ISSN : 0974 - 7451 Volume 9 Issue 1

Environmental Science
An Indian Journal
Current Research Paper

ESAIJ, 9(1), 2014 [14-22]

The "*present global warming hiatus*" is part of a quasi-60 years oscillation in the worldwide average temperatures in the downwards phase

Albert Parker
School of Aerospace, Mechanical, and Manufacturing Engineering, RMIT University, Bundoora, (AUSTRALIA)
E-mail : albertparker@y7mail.com

ABSTRACT

Since the beginning of this century, the seas have not been warming over the surface as well as in the layers up to 2000 m depth, as measured in the ARGO project. Over the same period, the reconstructed land and sea temperatures of the HADCRUT4, GISS and NCDCdata sets have been warming marginally, mostly because of the largest opportunities to introduce upward biases in a less accurate mixed computational and experimental result. Over the same period of time, the CMIP3 and CMIP5 have predicted huge warmings that have no support in the measurements or reconstructions. It is shown here that the "*present global warming hiatus*" is possibly a repetition of a dwelling period of not significant warming that the reconstructions locate from 1945 to 1975.

INTRODUCTION

Kosaka and Xie[1] correctly state in the introduction of their latest paper that "*despite the continued increase in atmospheric greenhouse gas concentrations, the annual-mean global temperature has not risen in the twenty-first century, challenging the prevailing view that anthropogenic forcing causes climate warming*". The authors then try as many others[2-5] to conciliate the more than decadal lack of global warming with the increased heat uptake assumption of the 1979 Charney report proposing unrealistic mechanisms. According to Kosaka and Xie[1], "*accounting for recent cooling in the eastern equatorial Pacific reconciles climate simulations and observations*", and "*the current hiatus is part of natural climate variability, tied specifically to a La-Niña-like decadal cooling*" to obviously conclude "*although similar decadal hiatus events may occur in the future, the multi-decadal warming trend is very likely to continue with greenhouse gas increase*."

Different conclusion could have been inferred ifKosaka and Xiecould have examined the experimental evidence offered by the ARGO project[6,7] of a completely stable ocean locally and globally with oscillations of temperature 0 - 2000 m within the limit of the measuring accuracy[8,9], plus the regular oscillations about a longer term trend of the upwards biased reconstructed land and sea temperatures of the HADCRUT4, GISS and NCDC data sets and the regular oscillations of the climate indices relevant for the Pacific as NINO, SOI and MEI.

In this paper we will try to answer some important questions about the land and sea temperature behaviour also covering the reliability of reconstructions and computations to conclude that the present "global warming hiatus" would very likely continue until 2035 having different motivations from those proposed so far.

IS THE SEA TEMPERATURE PRESENTLY WARMING?

The ARGO data set is a truly experimental data set, differing from the data sets previously and contemporarily adopted in the climate science where the data set are mostly reconstructed or simulated values rather than true measurements. With 3633 buoys (as per September 3, 2013, figure 1) sampling the oceans down up to 2000 m depth, this programme delivers the first really high quality data of the ocean temperatures.

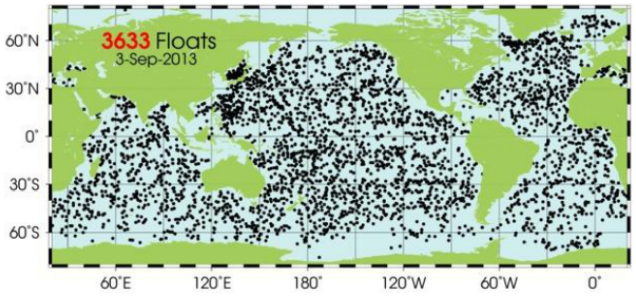

Figure 1 : Positions of the floats that have delivered data within the last 30 days (from [7])

If we consider the sea temperatures as measured in the ARGO programme the worldwide average (65 N to 65 S, 0 E to 360 E) surface temperature has been decreasing -0.0125 °C/year while the 0 – 2000 m average has been increasing of 0.0012 °C/year over the years 2004 – 2012[8,9].

In addition to this result of global insignificant changes, the isotherms of different layers are also very close each other the first and the last year of the measurements[8,9]. Figure 2 presents the isotherms measured in 2004 and 2012 at the surface and over the layer 0 – 2000 dbar. In 2012 the measured isotherms at every sampled depth were very close to what was measured in 2004, suggesting a relative stability of the ocean heat content. Figure 2 also zooms on the west tropical pacific area, where at different depths the temperatures are pretty much the same.

From the substantially stable temperatures locally and worldwide on average we may conclude that there has been not too much of a cooling or of a warming over the last decade globally and locally.

IS THE COMBINED SEA AND LAND TEMPERATURE PRESENTLY WARMING?

Not that different conclusions can be inferred from the much less accurate (certainly for the sea component in the present and for the sea and land component in the past) data sets as of HADCRUT4[10], GISS[11] andNCDC[12] that are covering both land and sea.

