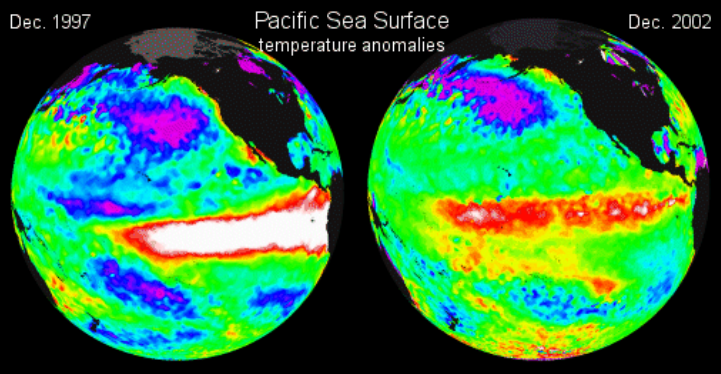
ENSO ***diversity*** discussion



Classic El Niño **Central Pacific El Niño**

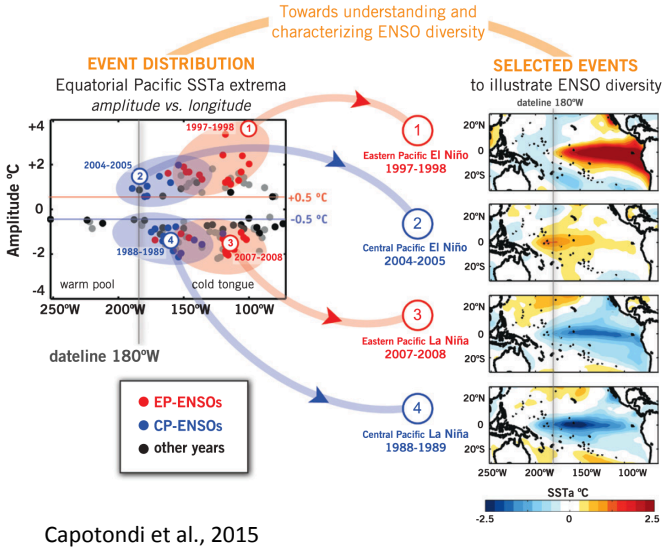
(e.g., Ashok et al. 2009, Kug et al. 2009, Yeh et al. 2009)

Overarching questions

As our climate system continues to warm, will we see changes to the:

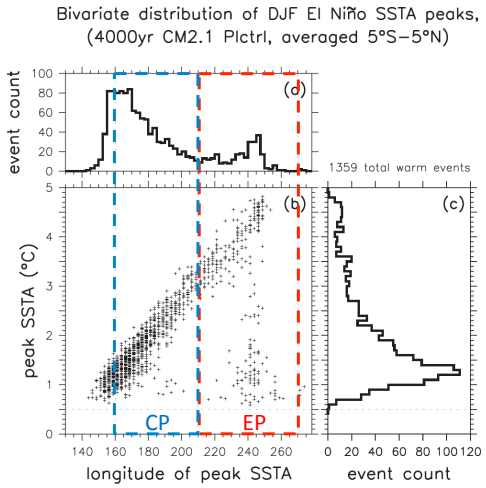
1. ***background state*** of the tropical Pacific? (Tues)
2. ***frequency*** of ENSO events? (Tues)
3. ***spatial pattern*** of ENSO events?
4. ***intensity*** of ENSO events?

