

# **Solar Warming of South Central Pacific**

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**With implication to the N Pacific Blob**

**GHRST Meeting July 2015 in Estec**

**Record warming event in SC Pacific started in 9/2010 and peaked in 12/2010**

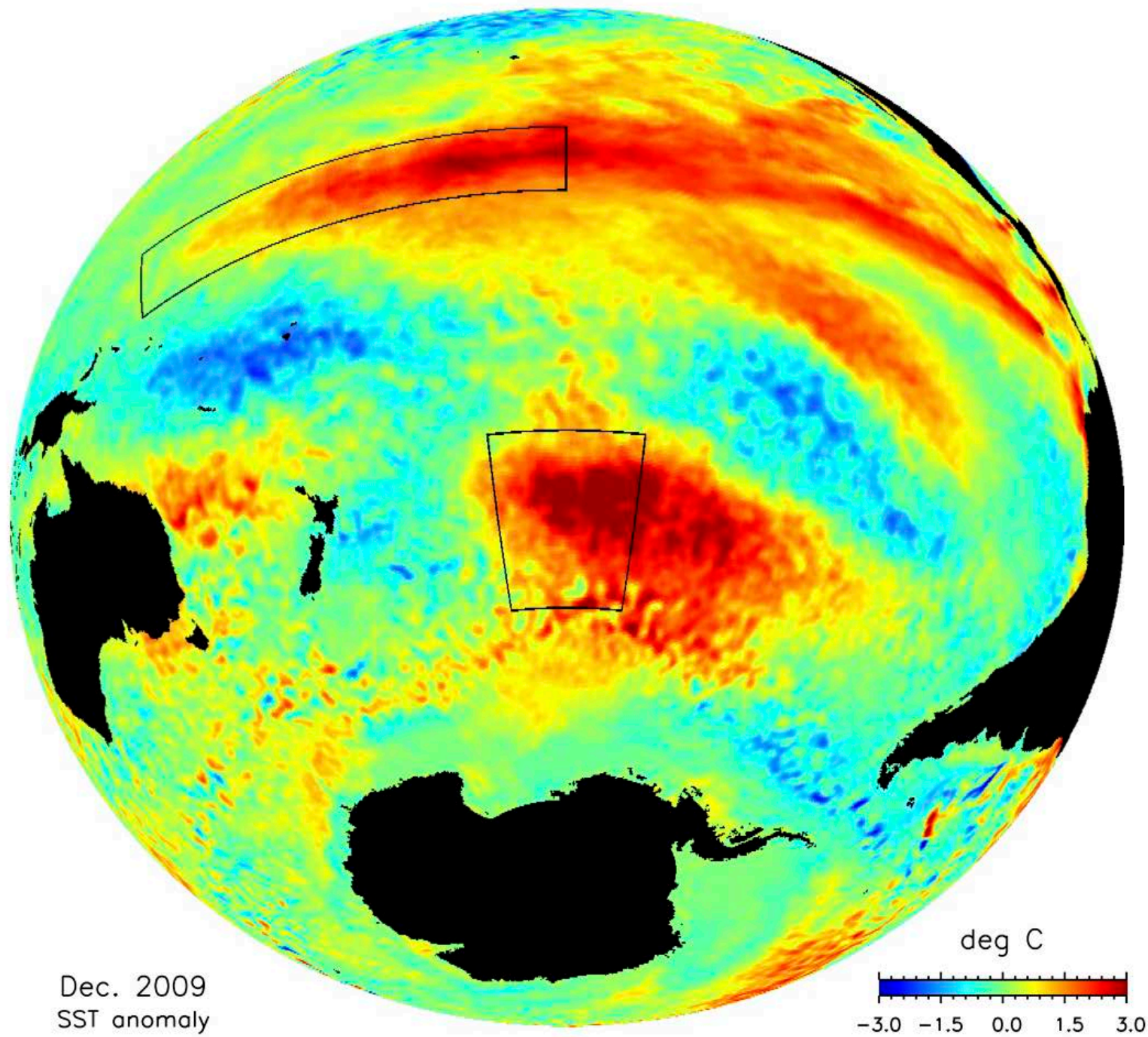
**Lee et al. (2010) attribute anomalies to reduced wind speed (evaporative cooling) and wind advection changes caused by a persistent anticyclone related to El Nino.**