Figure 3 presents the GISS result. GISS uses NCDC ERSST.v3b sea surface temperature data[13]. Unlike HADCRUT4 and NCDC andGISS masks sea surface temperature data at the poles where seasonal sea ice exists extending land surface temperature data over the seas. Figure 3 shows the land and sea isotherms from the GISS data set for 2004 and 2012. More differences are detectable, especially for the sea component, simply because of the less reliable representation especially of this component and the more relevant computational component.

Keeping in mind that what is not properly measured is not known with reasonable precision, and reconstructions (especially for the past, but sometimes also for the present when starting from very scattered data of unspecified accuracy)may be unreliable, we may then certainly consider the land and sea reconstructed temperature time series of GISS (HADCRUT4 and NCDC providesimilar results, see[14]) to conclude that the global temperatures have not been warming.

Linearly fitting the time series of average temperatures land and sea January 2000 to June 2013 (from[9]) returns a temperature gradient dT/dt of 0.0027 °C/year (GISS 250) and 0.0055 (GISS 1200), as shown in[14]. HadCRUT4 and NCDC v3 return similar values of 0.0041 and 0.0047 °C/year, as also shown in[14].

Other anthropogenic factors not related to the carbon dioxide emission are biasing upwards the temperatures (land use, urban heat island, waste heat, arbitrary corrections) and it is certainly not simple to separate the influence of the anthropogenic carbon dioxide emission from the other anthropogenic factors and the natural factors.

ARE LAND AND SEA TEMPERATURE RECONSTRUCTIONS ACCURATE?

The reconstructions of sea and land temperatures of Figure 3 are not reliable as recent measurements may be. To explain thisreliability issue, Figure 4 shows same results of Figure 3 for the year 1880, while Figure 5 presents the recent results of the ARGO measurements

of ocean temperatures compared to the sea surface temperature (SST) of ERSST v3b2 and HadISST1, that are the sources for this info in the GISS, HADCRUT4 and NCDC data sets. Figure 6 finally presents the temperatures measured in Alice spring 1878 to 2012 and temperature reconstructed by GISS for the same latitude and longitude and time interval.

From the 1880 isotherms of Figure 4 the description of the Australian land and seas appears to be macroscopically far from accurate. The first meteorological station of Australia was MELBOURNE REGIONAL OFFICE (latitude -37.8075, longitude 144.97) established in 1855. It is not until 1878 that one station is established west of longitude 143.5 (ALICE SPRINGS

