

# Climate Models

# FAIL

## Mother Nature's School of Climate Modeling

Student:	IPCC Modeling Group	
Models:	CMIP5 archive	F
Surface Temperature:	Land Surface:	f
	Sea Surface:	F
	Combined Land Plus Sea Surface:	F
Global Precipitation:		f
Sea Ice Area:		
Notes:	Models show no skill at being able to simulate coupled ocean-atmosphere processes that dictate temperature and precipitation on Earth.	
Teacher Comments:	Simplify, and concentrate on ocean-atmosphere processes like El Nino/La Nina and Atlantic Multidecadal Oscillation.	

Parent Signature: Mrs P.

By Bob Tisdale  
Author of *Who Turned on the Heat?*

The following is a blog post that I prepared a few days after *Climate Models Fail* was published. I've presented it here in pdf form as a supplement to the book.

### **Models Fail: Land versus Sea Surface Warming Rates**

Posted on September 28, 2013 by Bob Tisdale

In [\*Climate Models Fail\*](#), using a number of different datasets, I illustrated how the climate models used by the IPCC for their 5<sup>th</sup> Assessment Report could not simulate climate variables such as surface temperatures (land surface air, sea surface and combined land+sea surface), precipitation and sea ice area. There's another splendid way to present the model failings (that wasn't presented in the book): by comparing the warming rates of global land surface air temperatures with the warming rates of global sea surface temperatures. It's astounding that the models perform so poorly. See Table 1.

<b>Table 1 - Global Land Surface Air &amp; Sea Surface Temperature Warming Rates - Nov 1981 to Aug 2013 (Deg C/Decade)</b>			
<b>Metric</b>	<b>Modeled</b>	<b>Observed</b>	<b>% Difference</b>
Land Surface Air Temp	0.35	0.28	23%
Sea Surface Temp	0.17	0.08	97%
Ratio Land/Sea Surface Temp	2.10	3.36	-37%

**Observations:**

**Land Surface Air Temperature = GISS LOTI w/ Oceans Masked**

**Sea Surface Temperature = Reynolds Ol.v2**

**Models (Multi-Model Ensemble Mean) Historic-RCP6.0:**

**Land Surface Air Temperature = CMIP5 TAS /w Oceans Masked**

**Sea Surface Temperature = CMIP5 TOS**

**Ratio Land/Sea Surface Temperature =**

**Land Surface Air Temperature Trend/Sea Surface Temperature Trend**

**% Difference =**

**((Modeled Trend/Observed Trend)-1)\*100**

**Note: The significant figures in Table 1 have been reduced. Therefore, the "% Difference" and "Ratio Land/Sea Surface Temp" contain rounding errors.**

**Note: I've made a few changes to the post at the suggestions of the first few persons to comment on the WUWT cross post. Table 1 has been updated and so has the text of the paragraph before Figure 7-29. (Thanks, to bloggers DB and Keith Minto.) And I've added a note to the table about rounding errors. (Thanks, Steve Keohane.)**

As shown, the models overestimated the warming of global land surface air temperatures since November 1981 by about 23% (which isn't too bad), but the models doubled the observed rate of warming of the surface temperatures of the global oceans (and that's horrendous). Now consider that most of the warming of global land surface air temperatures is in response to the warming of global sea surface temperatures. (See Compo and Sardeshmukh (2009) "[Ocean Influences on Recent Continental Warming](#)." ) In the real world, the land surface temperatures warmed at a rate that was

more than 3 times faster than the warming of global sea surface temperatures, but in the fantasy modeled world, land surface temperatures only warmed 2 times as fast.

And what does that suggest?

Well, we already know that models can't simulate the coupled ocean-atmosphere processes that cause global sea surface temperatures to warm over multidecadal periods. (See the quick overview that follows.) So, the difference between the modeled and observed ratios of land to sea surface temperature warming rates suggests the basic underlying physics within the models are skewed. Skewed is the nicest word I could think to use.

Consider this: the models simulate coupled ocean-atmosphere processes so poorly that, while the models doubled the observed rate of warming of sea surface temperatures, the models could only overestimate the observed rate of warming of land surface air temperatures by 23%.

#### **TABLE 1 DATA AND MODEL OUTPUT INFORMATION**

Source of Data and Model Outputs: [KNMI Climate Explorer](#). (See my blog post [Step-By-Step Instructions for Creating a Climate-Related Model-Data Comparison Graph](#).)