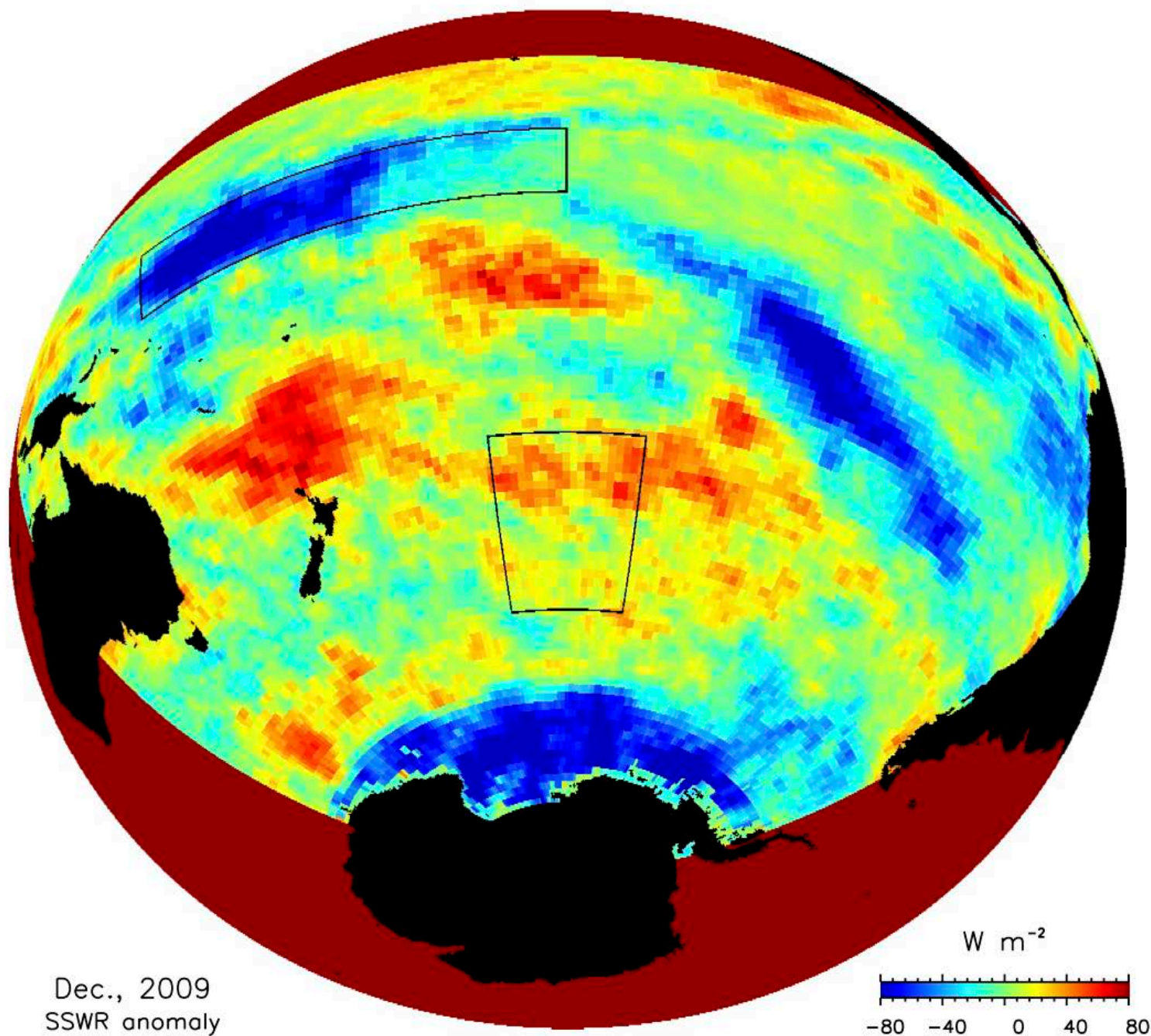
**Boening et al. (2011) suggested coincident high ocean bottom pressure and sea surface height was caused by mass convergence resulted from wind stress curl associated with the anticyclone.**

**Solar heating was deemed not important because NCEP data show reduced surface solar flux,**

# Data

- 24 years of ISCCP-FD SSWR (1984-2007) were used to examine El Nino teleconnection
- ISCCP data were not available to cover the warming event
- 4 years of SSWR 7/2006-6/2010 were specifically computed from MODIS
- AVHRR SST (1982-2010) are used to compile ENSO index and examine the warming event