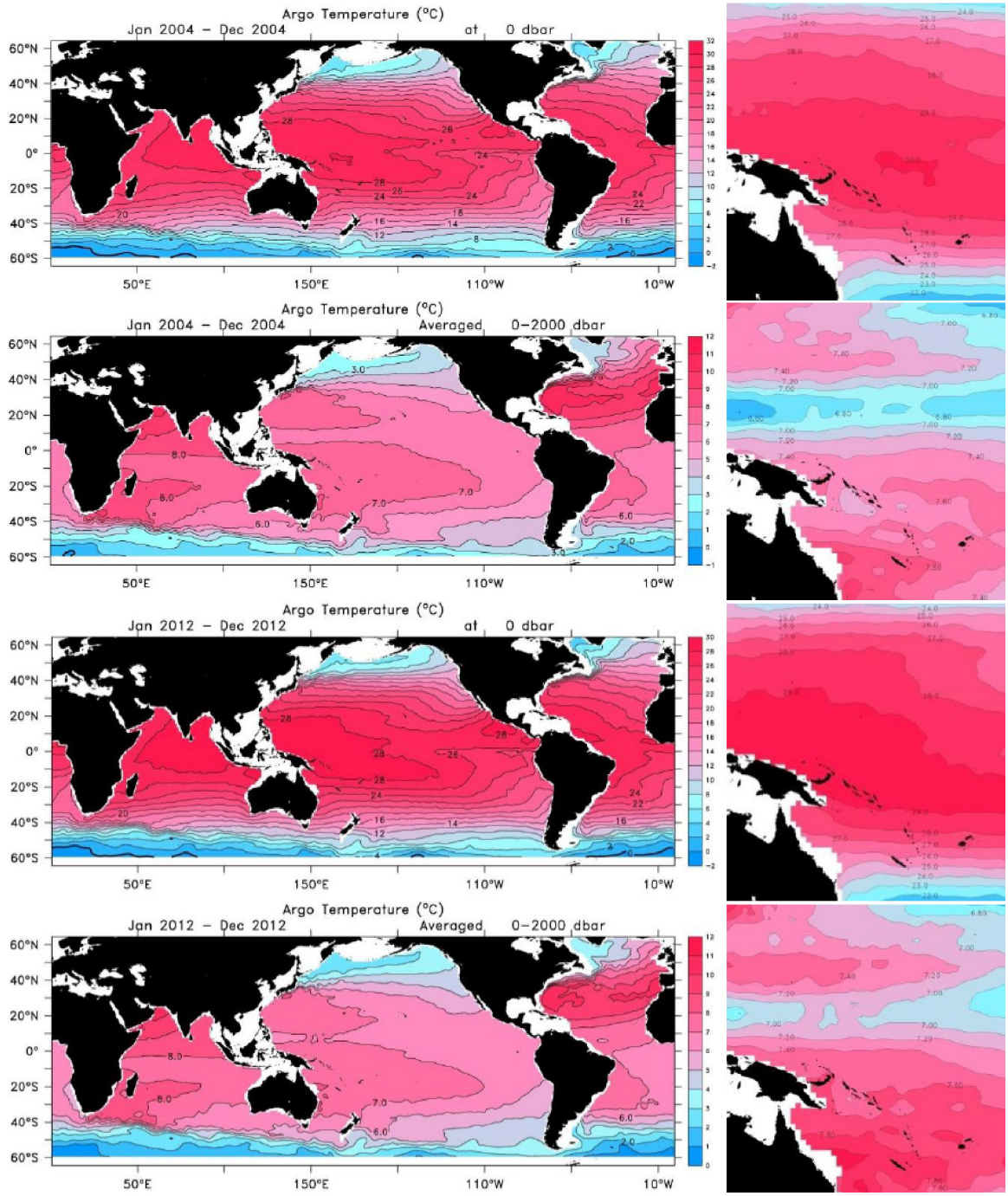

Figure 2 : ARGO isotherms at the surface and over the layer 0 – 2000 dbar measured in 2004 (top) and 2012 (bottom). The surface temperature has been decreasing -0.0125 °C/year while the temperature opf the 0 – 2000 m layer has been increasing of 0.0012 °C/year over the years 2004 – 2012.

POST OFFICE, latitude -23.71, longitude 133.8683), and it is 1897 when 2 stations are established west of longitude 130.8 (BROOME POST OFFICE, latitude -17.95, longitude 122.25 and PERTH REGIONAL OFFICE, latitude -31.9556 and longitude 115.8697). Therefore, in 1880 only ALICE SPRINGS POST OFFICE was operational west of the relatively close to MELBOURNE CAPE OTWAY LIGHTHOUSE.

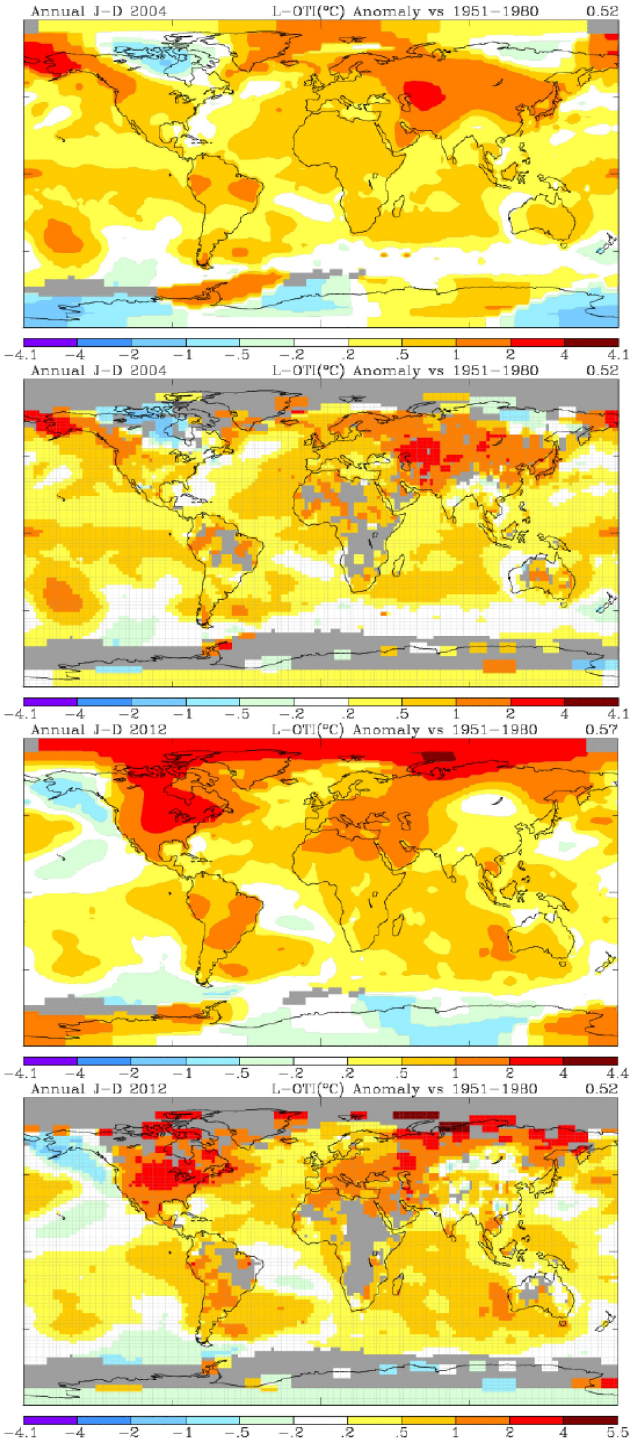

Figure 3 : Land and sea isotherms from the GISS data set 1200 and 250 km resolution (from [11]) for 2004 (top) and 2012 (bottom). Linearly fitting the time series of average temperatures land and sea January 2000 to June 2013 returns a temperature gradient dT/dt of 0.0027 °C/year (GISS 250) and 0.0055 (GISS 1200), as shown in [14].

