June 2012: Investigation into the 10 warming myths as presented by Andrew Bolt

I've been through the list of Andrew Bolt's warming myths and have researched his sources of information as I was interested to find if there WAS something that was missing.

What I found was:

1. He basically cherry-picked, every time. i.e. he chose what he wanted to validate his own views and either forgot to mention other information within the same press release/report or slightly changed a few words, or he puts forward isolated disparate information and labels it "anti-climate change"– such as record temperatures – this relates to weather not climate – it is a red herring.
2. Also following through in later articles from him, he has neglected to update prior information even when it came from the same sources. (I gather he felt that such sources were "worthy" of consideration, at some point, so I have updated the information from the SAME sources he has highlighted.)
3. When you Google specific phrases he has used, the exact same references come up from a variety of websites with a variety of dates stretching into 2011. i.e. the same information is regurgitated over and over as "new" e.g. Crude Oil. It is difficult to tell where the original text has come from.
4. He has used out of date information that was proven inaccurate (by the same scientists involved) and failed to use updated information or failed to correct this oversight in further columns.

I've limited my investigations to the first 6. It is best to remember that climate change is complex and never static and so is the science which is trying to track it.

Andrew Bolt's Column - The 10 Warming Myths 29 April 2009

MYTH 1: THE WORLD IS WARMING

Wrong. It is true the world did warm between 1975 and 1998, but even **Professor David Karoly,** one of our leading alarmists, admitted this week "temperatures have dropped" since - "both in surface temperatures and in atmospheric temperatures measured from satellites". In fact, the fall in temperatures from just 2002 has already wiped out a quarter of the warming our planet experienced last century. (**Check data from Britain's Hadley Centre, NASA's Aqua satellite and the US National Climatic Data Centre.)** Some experts, such as Karoly, claim this proves nothing and the world will soon start warming again. Others, such as Professor Ian Plimer of Adelaide University, point out that so many years of cooling already contradict the theory that man's rapidly increasing gases must drive up temperatures ever faster. But that's all theory. **The question I've asked is: What signs can you actually see of the man-made warming that the alarmists predicted?**

RESPONSE:

CLARIFICATION EMAIL FROM PROF DAVID KAROLY (16/6/12) "I have no idea where that selected quote, from something I said, originated. It was probably an interview on radio or TV but I have no idea where or when. It is likely that I was referring to short term year to year temperature variations. 2009 was followed by record high global average temperatures in 2010, then slightly lower temps in 2011 due to La Nina. **The long term average temperatures, such as for the last decade, show higher temperatures than any decade for which we have instrumental data. Global temperatures do not show long term cooling at present."**

HADLEY CENTRE (Britain's Met Office)

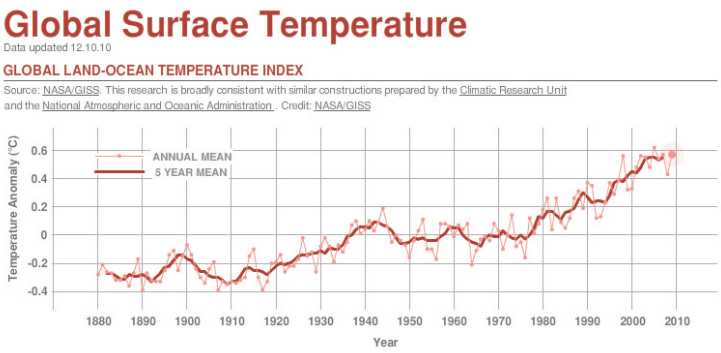
"The evidence continues to accumulate, strengthening the link between man's activity and a wide range of indicators of a changing climate, both globally and regionally. Changes have now been observed in many different climate variables, in addition to temperature: the amount of moisture in the atmosphere; continuing sea-level rise; and a decreasing Arctic sea-ice extent. All are consistent with a long-term warming trend.

The period 2000-2009 was warmer than the 1990s that, in turn, were warmer than 1980s. In fact, the average temperature over the first decade of the 21st century was significantly warmer than any preceding decade in the instrumental record, stretching back 160 years. **Despite variability from year to year - which sees some years warmer and others cooler - we have identified a clear underlying trend of increasing global temperatures from the late 1970s of about 0.16 °C per decade."** http://www.metoffice.gov.uk/climate-change/policy-relevant/evidence

NASA WEBSITE (the Aqua satellite collects data which is then interpreted):

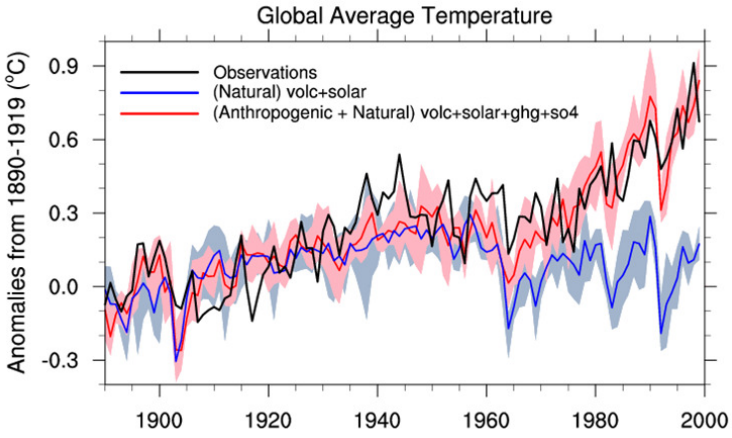
Data source: NASA's Goddard Institute for Space Studies (GISS). This trend agrees with other global temperature records provided by the U.S. National Climatic Data Center, the Japanese Meteorological Agency and the Met Office Hadley Centre / Climatic Research Unit in the U.K. Credit: NASA/GISS