Data: The land surface temperature data are the GISS Land-Ocean Temperature Index with the oceans masked, and the sea surface temperature data are Reynolds OI.v2.

Model Outputs: I've used the CMIP5 multi-model ensemble mean (historic through 2005 and RCP6.0 afterwards). The oceans are masked for the land surface air temperature outputs (tas), and the outputs for sea surface temperature (tos) are as presented by the KNMI Climate Explorer.

Other: The start month (November 1981) is dictated by the satellite-enhanced sea surface temperature data. The base years for anomalies are 1982 to 2010 to accommodate the time period.

## **FAILURES TO SIMULATE COUPLED OCEAN-ATMOSPHERE PROCESSES**

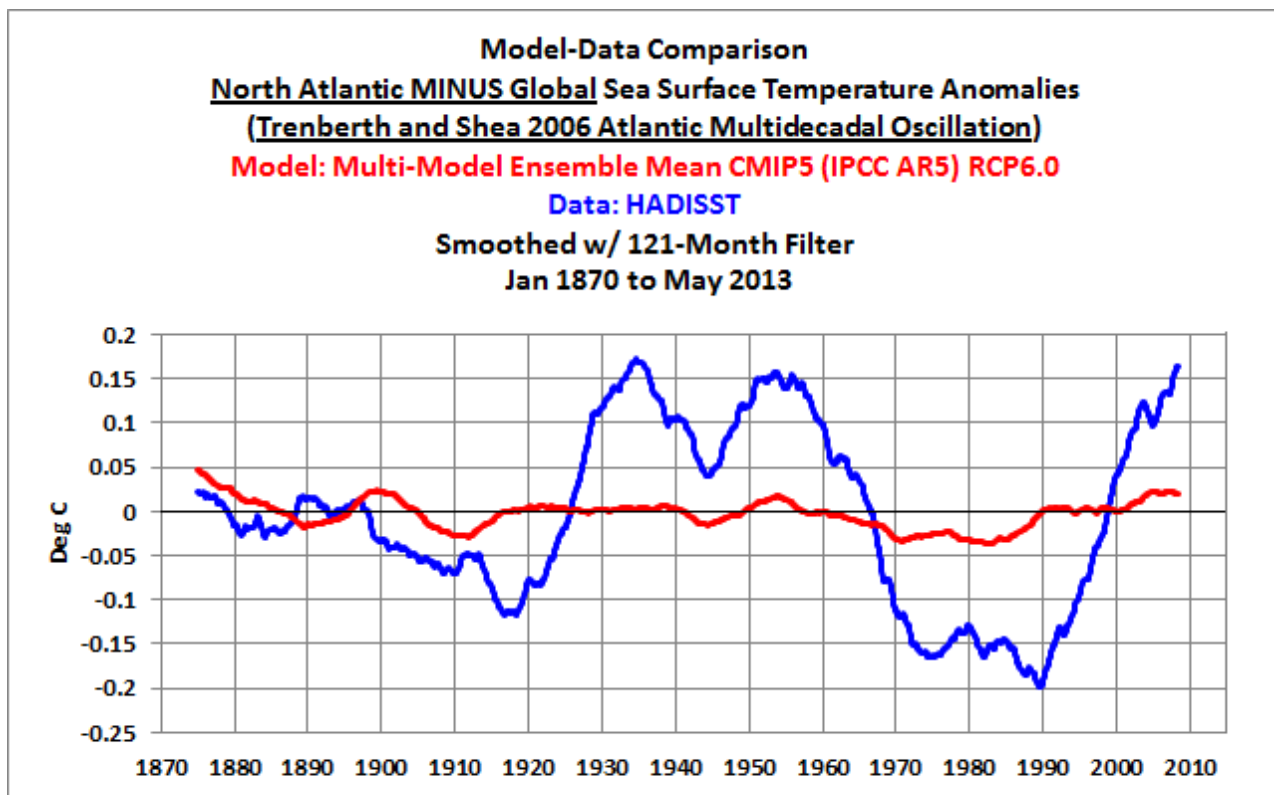
[Note: The following Figure numbers are as they appear in *Climate Models Fail*.]

This part of the discussion gets a little technical, but it provides a basic overview of the naturally occurring processes that cause sea surface temperatures to warm. And it shows quite clearly that the models used by the IPCC for their 5<sup>th</sup> Assessment Report do not properly simulate those processes.