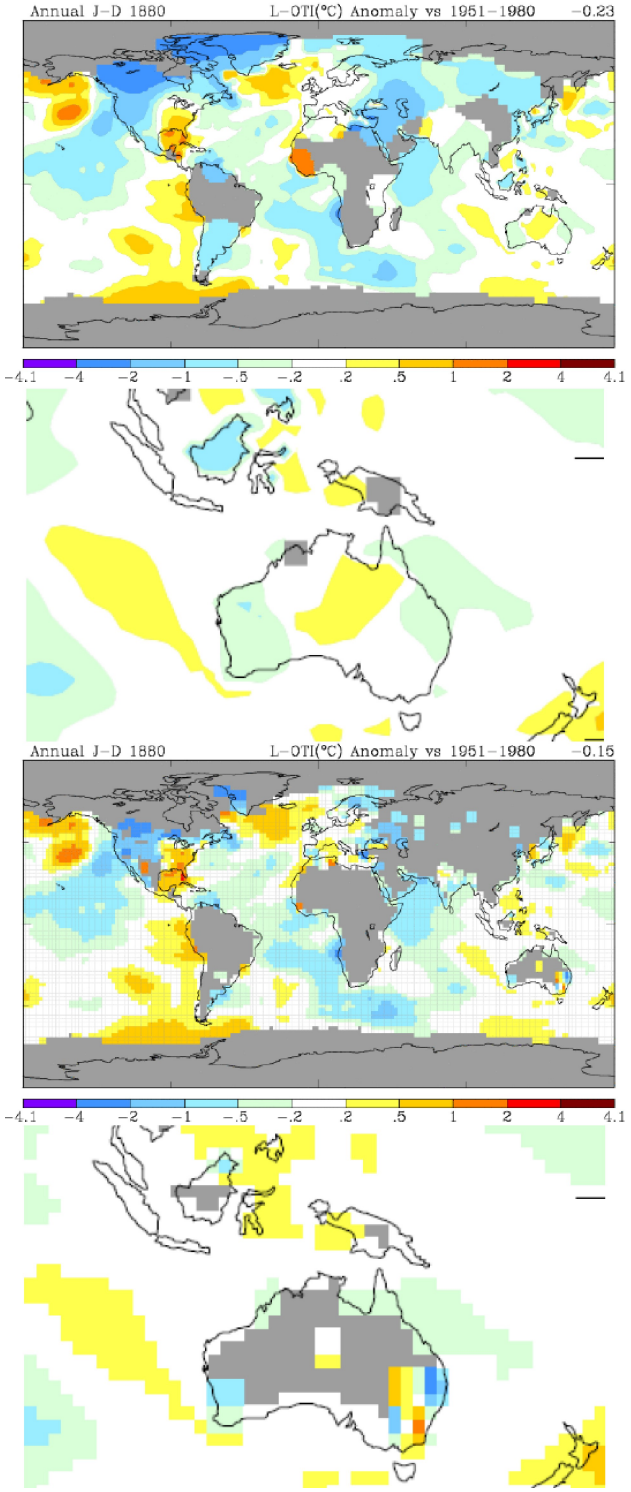

Figure 4 : Land and sea isotherms from the GISS data set for 1880, 1200 and 250 km resolution (from [11]).

The most part of the values on the map for land and sea temperatures in and around Australia are therefore not supported by any measurement

There have been (and there are) not too many measurements available around Alice Spring.In 1880 the average of annual maximum and minimum temperatures was 21.55 °C, over the period 1951 to 1980 used for the anomalies of Figure 3 this average was 20.88 °C, for a difference of 0.67 °C that is larger than the 0.2 to 0.5 °C that may be inferred from the map of Figure 4. The values on the map for land and sea temperatures in and around Australia whensupported by measurements lack of precision..

Figure 5 proposes the results 2004 to present of the ARGO measurements compared to the SST reconstructed in the HadISST1 and ERSST v3b2 data sets[15]. The figure proposes HadISST1 and ERSST v3b2 SST plus ARGO 0 bar and ARGO 0 to 100 bar layer temperatures. While the measured ARGO surface and top layer temperatures regularly oscillates over the year following the variable heat uptake produced by the Earth eccentricity, the reconstructed HadISST1 SST and ERSST v3b2 SST have a more complex behaviour of difficult interpretation. All the data in Figure 5 are arbitrarily shifted for a zero anomaly in January 2007. The distance from the Earth to the Sun changes the amount of radiation received at the Earth's surface in different seasons. Presently, there is a difference of only about 3% between aphelion (farthest point) and perihelion (closest point) producing a difference above 6% of the received sun energy from January to July.

The ARGO result reproduces the variations in natural heat uptake with a delay, similarly to the delay that sea temperatures have vs. the land temperatures following the seasonal cyclic pattern. The HadISST1 and ERSST v3b2 SST do not show this dependence. Furthermore, while the 2004 to present (March 2013) data of ARGO 0 bar may be fitted with a line having a slope of -0.0054 C/year, the reconstructed ERSST v3b2 SST 2004 to present (June 2013) has a slope of -0.0027 C/year, and the HadISST1 SST 2004 to present (June 2013) has a slope of -0.0036 C/year.