ENSO diversity



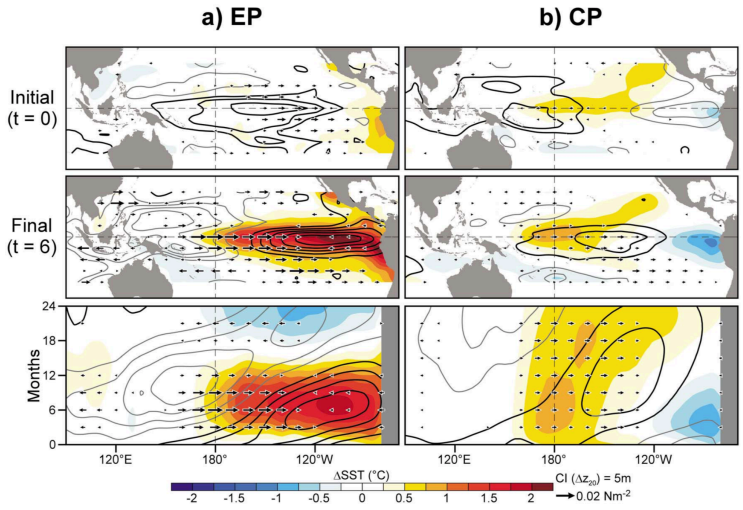
Capotondi et al., 2015

Strength vs. location



Capotondi et al., 2015

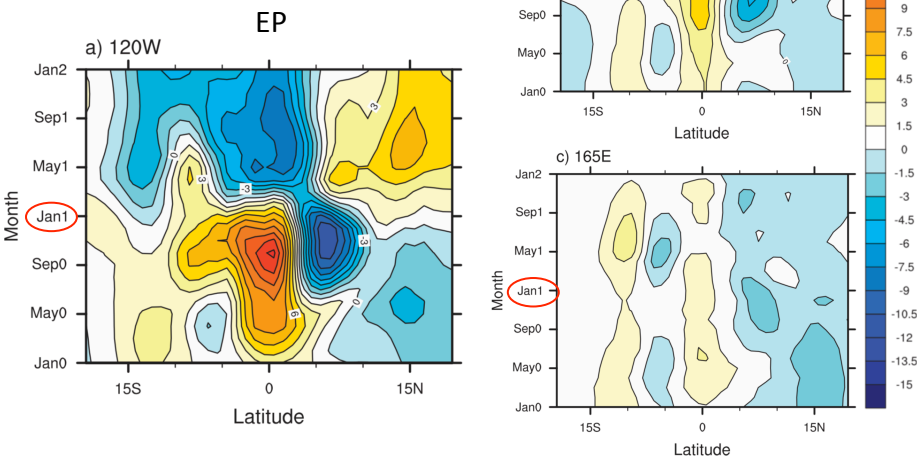
ENSO precursors & diversity



Newman et al., 2011, GRL

Thermocline Depth Change during El Niño

(500yr-long control simulation from NCAR-CCSM4)



Capotondi et al., 2013; 2015

Increasing # of CP events?

1. Are there sufficient observations in the central and eastern Pacific Ocean (1850-present)?

	Raw SST		Detrended SST	
	EP-El Niño years	CP-El Niño years	EP-El Niño years	CP-El Niño years
1850s				
1860s				
1870s	1876, 1877		1876, 1877	
1880s	1888		1888	
1890s	1896, 1899		1896, 1899	
1990s	1902,1904,1905		1902,1904,1905	
1910s	1911,1913,1914		1911,1913,1914,1918	
1920s	1925		1925	
1930s	1930, 1939		1930, 1939	
1940s	1940,1941		1940,1941	
1950s	1951,1957		1951,1957	
1960s	1963,1965,1969	1968	1963,1965,1969	1968
1970s	1972,1976,1979	1977	1972,1976,1979	1977
1980s	1982,1986,1987		1982,1986,1987	
1990s	1991,1997	1990,1992,1994	1991,1997	1990, 1994
2000s	2002,2003,2006	2001,2004	2003,2006	2001,2002,2004

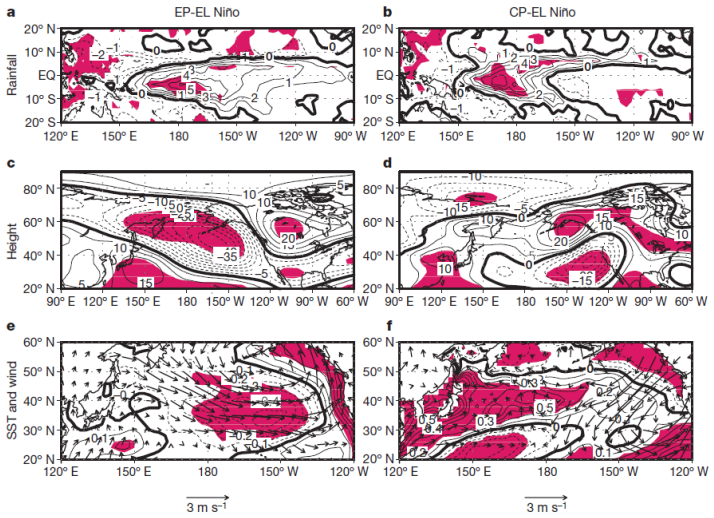
Increasing # of CP events?

