
Guobao Xu, **Ellie Broadman**, Matthew Meko, Lara Klippel,
Francis Ludlow, Isabel Dorado-Liñan, Jan Esper, and Valerie Trouet

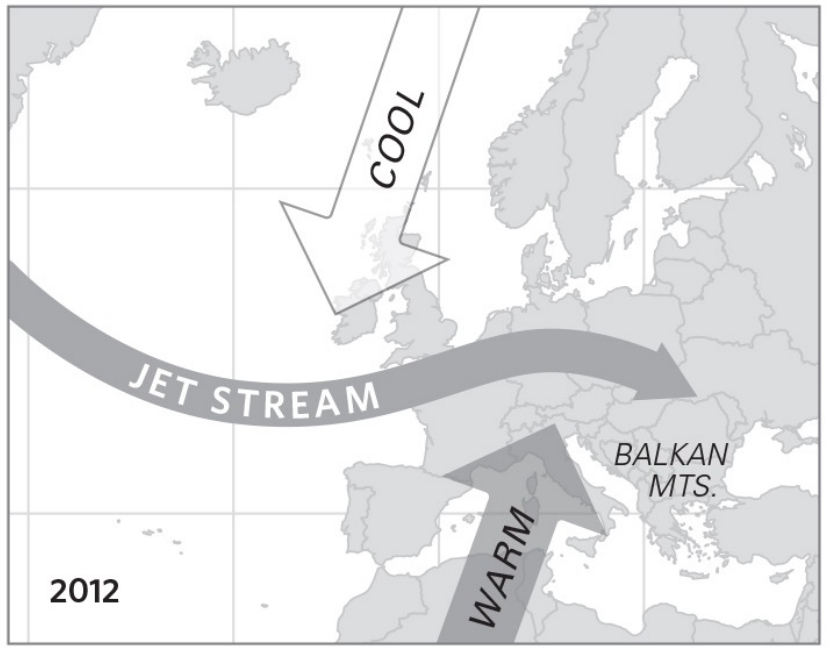