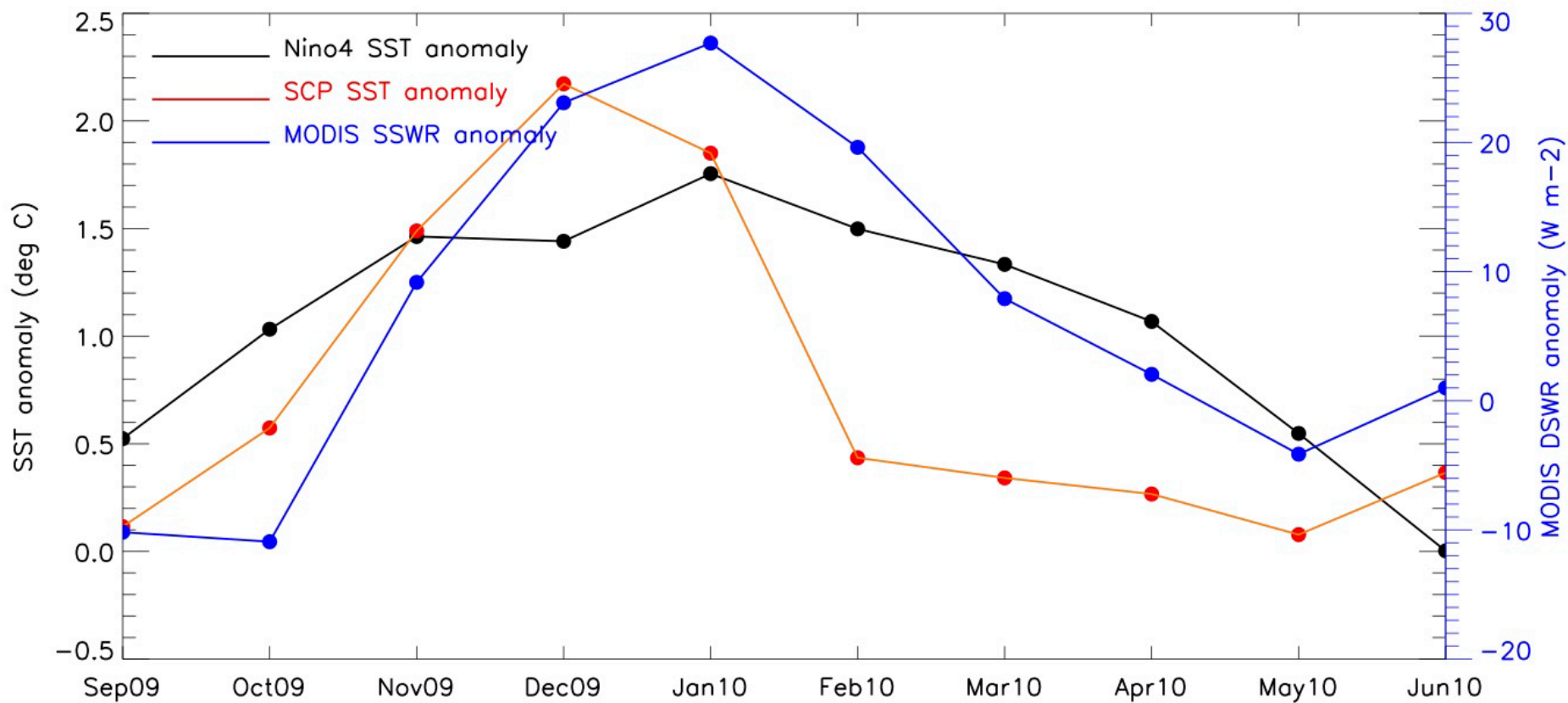


Table 1. Solar contribution to SCP warming

	(a) SSWR anomalies (W/m <sup>2</sup> )	(b) Ta (°C)	(c) SSTa (°C)	(d) Ta / SSTa (%)
Sept. 2009	-10.17	-0.1280	0.1153	-
Oct. 2009	-10.92	-0.1373	0.5736	-
Nov. 2009	9.17	0.1154	1.4890	7.75
Dec. 2009	23.07	0.2903	2.1725	13.36
Jan. 2010	27.70	0.3485	1.8502	18.84