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Climate models used by the IPCC for the 5<sup>th</sup> Assessment Report do not properly simulate the AMO (Atlantic Multidecadal Oscillation). In *Climate Models Fail*, I presented a number of scientific studies that were very critical of how models simulated many variables, including the Atlantic Multidecadal Oscillation. (See Ruiz-Barradas, et.al. (2013) is [The Atlantic Multidecadal Oscillation in twentieth century climate simulations: uneven progress from CMIP3 to CMIP5.](#))

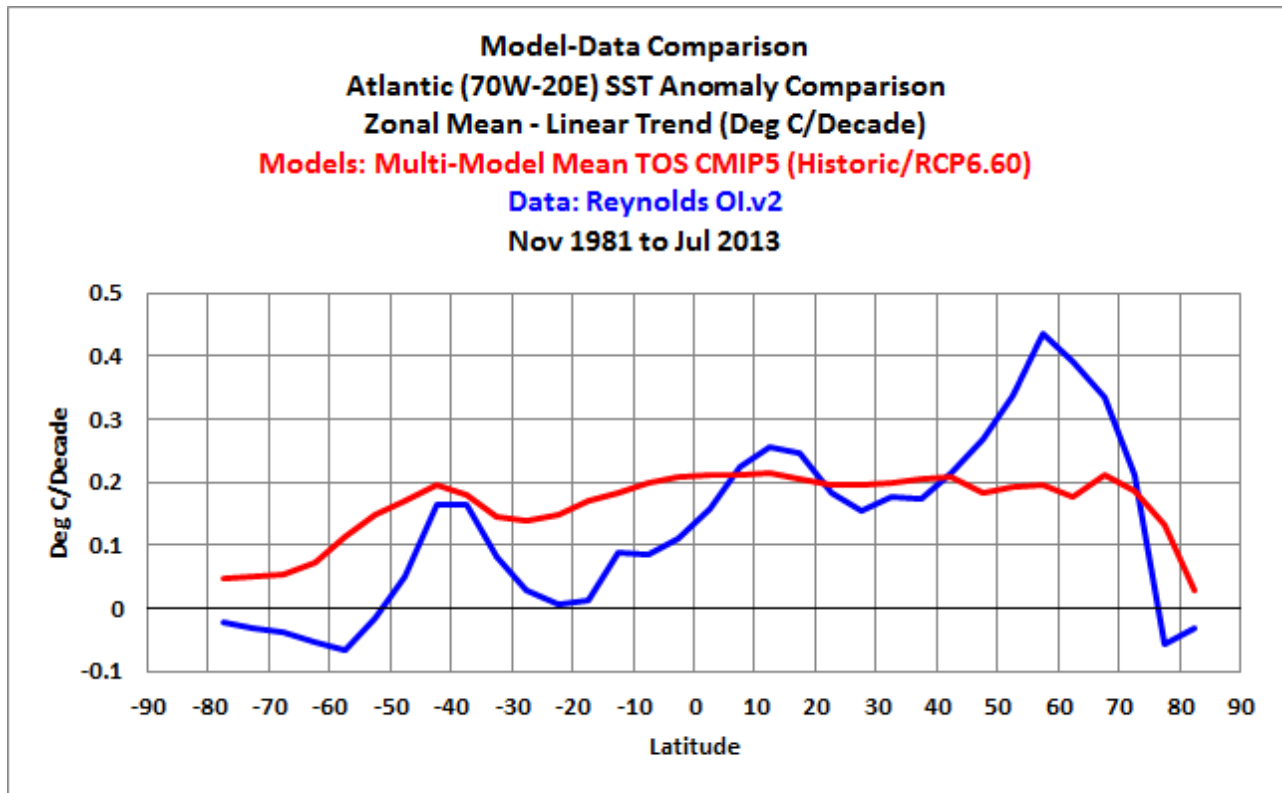
We can illustrate the Atlantic Multidecadal Oscillation using the method recommended by [Trenberth and Shea \(2006\)](#), and it was to subtract global sea surface temperature anomalies (60S-60N, excludes the polar oceans) from sea surface temperature anomalies of the North Atlantic (0-60N, 80W-0). They used HADISST data and so have I. In the time-series graph in Figure 7-22, I've also smoothed the AMO data with a 121-month running average filter. As shown by the blue curve, the North Atlantic has a mode of natural variability that causes its sea surface temperatures to warm and cool at rates that are much greater than the variations in the surface temperatures of the global oceans. And we can see that the variations occur over multidecadal time periods (thus the name Atlantic Multidecadal Oscillation). Keep in mind that the Atlantic Multidecadal Oscillation is responsible for some (but not all) of the warming of land surface temperatures in the Northern Hemisphere during the more recent warming period, [according to the climate scientists at RealClimate](#). (See also Tung and Zhou (2012) [Using data to attribute episodes of warming and cooling in instrumental records.](#))