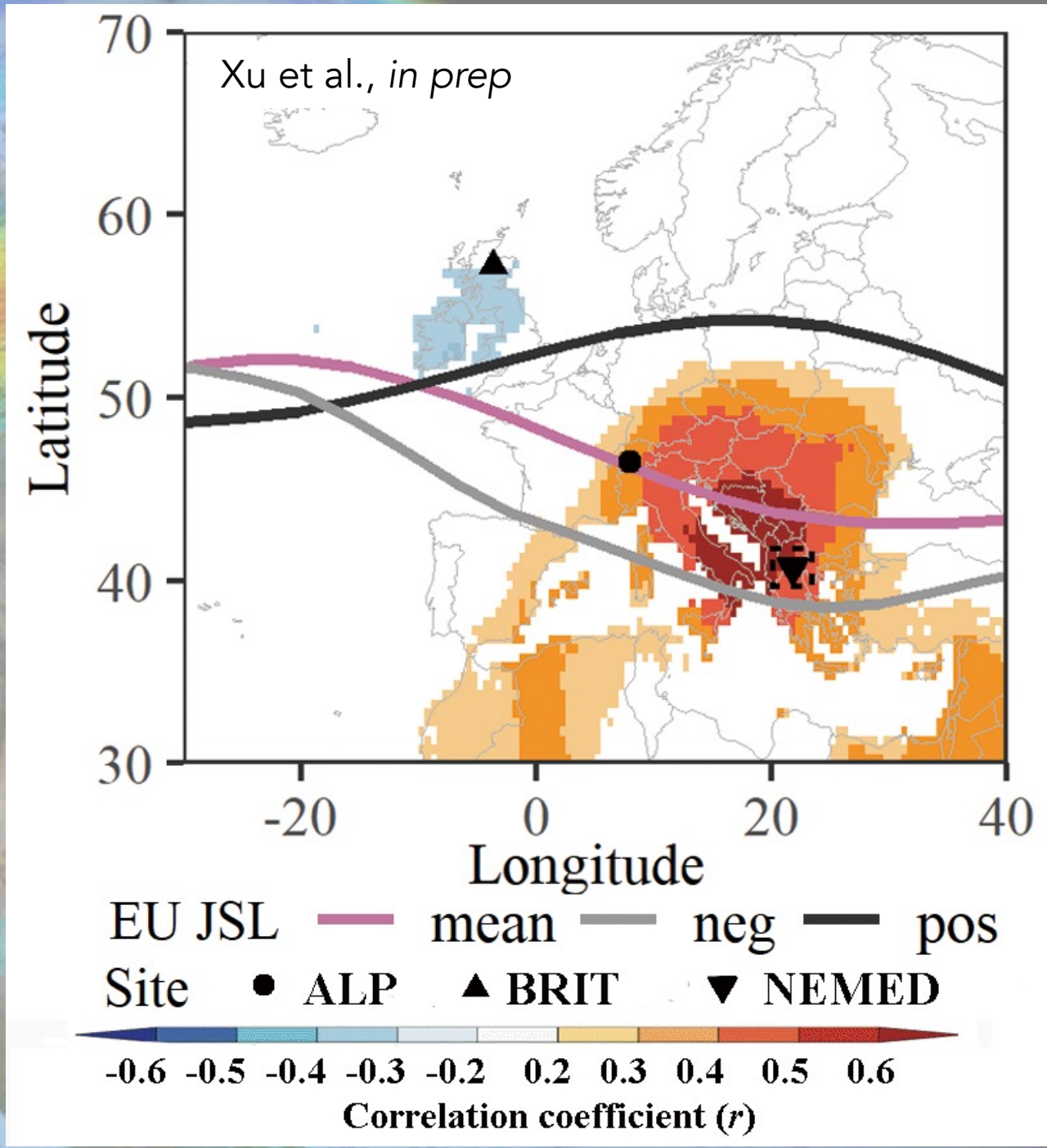

20°
0°
COOL
60°
JET STREAM
SCOTLAND
U.K.
EUROPE
ATLANTIC
OCEAN
40°
WARM
Normal
AFRICA

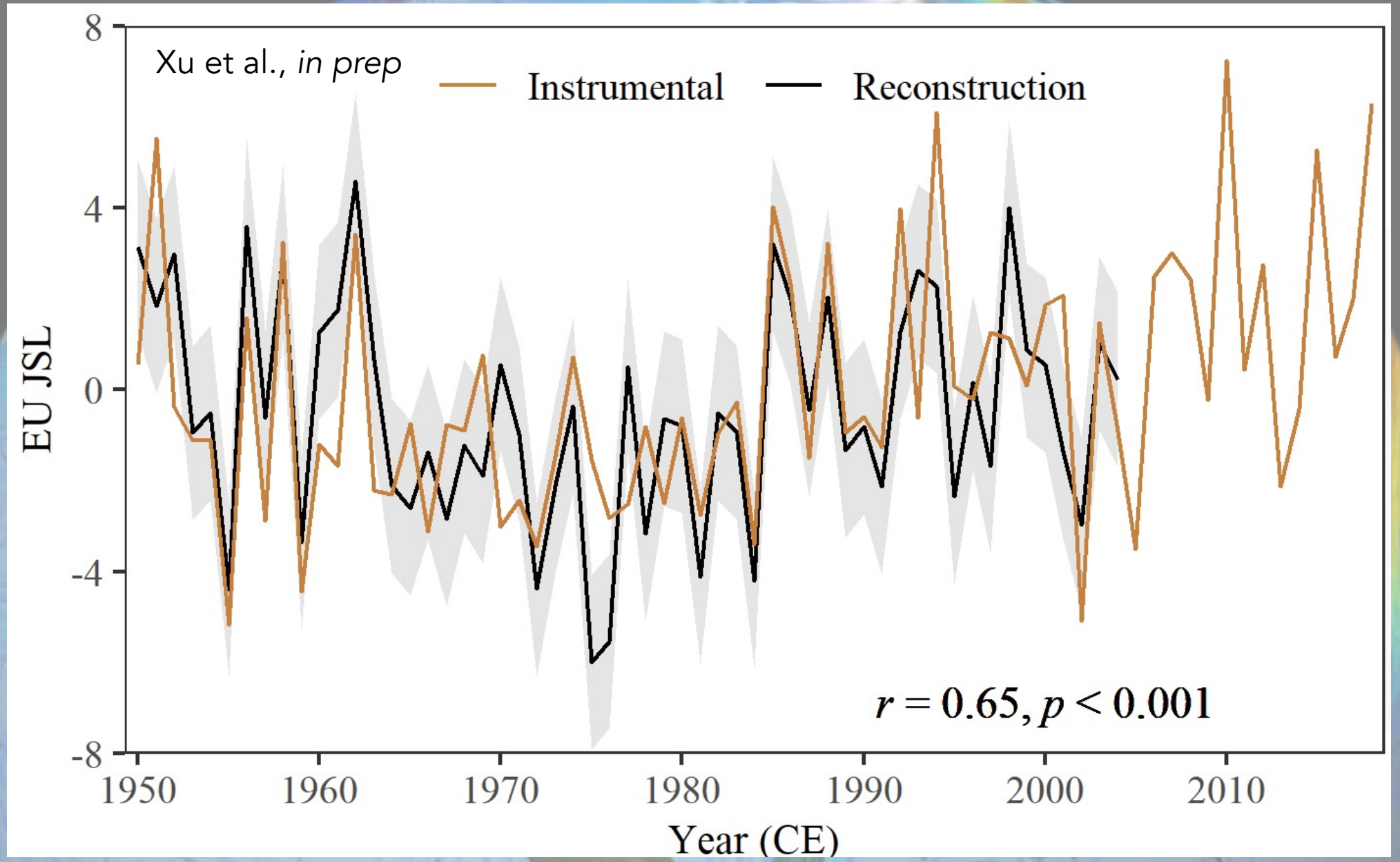

COOL
JET STREAM
BALKAN