Feb. 2010		0.2469	0.4350	56.76
Mar. 2010	7.91	0.0995	0.3415	29.14
Apr. 2010	2.04	0.0257	0.2666	9.64
May 2010	-4.14	-0.0521	0.0780	-
Jun. 2010	1.00	-0.0126	0.3661	-

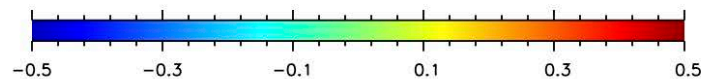
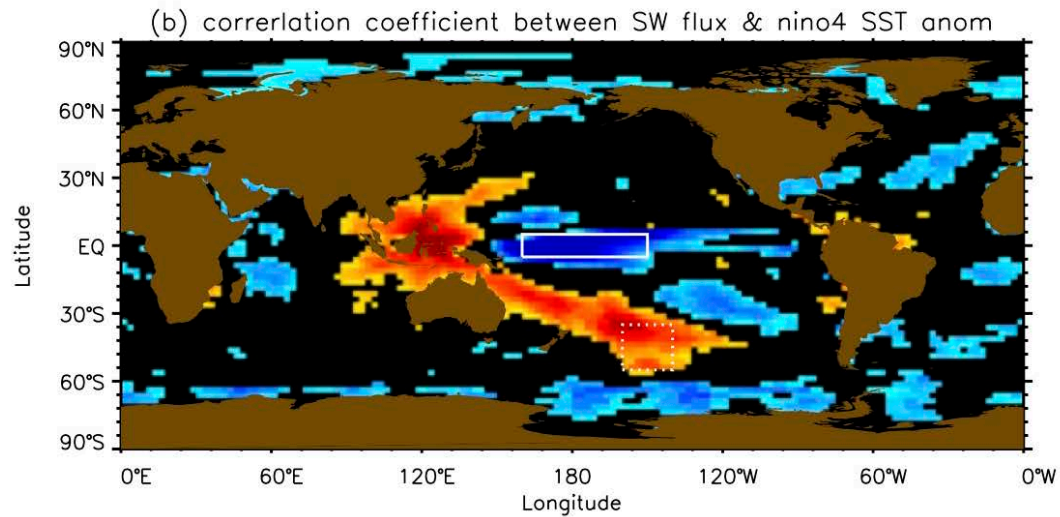
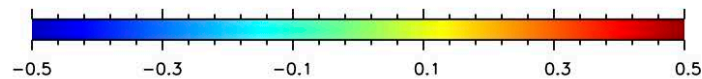
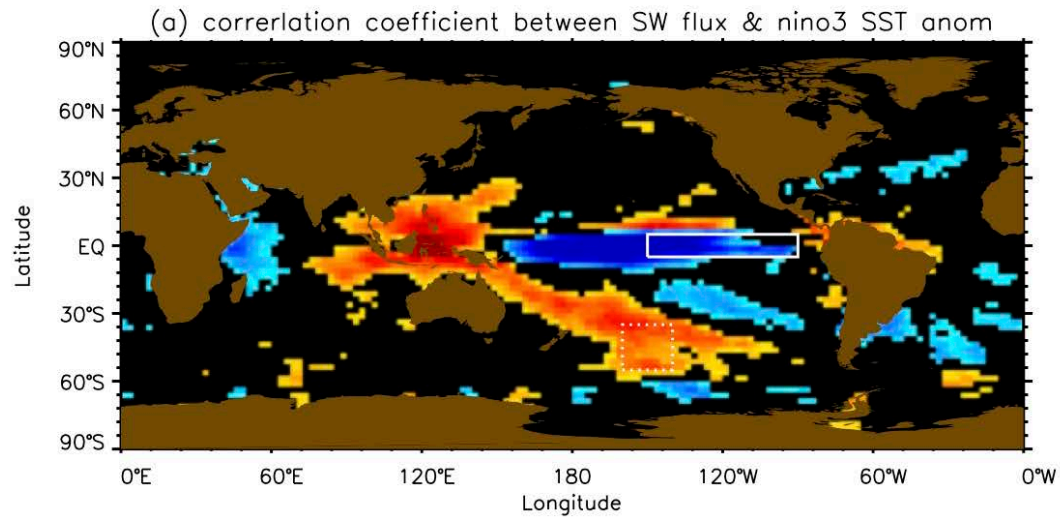
D: water column depth (50 m)