If we subtract the modeled global sea surface temperatures from the modeled sea surface temperatures of the North Atlantic (shown as the red curve in Figure 7-22), we can see that the forced component of the CMIP5 models (represented by the multi-model ensemble mean) does not simulate the observed multidecadal variations in the North Atlantic. That is, there is very little difference between the modeled variations in global and North Atlantic sea surface temperature anomalies. The comparison also strongly suggests that the Atlantic Multidecadal Oscillation is NOT a response to manmade greenhouse gases (or aerosols) used by the climate modelers to force the warming (or cooling) of sea surface temperatures of the North Atlantic.

So the modelers have tried to compensate for that failing. They try to force the warming of the surface of the Atlantic Ocean with manmade greenhouse gases, which results in a poor representation of that warming. We can see this in the modeled and observed warming rates of Atlantic sea surface temperatures during the satellite era. (See Figure 7-12)

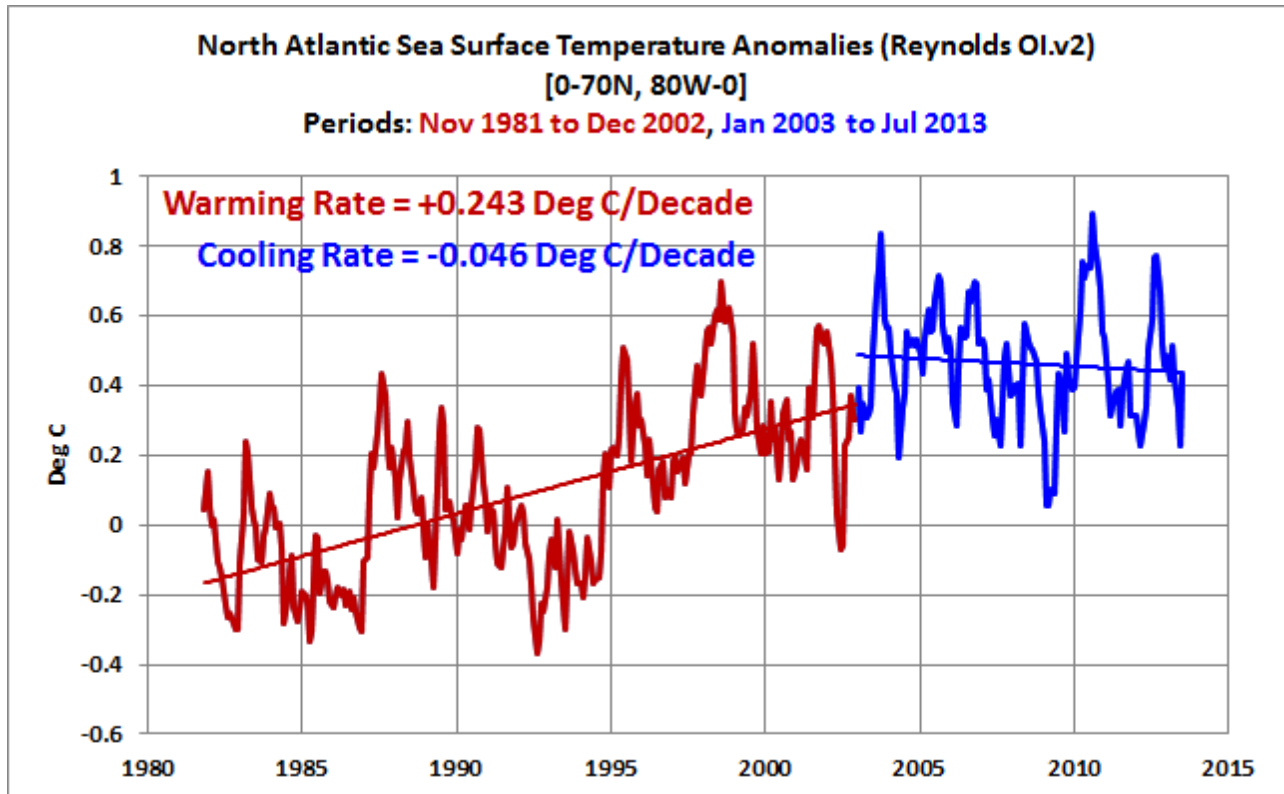
Overview of Figure 7-12: Its graph presents observed and modeled warming rates on a zonal-mean (latitude average) basis and it covers the last 31 years. The vertical axis (y-axis) presents the warming rates (based on linear trends) in deg C/decade. The horizontal axis (x-axis) is latitude: where the South Pole is at “-90” deg on the left, the North Pole in at “90” deg on the right, and in the center at “0” deg is the equator. So the North Atlantic is to the right. Basically, the graph shows how quickly the sea surface temperatures of the Atlantic warmed (and cooled) since November 1981 at different latitudes (modeled and observed).