MTS.
WARM
2012

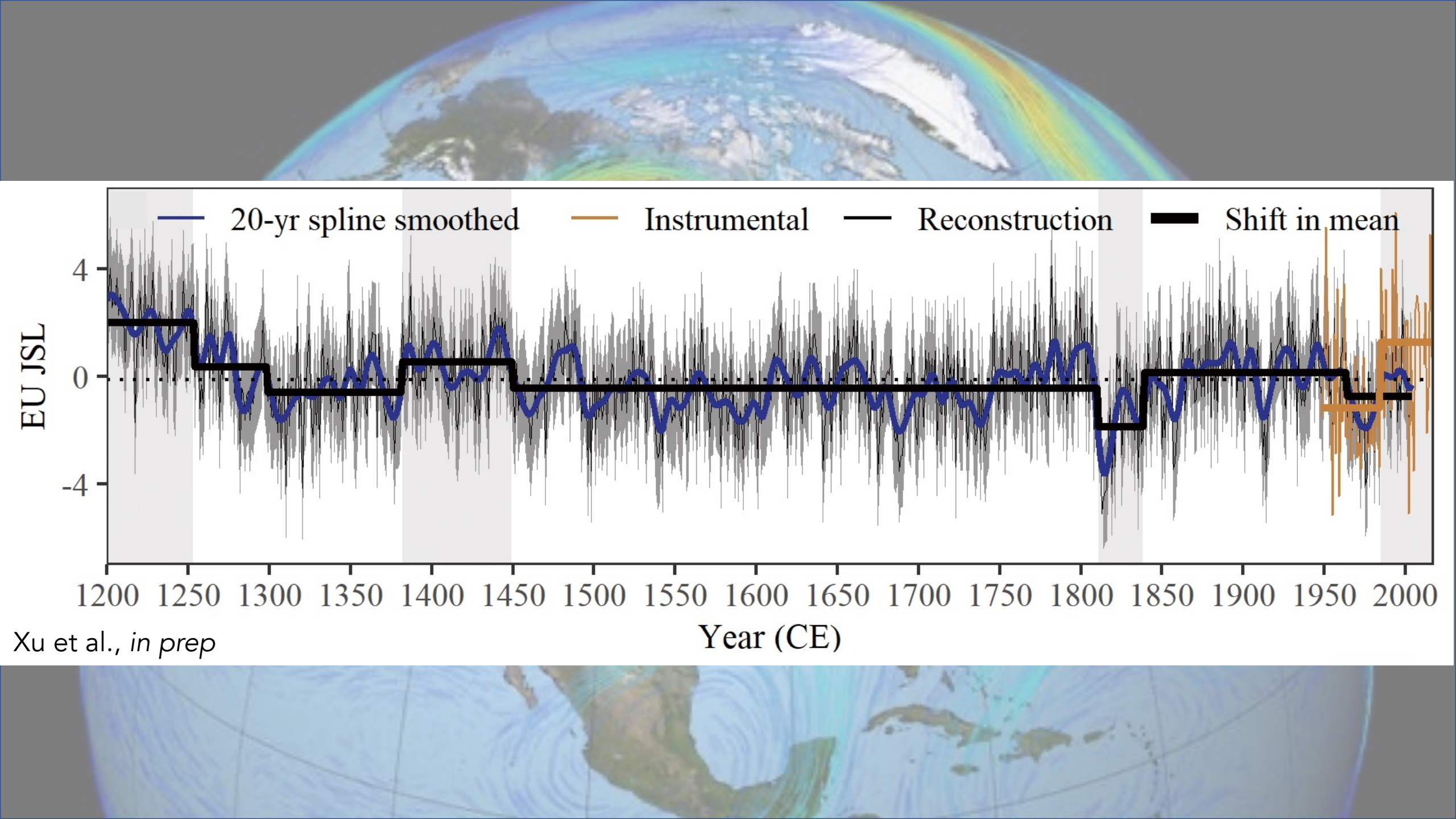



COOL
20°
0°
60°
JET STREAM
SCOTLAND
U.K.
EUROPE
ATLANTIC
OCEAN
40°
WARM
Normal
AFRICA

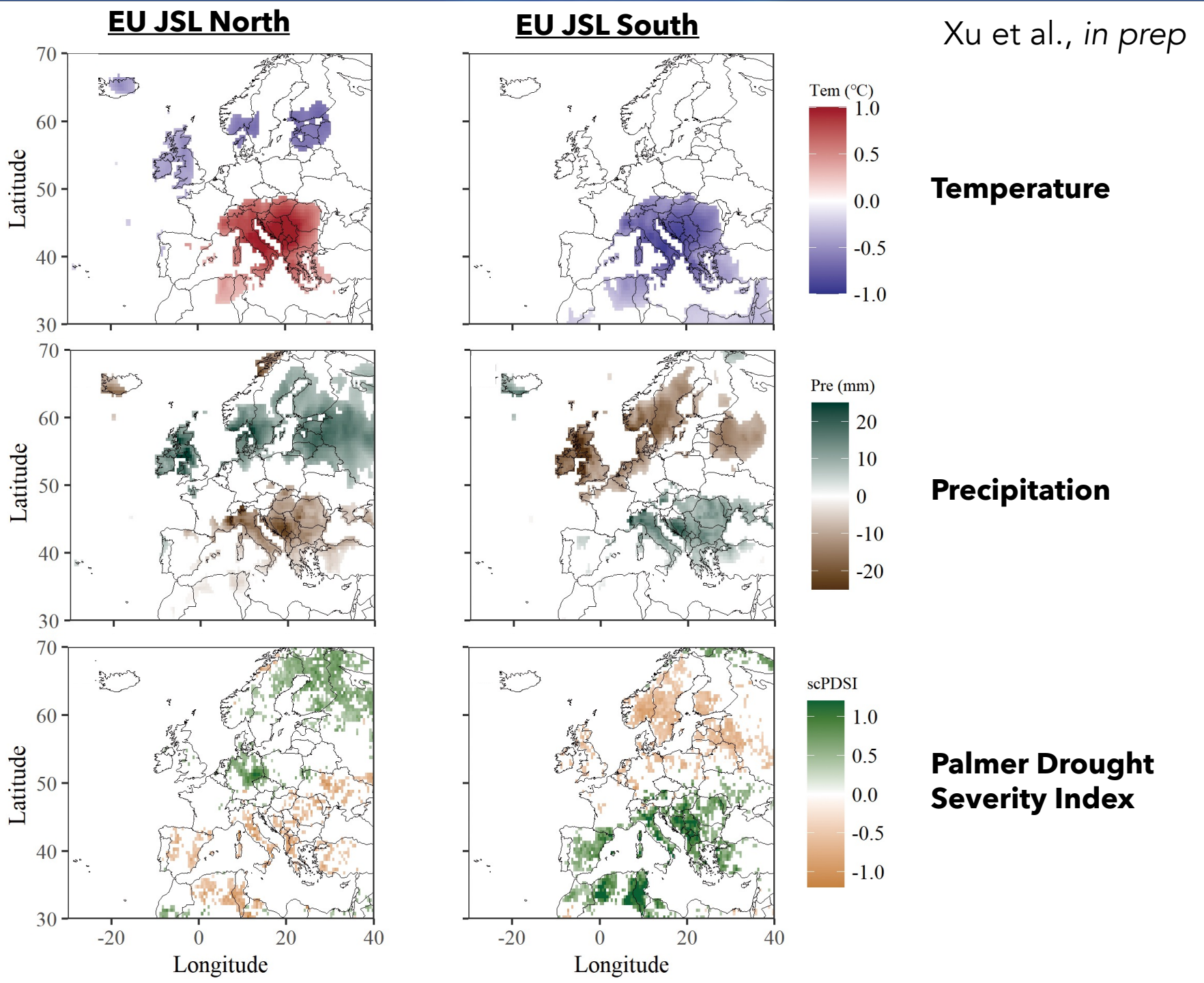

COOL
JET STREAM
BALKAN
MTS.
WARM
2012


Xu et al., in prep
Latitude
70
60
50
40
30
-20
0
20
40
Longitude
EU JSL
mean
neg
pos
Site
ALP
BRIT
NEMED
-0.6 -0.5 -0.4 -0.3 -0.2 0.2 0.3 0.4 0.5 0.6
Correlation coefficient (r)


Xu et al., *in prep*
Instrumental
Reconstruction
EU JSL
8
4
0
-4
-8
1950
1960
1970
1980
1990
2000
2010
Year (CE)
$r = 0.65, p < 0.001$