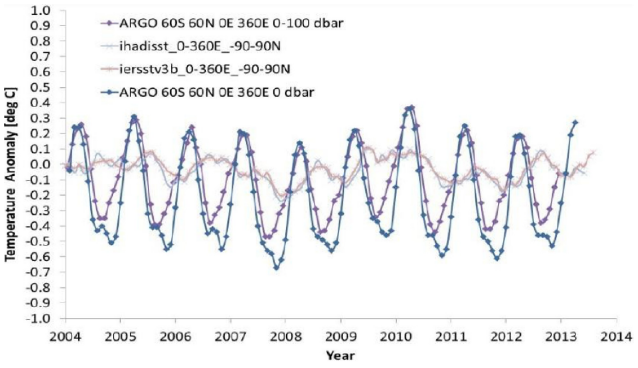

Figure 5 : Sea surface temperatures of the HadISST1 and ERSST v3b2 data sets (from [15]) and ARGO measurements.

Figure 6presents (top) the yearly average of measured daily maximum and minimum temperature and the mean of the two for Alice Spring (data from[16]) and (bottom) the GISS reconstruction for same latitude and longitude. The Alice Spring data set is a composite record of two different sites. Details of the homogenization of the two records are proposed in[17]. The measured temperature gradient is 0.0012 °C/year for the yearly average of daily maximum and 0.0049 °C/year for the yearly average of daily minimum, and it is 0.003 for the yearly average of daily maximum and daily minimum temperatures. The GISS result for the same latitude and longitude of Alice Spring has a much larger gradient of 0.009 C/year.

Reconstructions therefore unfortunately underestimate past temperatures and overestimate present temperatures to largely overestimate warmings.

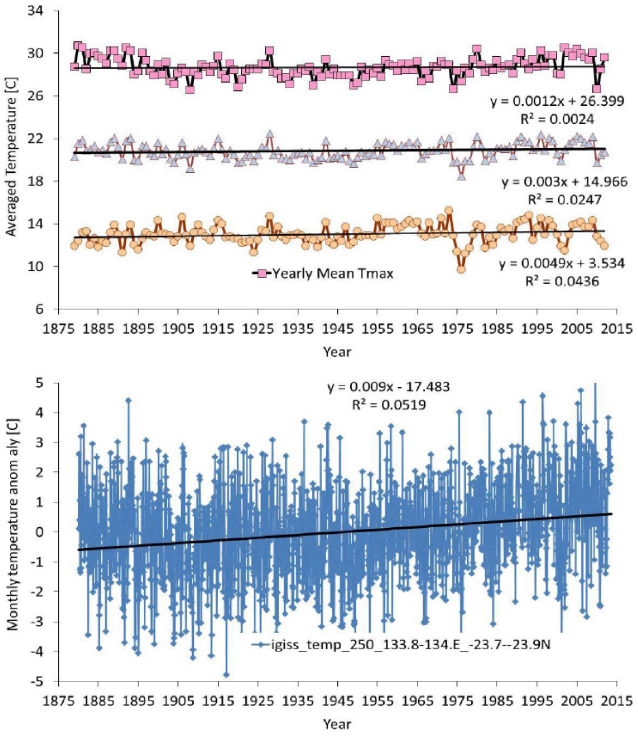

Figure 6 : Top: temperature measured in Alice Spring, NT; Bottom: temperature reconstructed by GISS in Alice Spring, NT.

ARECLIMATE MODELS PREDICTIONS ACCURATE?

This subject has been covered in[14]. The summary comparison is reproposed in TABLE 1 for completeness of this paper. Experimental (from ARGO), mixed experimental and computational (GISS, HADCRUT4 and NCDC) and purely computational (CMIP3 and CMIP5) temperature gradients are shown as dT/dt in °C/year. The warming of the measurements is negligible, $1\text{-}10^{-3}$ °C/year over the layer 0-2000 m depth. The warming of the reconstructions is minimal but overrated, from $3\text{-}10^{-3}$ to $5\text{-}10^{-3}$ °C/year, with a minimal cooling of the sea surface temperature that badly compare with the largest surface cooling of the ARGO measurements. Thanks to the increasing heat uptake due to the anthropogenic carbon dioxide emission assumed in all the models, the CMIP3 models compute a gradient of $+20\text{-}10^{-3}$ °C/year., and the CMIP5 variable temperature gradients in between $+17\text{-}10^{-3}$ and $+20\text{-}10^{-3}$ °C/year, poorly correlated to the experimental and reconstructed result over the same decade they have been designed.

TABLE 1 : Synthesis table of computed and measured temperature gradients dT/dt over the period January 2000 to June 2013 (from[14]).