SST dataset	El Niño type	Frequency	
		Before 1990	After 1990
The SST from the Hadley Centre	EP-El Niño	0.21/year	0.11/year
	CP-El Niño	0.05/year	0.41/year
The SST from the Kaplan extended SST version 2	EP-El Niño	0.23/year	0.17/year
	CP-El Niño	0.08/year	0.35/year

"This result is detectable even if the data is detrended and taken from two additional data sets."

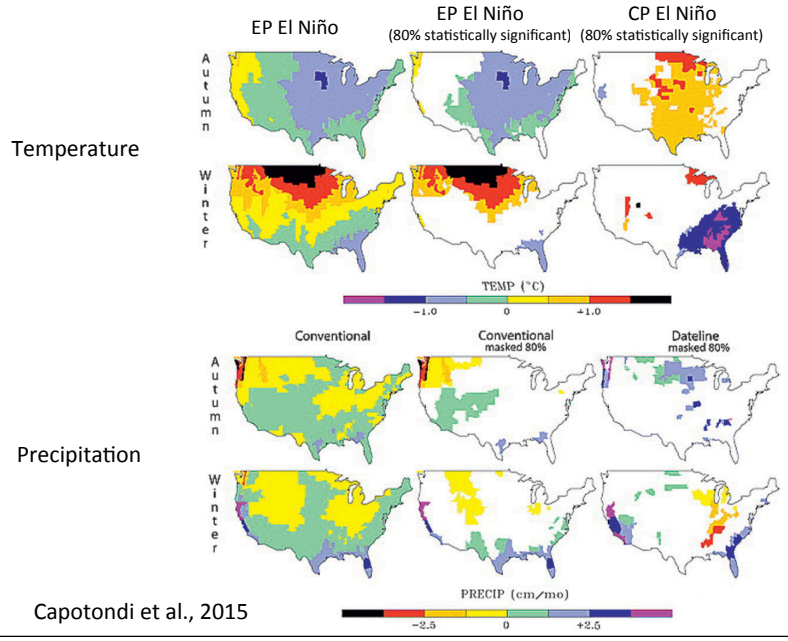
Independence of these data sets??

Difference in teleconnections?