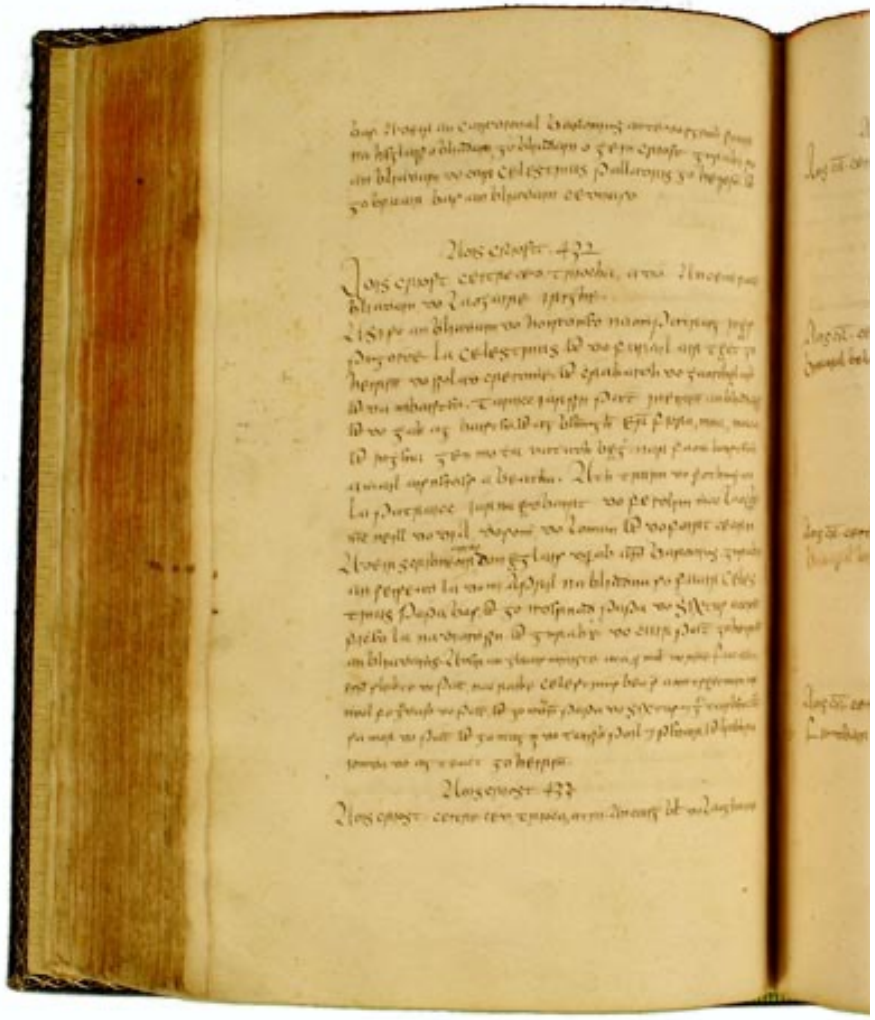


Xu et al., *in prep*


EU JSL North
EU JSL South
Xu et al., *in prep*
Tem (°C)
1.0
0.5
0.0
-0.5
-1.0
Temperature
Pre (mm)
20
10
0
-10
-20
Precipitation
scPDSI