C: heat capacity (3981 J kg<sup>-1</sup> K<sup>-1</sup>)

ρ: water density (1035 kg m<sup>-3</sup>)

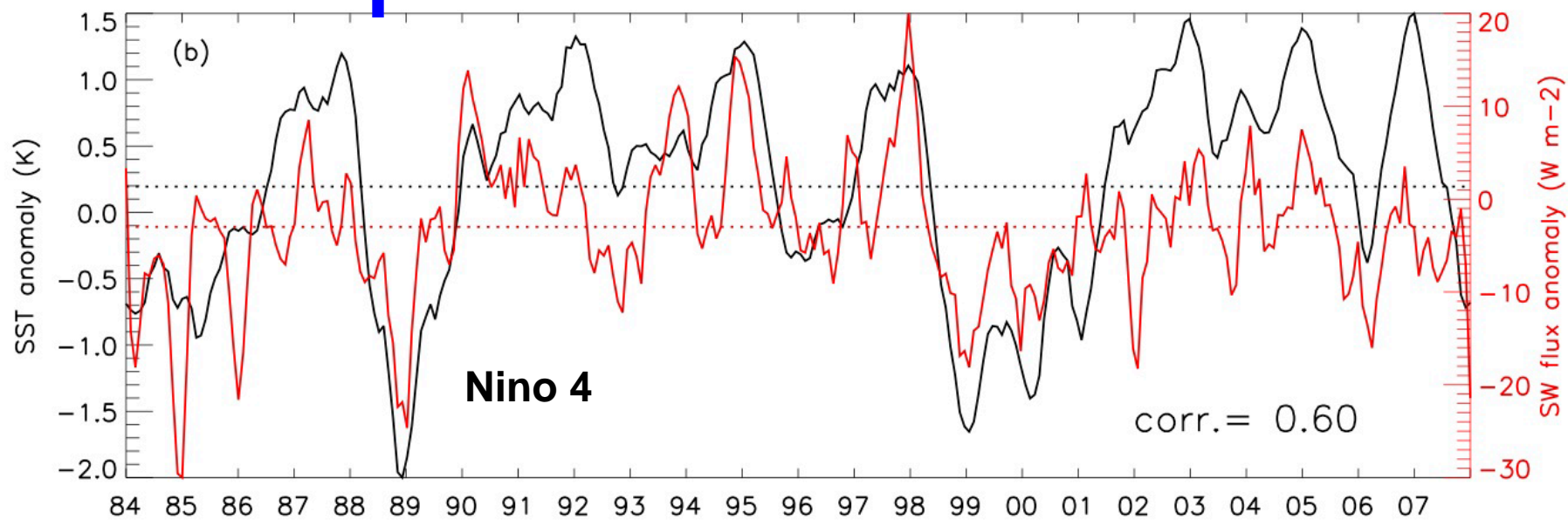
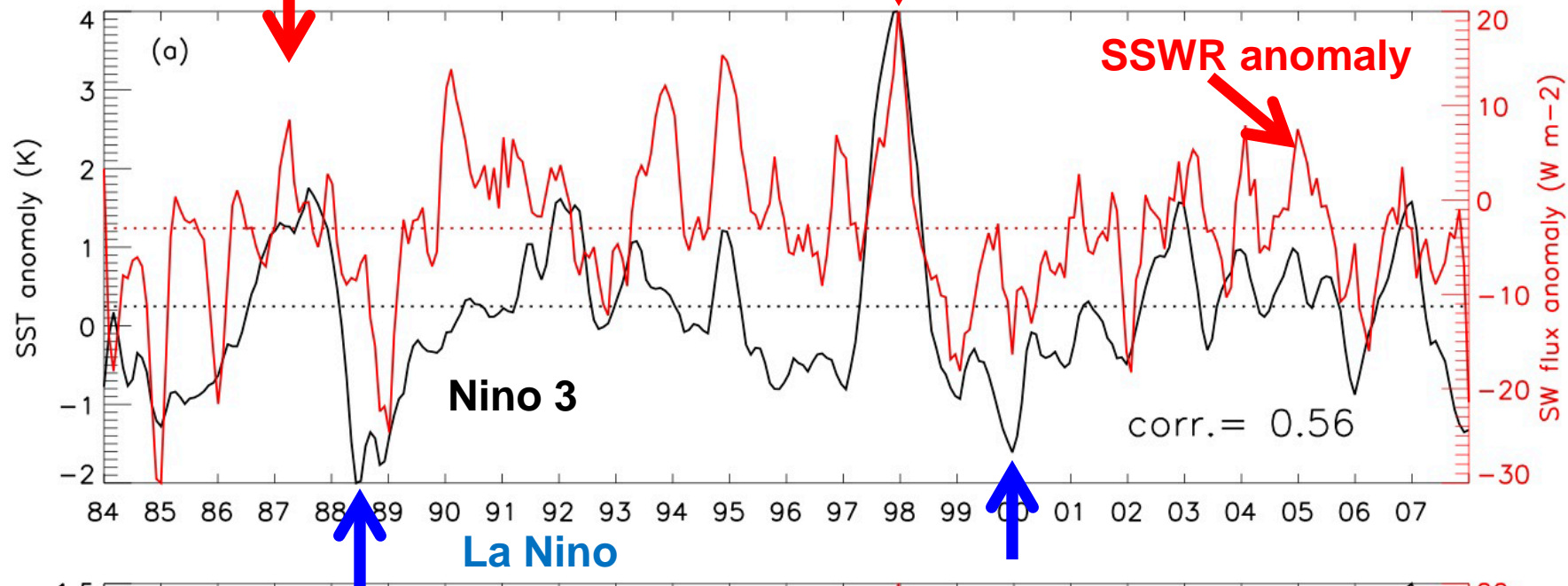
Ta (column b) is the temperature change in water column (from surface to 50m depth) in SCP area caused by SSWR anomaly (column a).