**Figure 7-12**

Because climate models cannot properly simulate the Atlantic Multidecadal Oscillation, the modelers tried to force that additional warming of Atlantic sea surface temperatures with manmade greenhouse gases and they needed to do that because the North Atlantic has a strong influence on land surface temperatures in the Northern Hemisphere. But, as shown in Figure 7-12, they failed to capture where the Atlantic warmed and how much it warmed. And that influences where land surface air temperatures warm in the models and by how much.

Also, recall that the high rate of warming in the North Atlantic is tied to a natural cycle, so it's temporary. The North Atlantic also cools for multiple decades. It may already have started. (See Figure 2-31) But in the models, the warming has not slowed (not illustrated).



In the models, the forced high rates of warming of sea surface temperatures by greenhouse gas then carries over to the other ocean basins — the Pacific for the next example.

As you'll recall, the Pacific Ocean is the largest ocean basin on the planet. It covers more of the surface of the global oceans than all of the continental land masses combined.

Also, the coupled ocean-atmosphere processes that cause the greatest variations in global surface temperature and precipitation take place in the Pacific Ocean. They are known as El Niño and La Niña events. There are no other natural climate-impacting

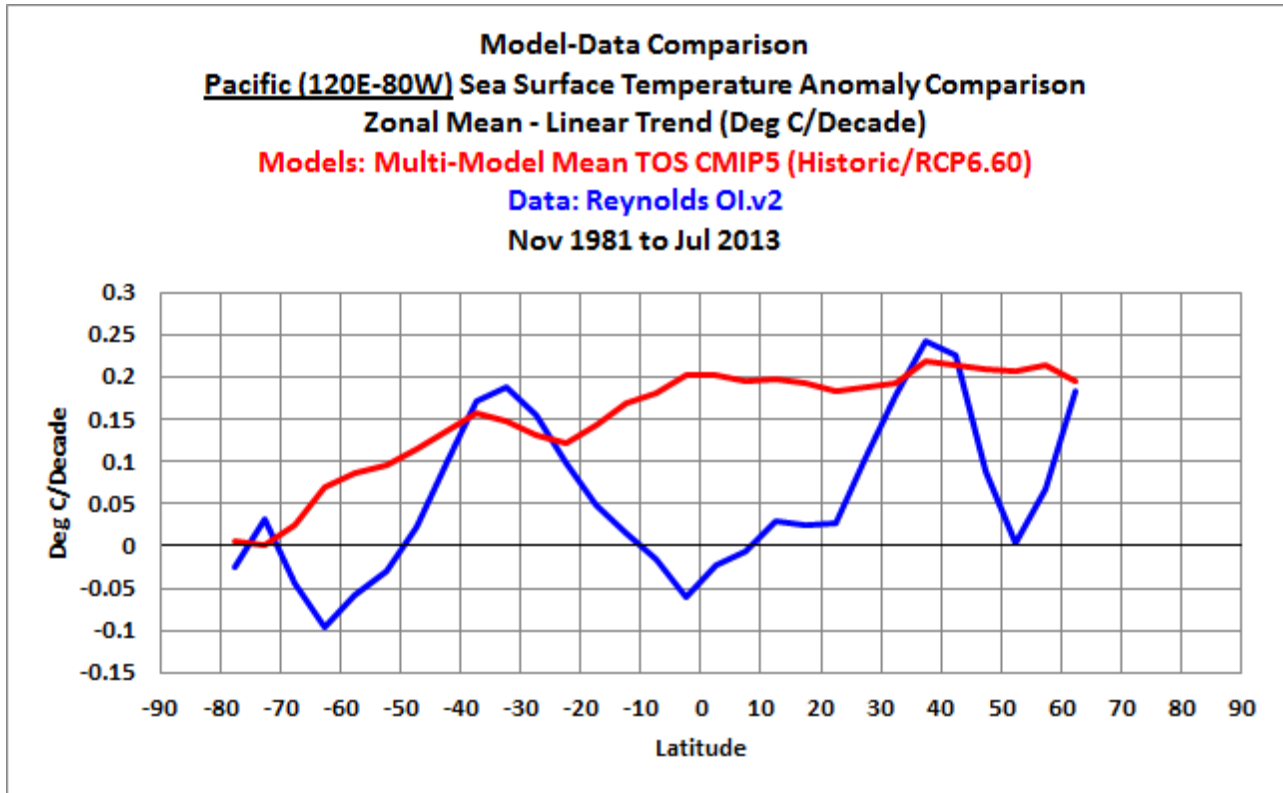


events on Earth that rival El Niños and La Niñas, other than catastrophic volcanic eruptions.