Yeh et al. 2009

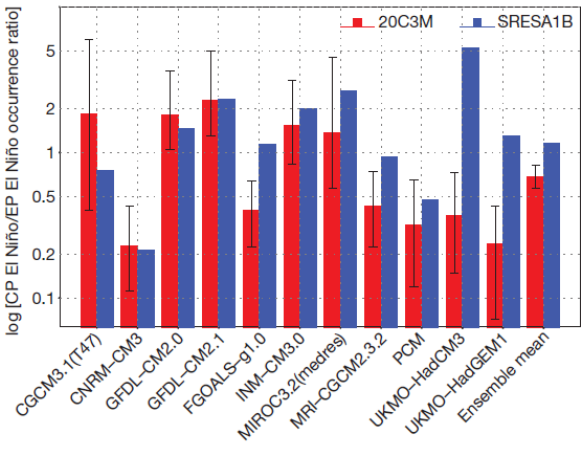
Teleconnections



Capotondi et al., 2015

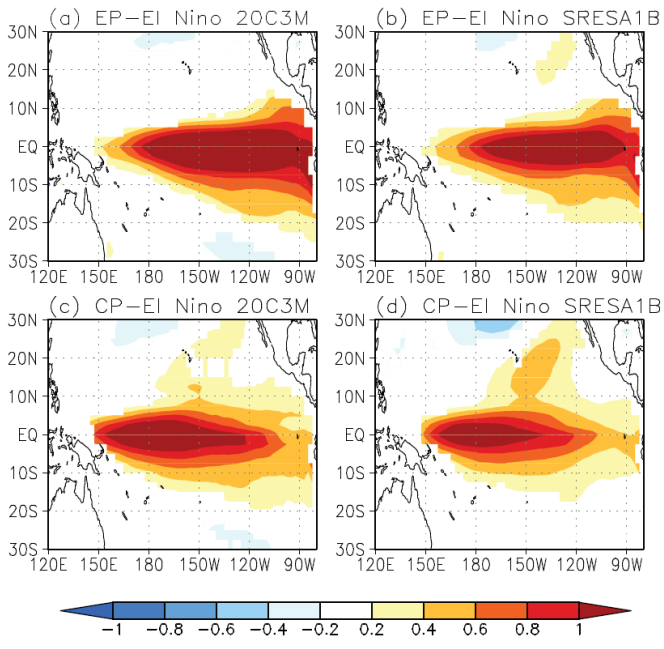
Future change in CP vs EP events

1. How well do these models do in simulating ENSO and teleconnections?

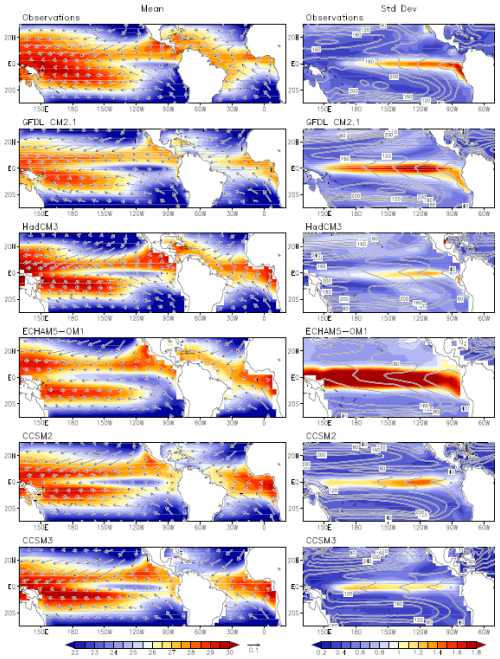


Yeh et al. 2009

Simulated ENSO

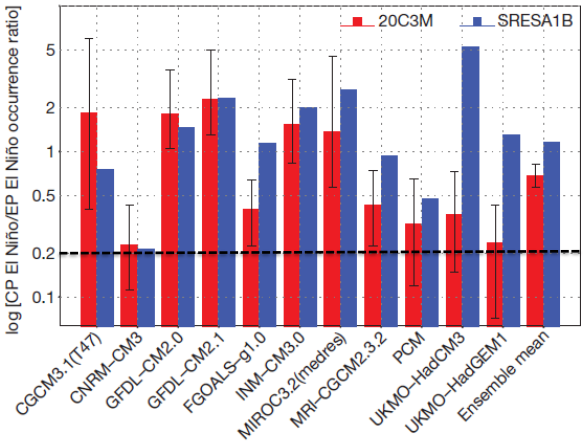


Simulated ENSO



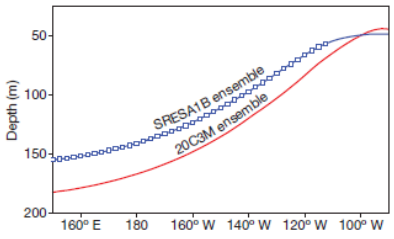
Future change in CP vs EP events

1. How well do these models do in simulating ENSO and teleconnections?
2. What metric do they use to select the best models? Do you think this metric is robust given observational constraints?



Yeh et al. 2009

What do Yeh et al. propose as the mechanism behind an increase in CP style ENSO events in the future?