1.0
0.5
0.0
-0.5
-1.0
Palmer Drought Severity Index
Latitude
70
60
50
40
30
Longitude
-20
0
20
40

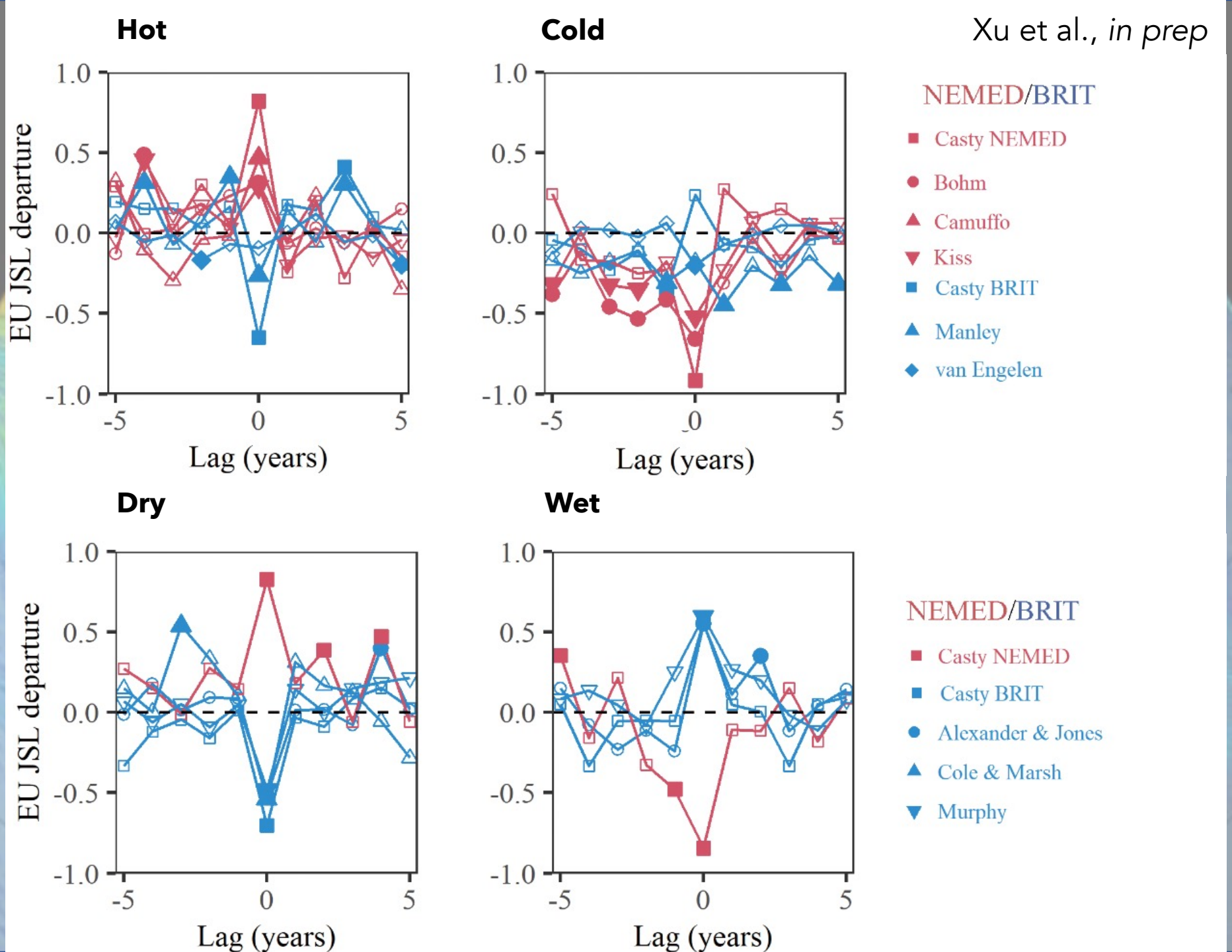
Human-documented climate-related information, including:

- Narrative sources (annals, chronicles)
- Personal correspondence
- Economic sources
- Pictorial evidence
- Newspapers
- Daily weather records and ship logs
- Agricultural records



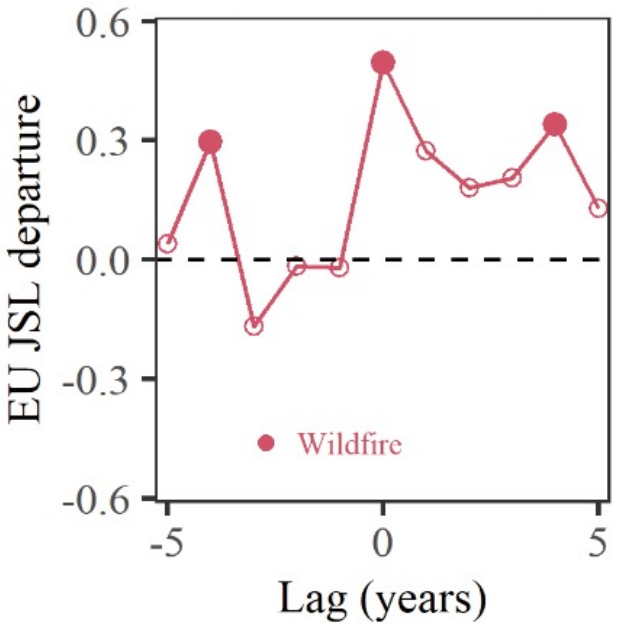
Irish Annals, 432 CE

Xu et al., *in prep*

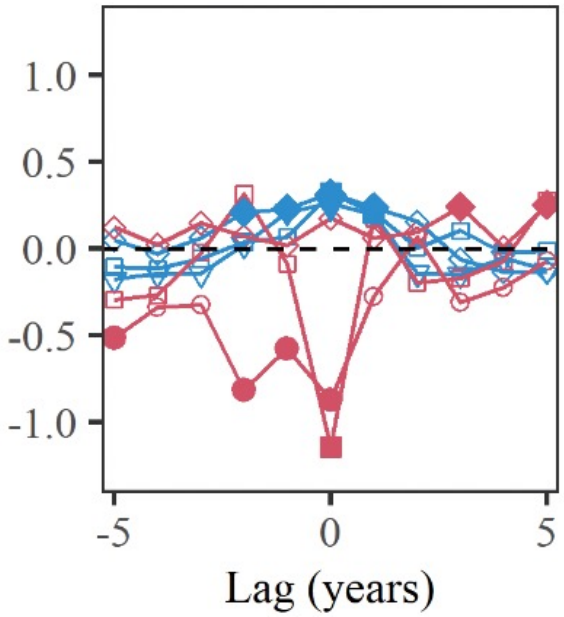


Xu et al., *in prep*

Wildfire



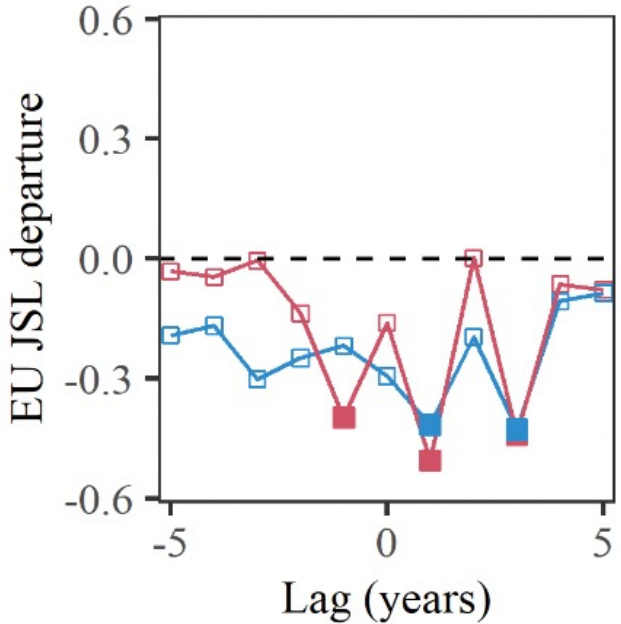
Grain price and harvest



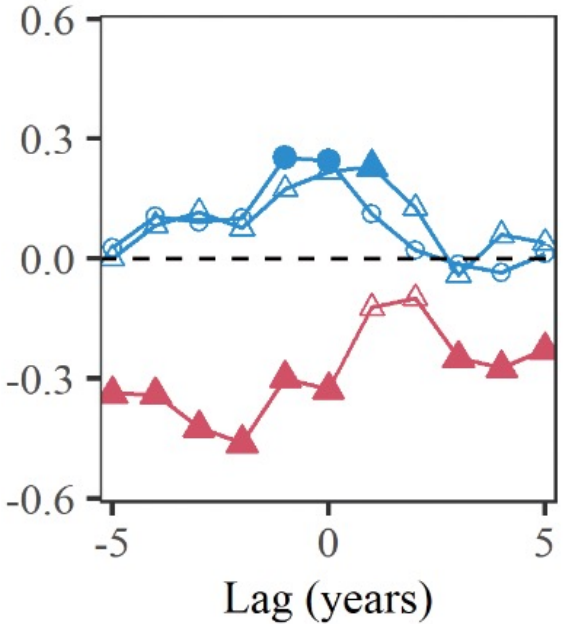
NEMED/BRIT

- Malanima
- Kiss
- Racz
- Clark wheat
- Clark barley
- Esper

Famine



Epidemic



NEMED/BRIT

- Alfani & O Grada Italy
- Buntgen
- Alfani & O Grada BRIT
- Campbell & Ludlow epidemics
- Campbell & Ludlow human mort

In Conclusion:

- We reconstructed jet stream position in Europe during the summer over the last 800 years
- Changes in the jet stream position create a summertime climatic dipole between the British Isles and the Balkans / Italy
- We find that the position of the summer jet stream influences both climate extremes and climate-related societal events, demonstrating the importance of natural climate variability in influencing human systems both now and in the past

Thank you!

Questions?
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