And what do we know about El Niños and La Niñas?

First, we know climate modelers haven't a clue how to simulate them and that includes the models used by the IPCC for their 5<sup>th</sup> Assessment Report. (See Guilyardi, et al. (2009) "[Understanding El Niño in Ocean-Atmosphere General Circulation Models: Progress and Challenges](#)" and Bellenger, et al. (2013) "[ENSO Representation in Climate Models: from CMIP3 to CMIP5](#)").

Second, we know that El Niño events release tremendous amounts of (naturally created) heat into the atmosphere, and result in massive volumes of (naturally created) warm water being transported away from the tropical Pacific — and that the warm water is carried into the Indian Ocean and into the mid-latitudes of the Pacific during the trailing La Niñas. (See Figure 7-29, which is a zonal-mean graph showing modeled and observed warming rates in the Pacific.) That's why, in the real world, the tropical Pacific Ocean has warmed very little over the past 31 years, and why the Pacific has warmed in the mid-latitudes. The strong El Niño events of 1986/87/88, 1997/98 and 2009/10 released a tremendous amount of warm water from below the surface of the tropical Pacific and it was redistributed from the tropical Pacific to the mid-latitudes during the trailing La Niñas.

**Figure 7-29**

Third, we know that El Niño events are fueled by warm water created during La Niña events, and that the warm water is created by temporary increases in sunlight associated with La Niña processes (not manmade greenhouse gases). Refer to [Trenberth et al \(2002\)](#) who write:

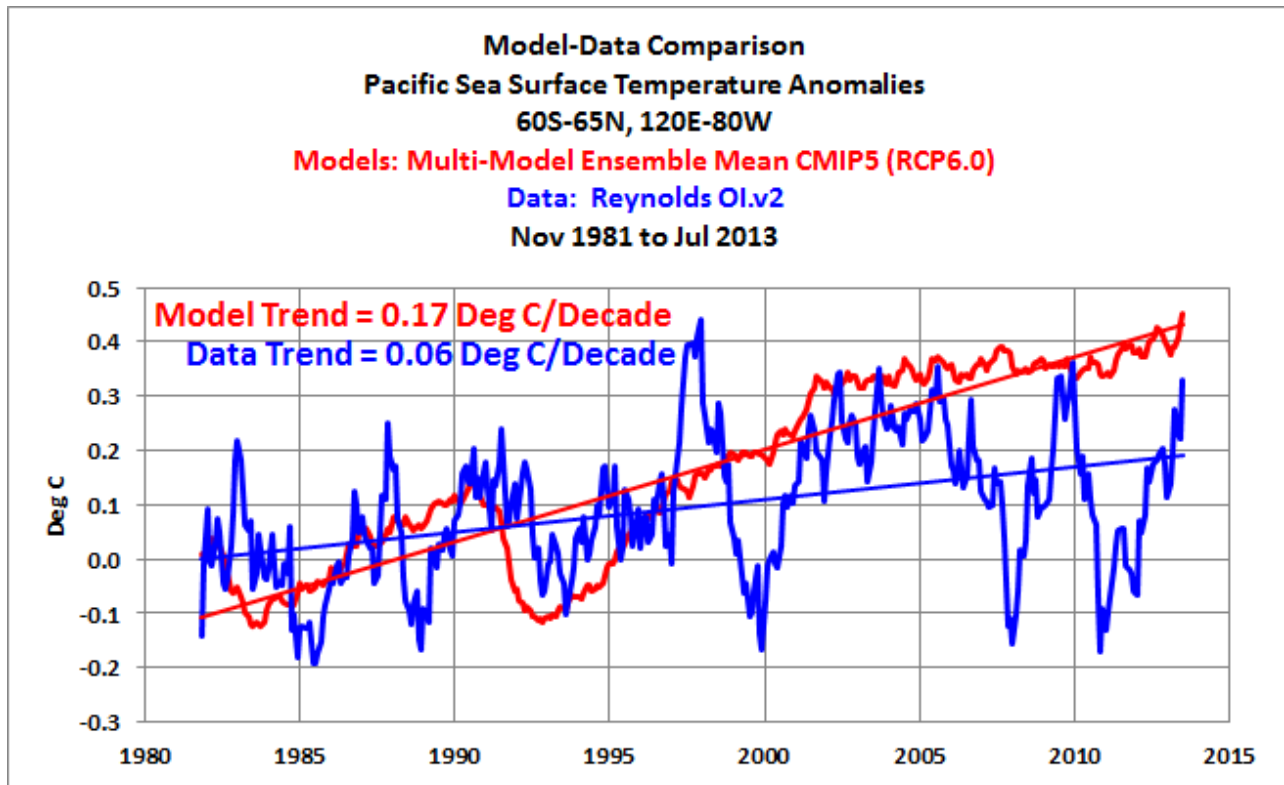
*The negative feedback between SST [sea surface temperature] and surface fluxes can be interpreted as showing the importance of the discharge of heat during El Niño events and of the recharge of heat during La Niña events.*

***Relatively clear skies in the central and eastern tropical Pacific allow solar radiation to enter the ocean, apparently offsetting the below normal SSTs, but the heat is carried away by Ekman drift, ocean currents, and adjustments through ocean Rossby and Kelvin waves, and the heat is stored in the western Pacific tropics. This is not simply a rearrangement of the ocean heat, but also a restoration of heat in the ocean.***

Back to Figure 7-29: Because the climate models used by the IPCC cannot simulate (sunlight-fueled) El Niño and La Niña events, they try to force the warming of the Pacific

Ocean with manmade greenhouse gases. And once again, the models fail to capture where the surface of the Pacific warmed and by how much. For example, they have forced the tropical Pacific in the models to warm at a very high rate, when, in the real world, the tropical Pacific has warmed very little in 31 years and in some areas it's cooled.

But the modelers also have another problem: they appear to have set their forcings to the values they need for the additional warming of the North Atlantic and in the models that additional forcing also impacts the Pacific Ocean. That's a logical explanation for why the models overestimated the warming of Pacific sea surface temperatures by a factor of 2.8. That is, the models almost tripled the warming rate of the Pacific sea surface temperatures. (See the time-series graph in Figure 7-25)



Yet somehow, in the climate models, land surface air temperatures do not warm as one would anticipate in response to all of the additional warming of sea surface temperatures. (Table 1) There must be some additional major flaws in the models.

## **CLOSING**

Climate models simulate naturally occurring and naturally fueled coupled ocean-atmosphere processes so poorly that it appears the modelers to have to “fudge” how land surface temperatures respond to the warming of ocean surfaces.