# Teleconnection between ENSO and global SSWR-24 yr 1987-2004



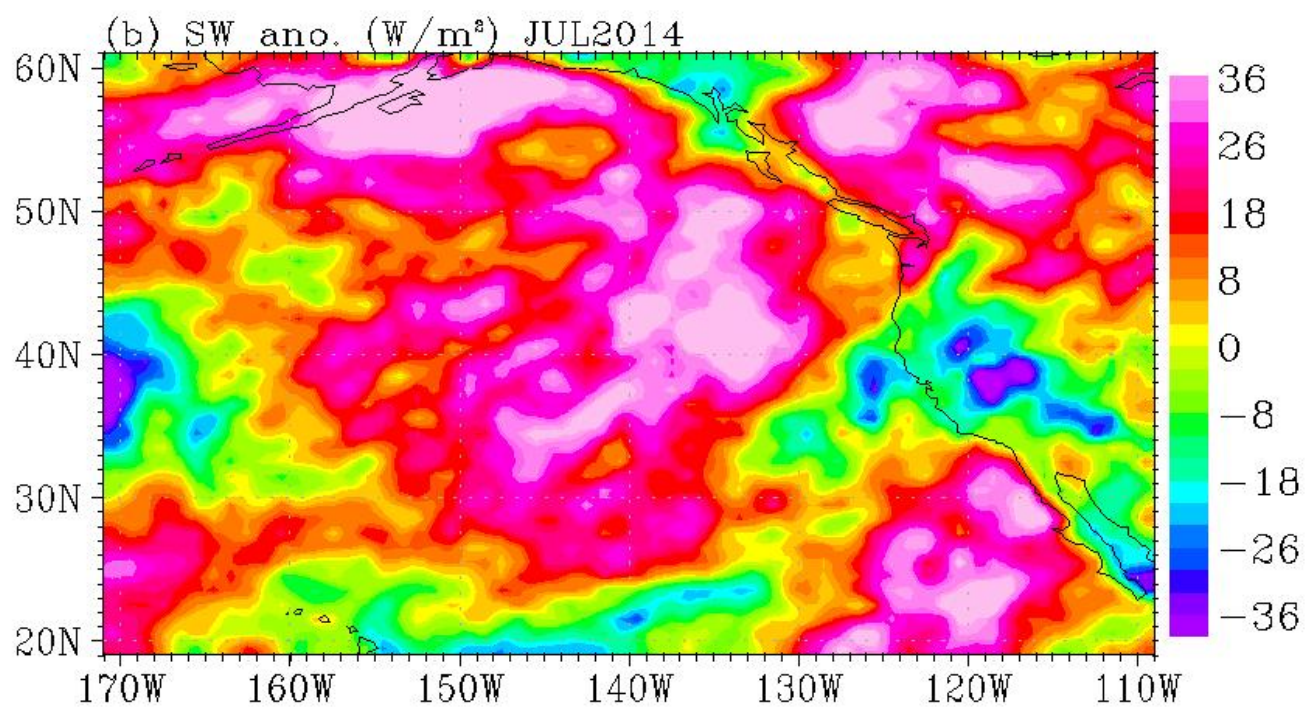
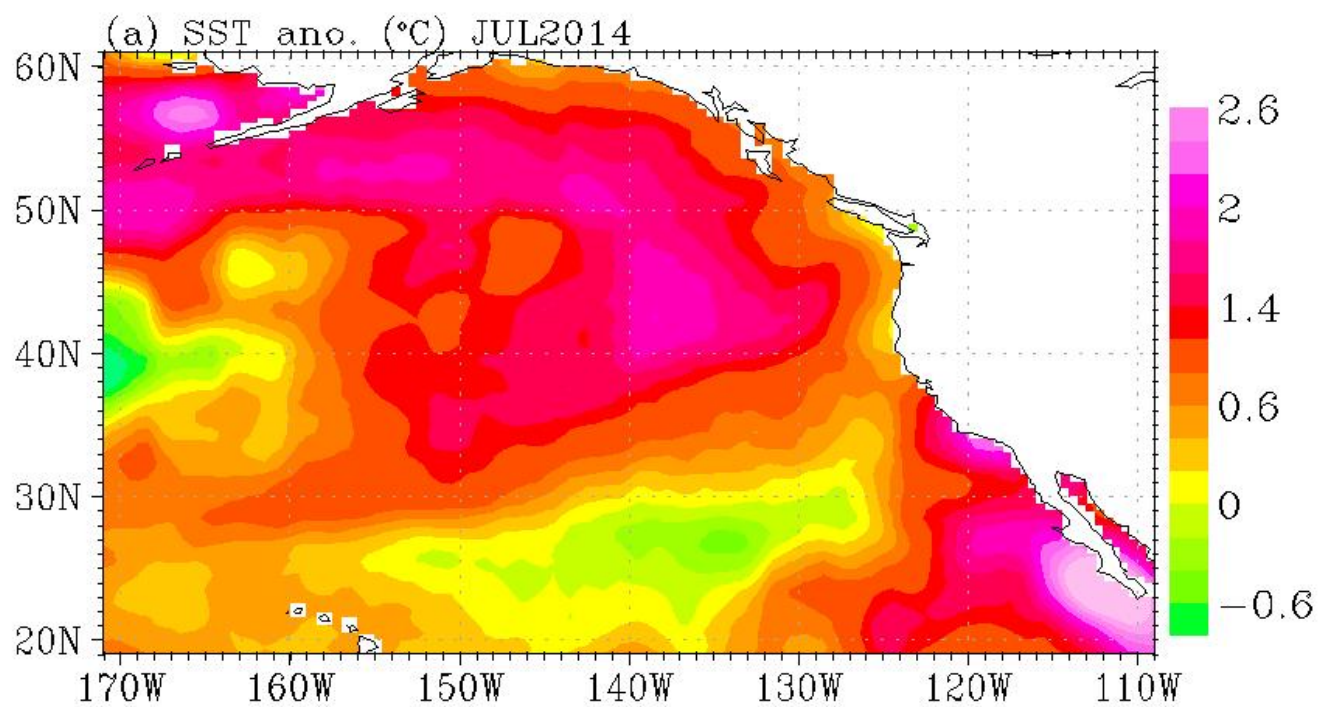
99% significant, radiation flux positive into ocean