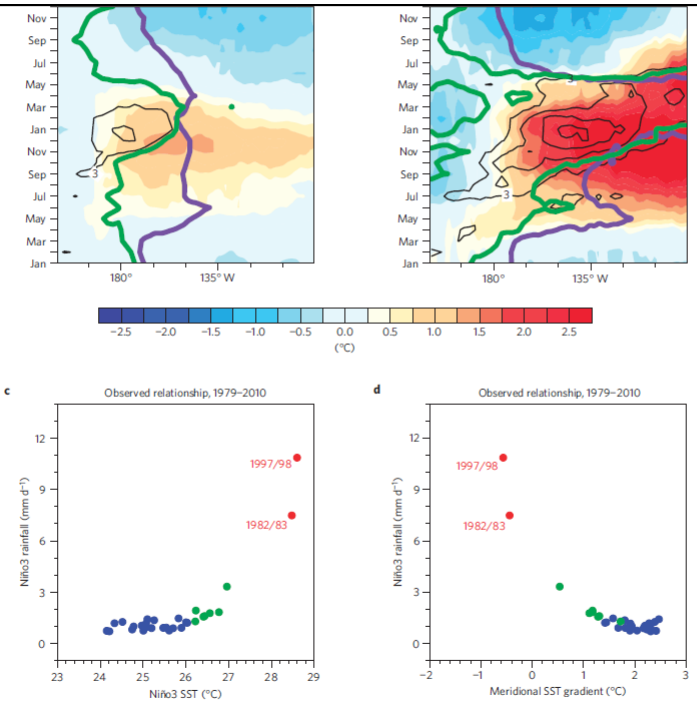


Overarching questions

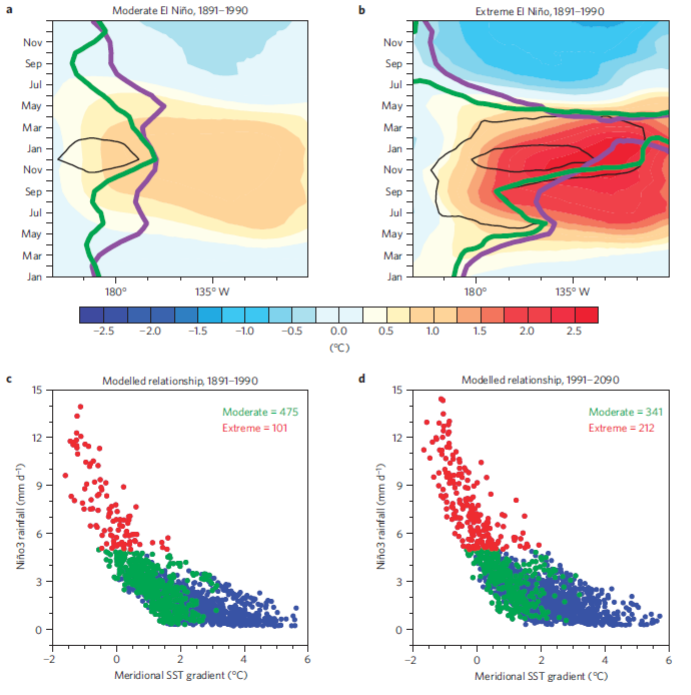
As our climate system continues to warm, will we see changes to the:

1. ***background state*** of the tropical Pacific? (Tues)
2. ***frequency*** of ENSO events? (Tues)
3. ***spatial pattern*** of ENSO events?
4. ***intensity*** of ENSO events?

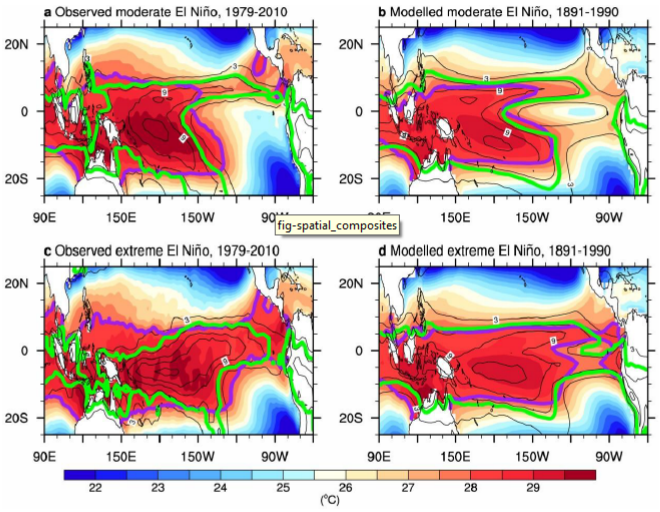
What is an extreme El Nino?



How were GCMs evaluated and selected for this analysis? What metrics were used? How well constrained are these metrics?



How were GCMs selected?