Time series of average temperatures land and sea January 2000 to June 2013 (from [9])	
data set	dT/dt [°C/year]
HadCRUT4200 SST/T2m anom 0-360E -90-90N Index	0.0041
GISS 250 T2m/SST anom 0-360E -90-90N Index	0.0027
GISS 1200 T2m/SST anom 0-360E -90-90N Index	0.0055
NCDC v3 SST/T2m anom 0-360E -90-90N Index	0.0047
CMIP3 20c3m/sresa1b multi-model mean tas 0-360E -90-90N Index	0.0205
CMIP5 modmean32 rcp26 tas 0-360E -90-90N ensemble Index	0.0199
CMIP5 modmean42 rcp45 tas 0-360E -90-90N ensemble Index	0.0195
CMIP5 modmean25 rcp60 tas 0-360E -90-90N ensemble Index	0.0170
CMIP5 modmean39 rcp85 tas 0-360E -60-60N ensemble Index	0.0167
Time series of average sea temperatures June 2004 to December 2012 (from [6])	
data set	dT/dt [°C/year]
ARGO 60S 60N 0E 360E 0-100 dbar	-0.0088
ARGO 60S 60N 0E 360E 100-700 dbar	0.0031
ARGO 60S 60N 0E 360E 700-2000 dbar	0.0012

ARE LAND AND SEA TEMPERATURES NATURALLY OSCILLATING?

Figure 7 (from[15]) presents the GISS land and sea temperature reconstruction 1880 to 2013, as well as the variation of temperature based climate indices as the SOI, MEI and the NINO12, all relevant for the western equatorial Pacific, the region of concern of[1], and Australia.

Local temperatures and other climate parameters changes periodically, with periodicities that may be hours, days, months, years, decades or multi-decades. In particular, it is very well known that there are decadal and multi decadal natural oscillations of climate parameters as SOI, MEI and NINO12 that locally may produce higher or lower temperatures in a repetitive pattern.

The reconstructed temperatures of Figure 7 seem to regularly oscillate following a more complex behaviour that what is proposed in the climate models. The climate indices, mostly based on temperatures, have similar regular oscillations.

The GISS results is further analysed in Figure 8.

GISS temperatures seem to reduce up to about 1910, but the reliability of this result is minimal, then there is a clear upwards trend in the reconstructed temperatures since 1910.We consider only the data 1910 to present to better understand warming trend and natural oscillations.

There are two periods of clear warming 1910 to 1945 and 1975 to 2000 separated by a dwelling of 30 years. Over these two warming periods, the tempera-