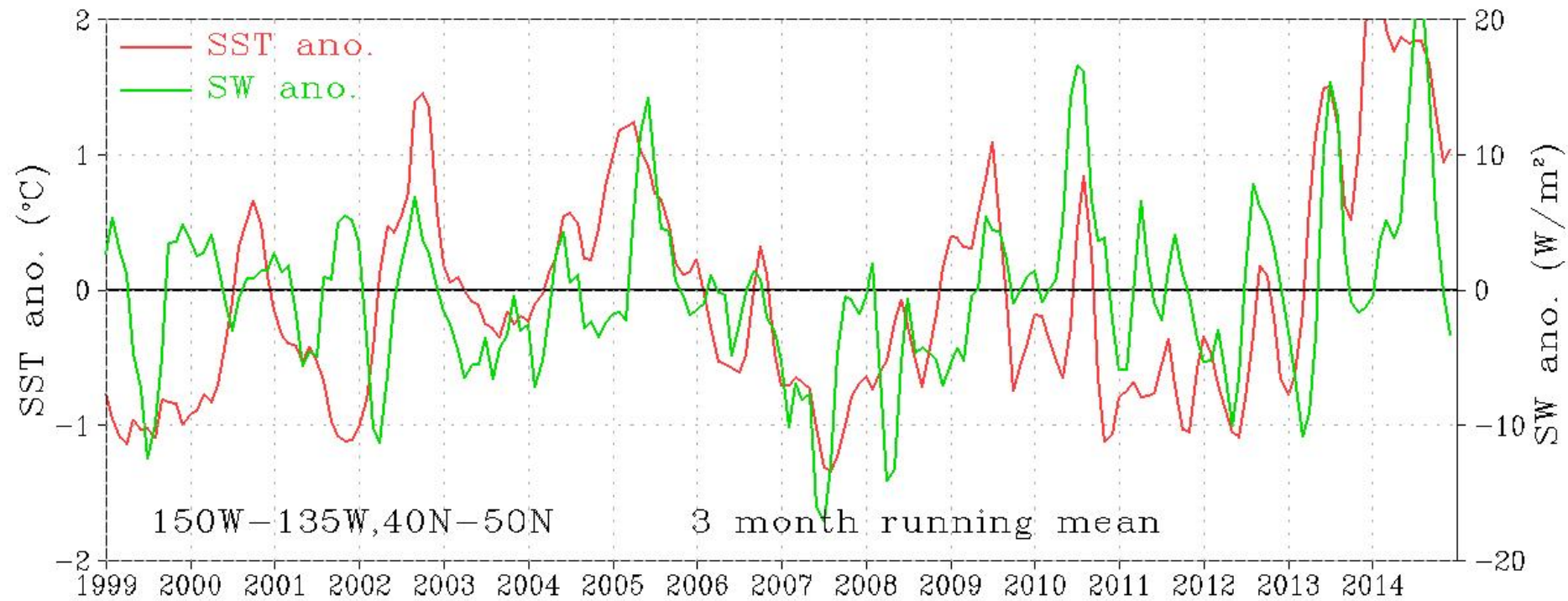
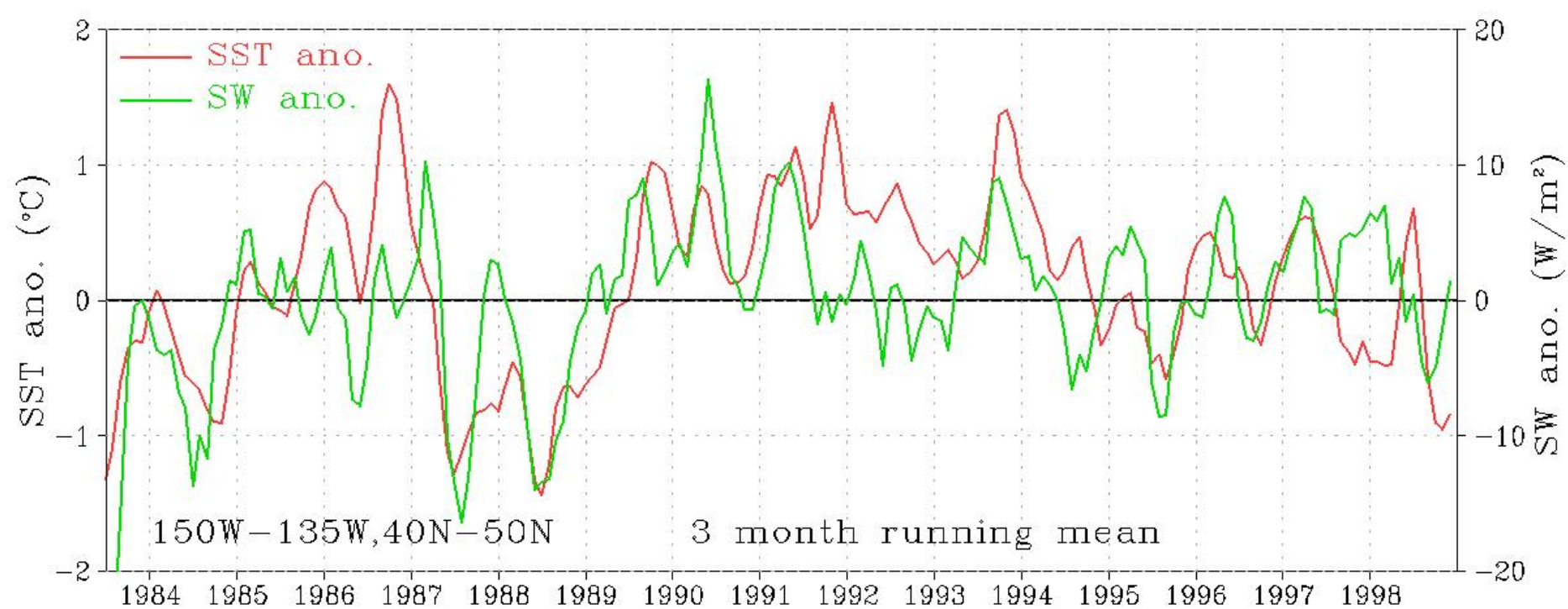
**El Nino**