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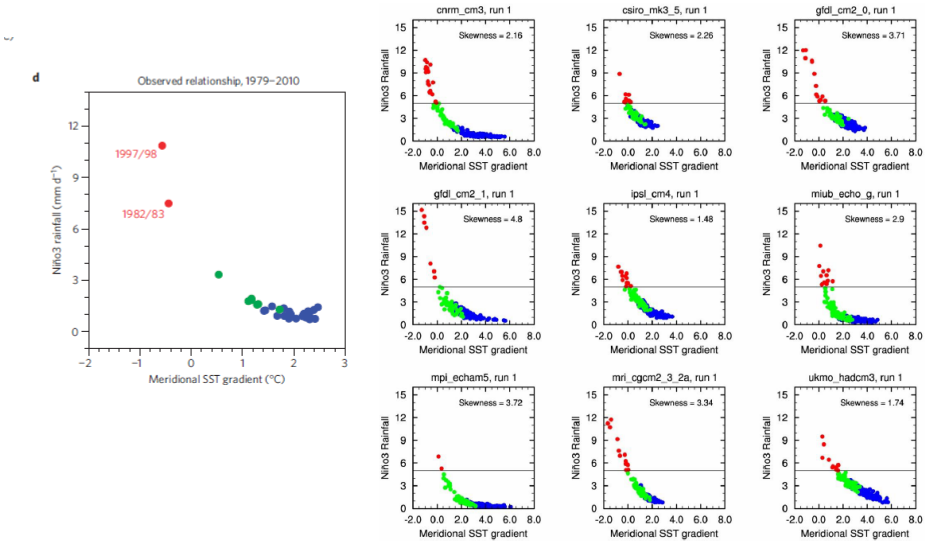
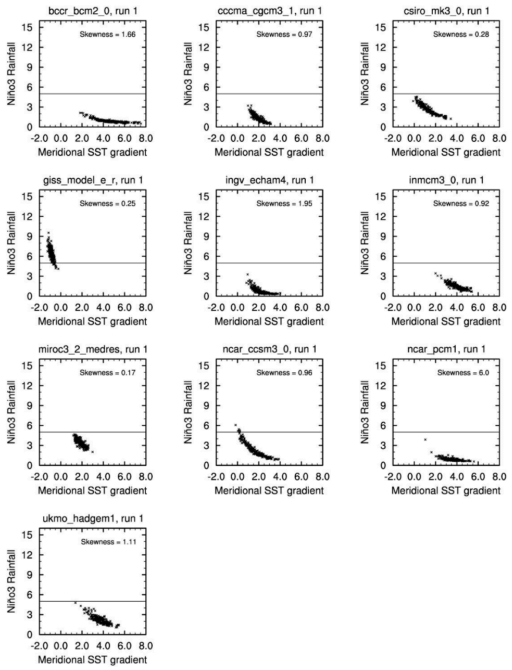
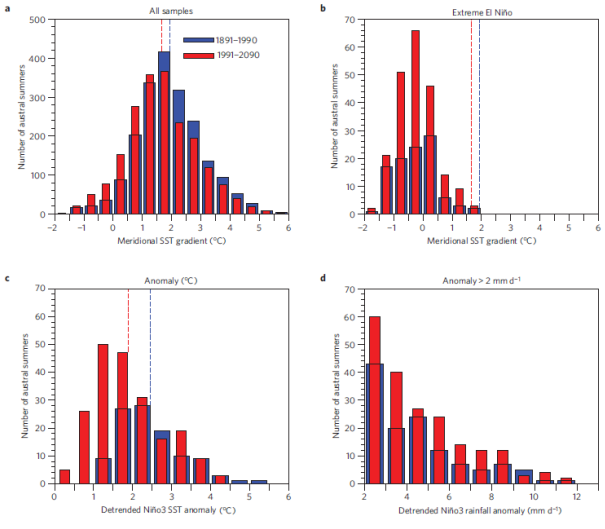


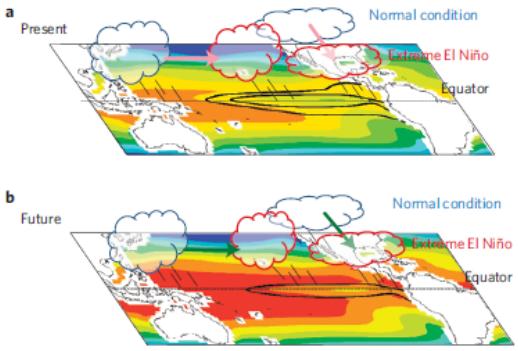


Future change in extreme ENSO

1. What is the proposed mechanism behind an increase in extreme El Niño events in the future simulated by models?
2. Why are future extreme El Niño events characterized by lower SST anomalies? If they are characterized by weaker SST anomalies, how/why are they defined as "extreme El Niño events"?



Background change



More on this on Tuesday!