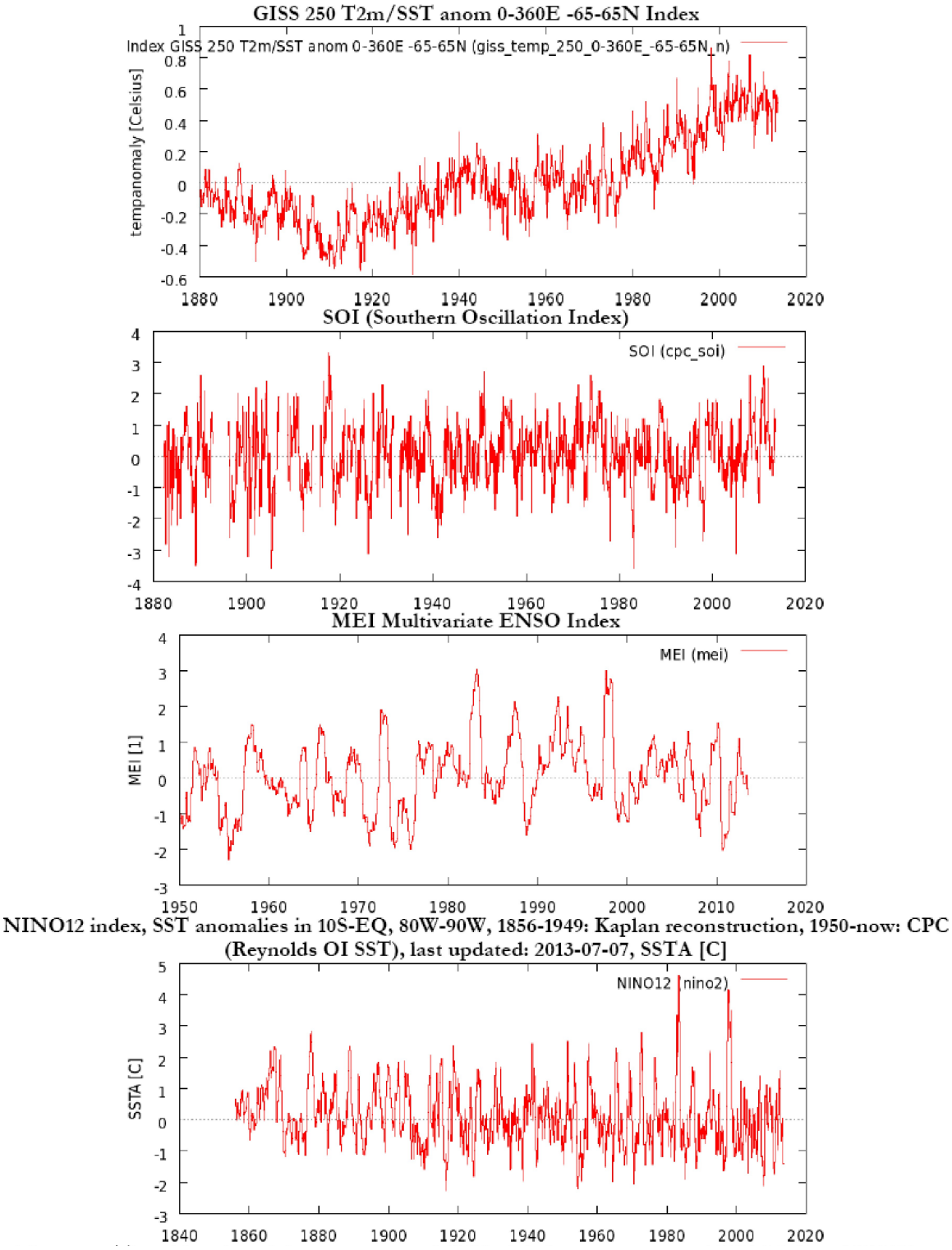

Figure 7 : Time histories of the reconstructed GISS global temperature and SOI, MEI and NINO12 indices (from [15]).

ture gradients (from linear fitting) have been 0.0138 and 0.0144 ºC/year respectively. Since 2000, there is a clear dwelling of temperatures as it was from 1945 to 1970. Biasing due to anthropogenic factors not related to the carbon emission and other inaccuracies may certainly account for part of the total warming of 0.0077 ºC/ year average over 100 years.

A sinusoidal oscillation is clearly superimposed to the linear trend. The complete GISS reconstruction has a longer quasi-60 year periodicity detectable in the Fou-