## **ADDITIONAL READING**

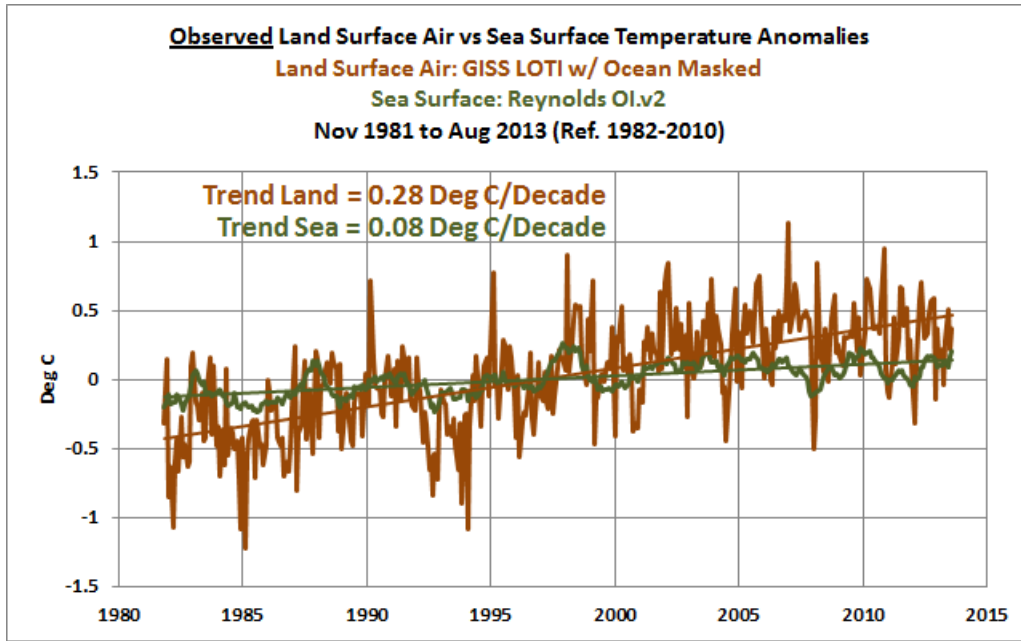
A multitude of climate model failings are discussed in [Climate Models Fail](#). And for further information about El Niño and La Niña events, I’ve written dozens of posts about their processes and their long-term aftereffects at my blog [Climate Observations](#) or you could refer to my earlier book [Who Turned on the Heat?](#)

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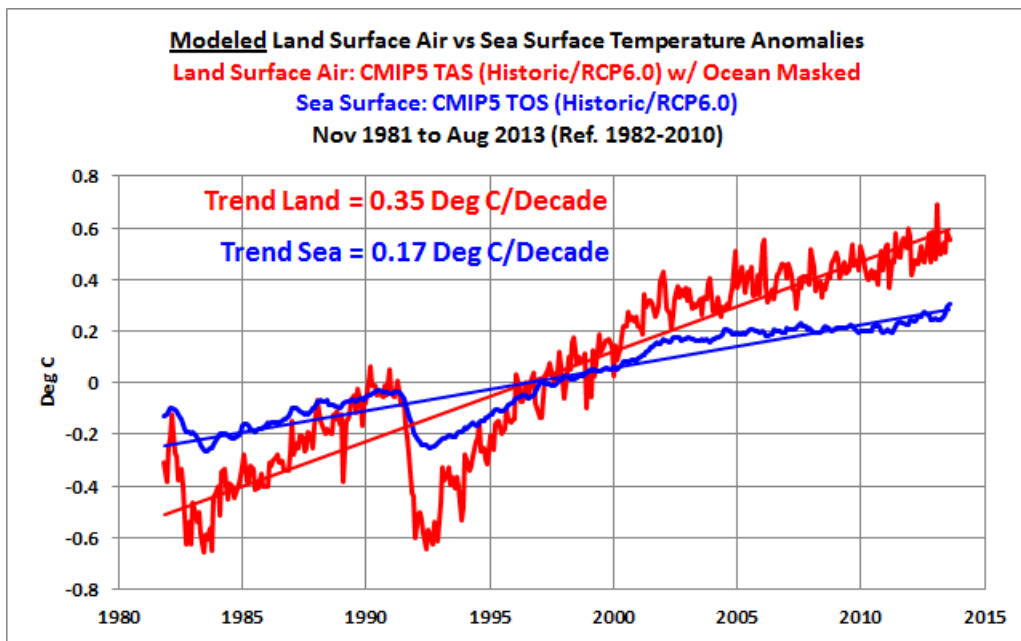
The above post was also [cross posted at WattsUpWithThat](#), for those who would like to read the numerous comments there.

## **REFERENCE GRAPHS**

The following two graphs are references for Table 1. They show the observed land surface air temperature and sea surface temperature anomalies since November 1981 and, in the second graph, the model outputs of the same metrics. They were not included in the blog post.



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