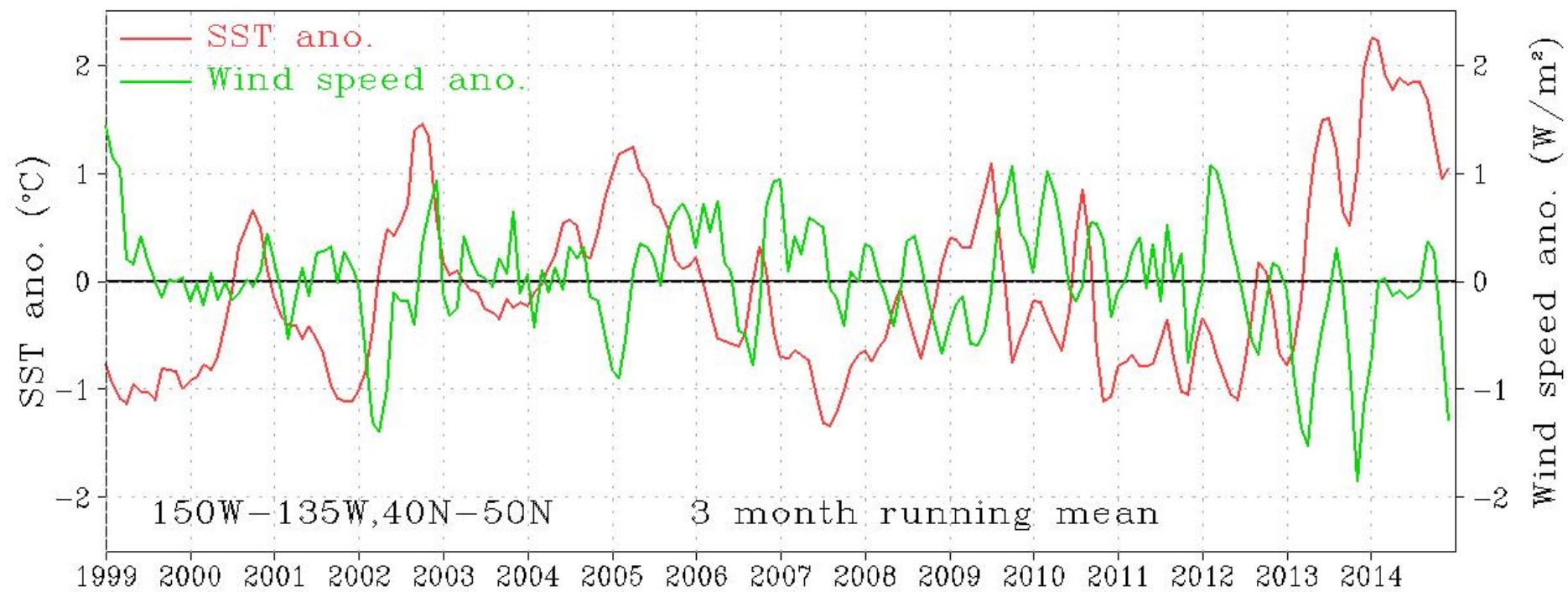
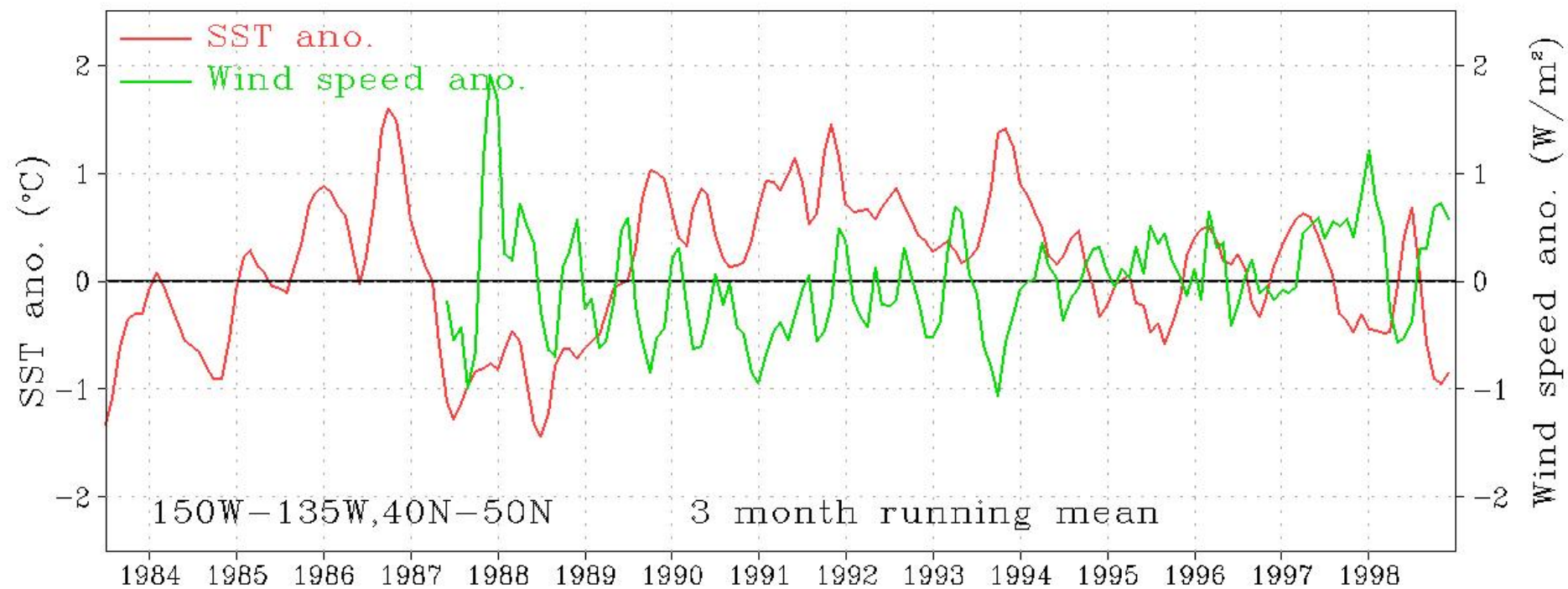


## Conclusion

- Solar heating is significantly related to the SCP warming event
- SCP is within a positive teleconnection pattern between ENSO SST and global SSWR
- The results extend the Atmospheric Bridge Hypothesis to solar radiation
- Deep convection results from El Nino change mid-latitude circulation and surface fluxes
- Atmospheric circulation change cloud cover and surface solar insolation.
- How heat trapped in surface is mixed down is the long held question







- Backup