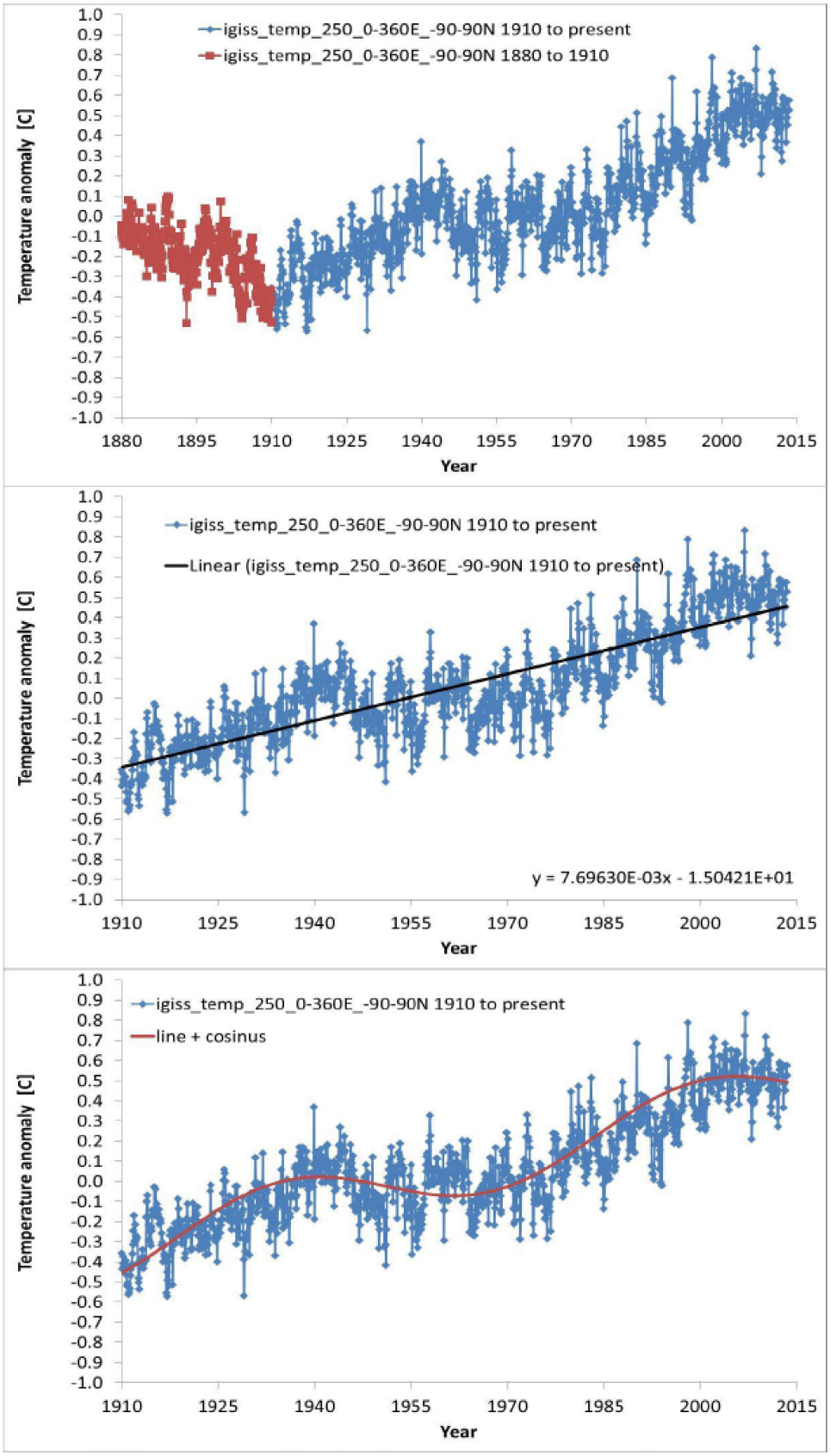

Figure 8 : GISS reconstructed land and sea temperature anomalies 1880 to present, 1910 to present with linear fitting, 1910 to present with line and cosinus fitting. Data are from[15].

rier analysis that became more evident as soon as we only focus on the data 1910 to present. This periodicity is closeto 65 years in the reduced data set. This picture suggests that in the limits of the reliability of the land and sea temperature reconstruction the "global warming hiatus" would very likely continue until 2035 being the result of a natural oscillation.

CONCLUSIONS

It is shown that temperature measurements are well below the reconstructed values, and reconstructed values are well below the climate model simulation results since the year 2000. This suggests that there are other forcings for the climate in addition to the anthropogenic carbon dioxide emissionthat have a natural rather than anthropogenic origin.

It does not seem supported by any evidence that there could have been a cooling of the Eastern Pacific associated with La Nina strong enough to cancel the effects of an increasing heat uptake[1]. Similar lack of evidence applies to the other explanations for the "global-warming hiatus" of this century[2-5]. The increased heat uptake – if any – is definitively much less than what is assumed in the climate models, and natural oscillations are predominant on any anthropogenic factor.

The decade of no warming in the temperatures of the land and the seas up to 2000 m depth has similarities with the lack of warming over the period 1945 to 1975. The reconstructed sea and land temperatures 1910 to present are fitted very well with a line and a cosinus law equation. The slope of the line is 0.0077 ºC/year very likely overestimated vs. the reality because of the many upwards biases of the reconstructions. The cosinus law has period 65 years. The oscillation about the warming trend now in a descending phase suggests that the present "*global warming hiatus*" will very likely continue until 2035 having different motivations from those proposed so far being part of the significant 65 years natural oscillation.

REFERENCES

[1] Yu Kosaka, Shang-Ping Xie; Recent global-warming hiatus tied to equatorial Pacific surface cooling, Nature, doi:10.1038/nature12534, **(2013)**.

[2] S.Solomon et al.; Contributions of stratospheric water vapor to decadal changes in the rate of global warming. Science, **327**, 1219–1223 **(2010)**.

[3] S.Solomon et al.; The persistently variable "background" stratospheric aerosol layer and global climate change. Science, **333**, 866–870 **(2011)**.

[4] R.K.Kaufmann, H.Kauppi, M.L.Mann, J.H.Stock; Reconciling anthropogenic climate change with observed temperature 1998–2008. Proc. Natl Acad. Sci. USA, **108**, 11790–11793 **(2011)**.

[5] G.A.Meehl, J.M.Arblaster, J.T.Fasullo, A.Hu, K.E.Trenberth; Model-based evidence of deep-ocean heat uptake during surface-temperature hiatus periods. Nature Clim. Change, **1**, 360–364 **(2011)**.

[6] ARGO.NET; The Argo project. www.argo.net/, **(2013)**.

[7] www.argo.ucsd.edu/

[8] A.Parker; A realistic lower bound to the 2050 sea-level rise, International Journal of Sea and Climate Systems, **4(3)**, 197-211 **(2013)**.

[9] A.Parker, The only reliable measurements of sea temperatures show a statistically not significant warming over the decade since they started, Applied Oceanography, accepted paper, in press, www.tsijournals.com/tsijournals/Journals/Applied-Seaography/PIP/abs_1.html, **(2013)**.

[10] Met Office Hadley Centre observations datasets, HadCRUT4. www.metoffice.gov.uk/hadobs/hadcrut4/, **(2013)**.

[11] National Aeronautics and Space Administration Goddard Institute for Space Studies, GISS Surface Temperature Analysis (GISTEMP). data.giss.nasa.gov/gistemp/, **(2013)**.

[12] National Climatic Data Center, Global Temperature and Precipitation Maps www.ncdc.noaa.gov/temp-and-precip/global-maps.php, **(2013)**.

[13] National Climatic Data Center, Extended Reconstructed Sea Surface Temperature. www.ncdc.noaa.gov/ersst/, **(2013)**.

[14] A.Parker; Global warming is missed since the year 2000, paper submitted to Nonlinear Engineering, under review.

[15] KMNI Climate Explorer, Time series. climexp.knmi.nl/get_index.cgi, **(2013)**.

[16] Australian Government Bureau of Meteorology, Climate data online. www.bom.gov.au/climate/data/index.shtml?bookmark=200, **(2013)**.

[17] A.Boretti; Statistical analysis of the temperature records for the northern territory of australia, Theoretical and Applied Climatology, accepted paper, in press.