SOURCE: http://climate.nasa.gov/keyIndicators/index.cfm#globalTemp



US NATIONAL CLIMATIC DATA CENTRE: State of the Climate Report 2009
"**A comprehensive review of key climate indicators confirms the world is warming and the past decade was the warmest on record.** More than 300 scientists from 48 countries analysed data on 37 climate indicators, including sea ice, glaciers and air temperatures. A more detailed review of 10 of these indicators selected because they are clearly and directly related to surface temperatures, all tell the same story: global warming is undeniable. For example, the surface air temperature record is compiled from weather stations around the world, and analyses of those temperatures from four different institutions show an unmistakable upward trend across the globe. But even without those measurements, nine other major indicators of climate change agree: **the earth is growing warmer and has been for more than three decades".**
http://www1.ncdc.noaa.gov/pub/data/cmb/bams-sotc/2009/bams-sotc-2009-brochure-lo-rez.pdf
Powerpoint presentation http://www.ncdc.noaa.gov/faqs/20100506-Global-Warming-Karl.pdf

BOLT ASKS: WHAT SIGNS CAN YOU ACTUALLY SEE OF THE MAN-MADE WARMING?
The red shaded band shows the 5% to 95% confidence range (common limits of confidence in model calculations) for 58 different simulations from 14 climate models using both natural and anthropogenic (man-made) forcings. These different simulations and the different models are used by different scientific groups and represent different treatments of the Earth system.



This illustration depicts actual temperature observations compared with two sets of model runs, one which only includes natural forcings, and one that includes both natural and anthropogenic forcings. Natural forcings can account for most variations in global temperature until *approximately* 1980, but after that one must include anthropogenic forcings to better match the observations. **National Center for Atmospheric Research (NCAR – USA)**

MYTH 2: THE POLAR CAPS ARE MELTING
Wrong. The **British Antarctic Survey,** working with NASA, last week confirmed ice around Antarctica has grown 100,000 sq km each decade for the past 30 years. Long-term monitoring by the **US National Oceanic and Atmospheric Administration** reports the same: southern hemisphere ice has been expanding for decades. As for the Arctic, wrong again. The Arctic ice cap shrank badly two summers ago after years of steady decline, but has since largely recovered. Satellite data from NASA's Marshall Space Flight Centre this week shows the Arctic hasn't had this much April ice for at least seven years. Norway's **Nansen Environmental and Remote Sensing Centre** says the ice is now within the standard deviation range for 1979 to 2007.

NOTE: There is a difference between "sea ice" which this myth refers to and glacial/land-based ice. Also warming of oceans is taken as a sign of climate change warming.

BRITISH ANTARCTIC SURVEY:
Issue date: 21 Apr 2009 Number: 05/2009
"Increased growth in Antarctic sea ice during the past 30 years is a result of changing weather patterns caused by the ozone hole according to new research published this week (Thurs 23 April 2009). Reporting in the journal *Geophysical Research Letters* scientists from British Antarctic Survey (BAS) and NASA say that while there has been a dramatic loss of Arctic sea ice, Antarctic sea ice has increased by a small amount as a result of the ozone hole delaying the impact of greenhouse gas increases on the climate of the continent."
Source: http://www.agu.org/journals/gl/gl0908/2009GL037524/2009GL037524.pdf

"Issue date: **23 Sep 2009**
Number: **09/2009**
The most comprehensive picture of the rapidly thinning glaciers along the coastline of both the Antarctic and Greenland ice sheets has been created using satellite lasers. The findings are an important step forward in the quest to make more accurate predictions for future sea level rise.

Reporting this week in the journal *Nature* researchers from British Antarctic Survey and the University of Bristol describe how analysis of millions of NASA satellite measurements* from both of these vast ice sheets shows that the most profound ice loss is a result of glaciers speeding up where they flow into the sea. The authors conclude that this 'dynamic thinning' of glaciers now reaches all latitudes in Greenland, has intensified on key Antarctic coastlines, is penetrating far into the ice sheets' interior and is spreading as ice shelves thin by ocean-driven melt. Ice shelf collapse has triggered particularly strong thinning that has endured for decades.

Lead author Dr Hamish Pritchard from British Antarctic Survey (BAS) says,
"We were surprised to see such a strong pattern of thinning glaciers across such large areas of coastline — it's widespread and in some cases thinning extends hundreds of kilometres inland. We think that warm ocean currents reaching the coast and melting the glacier front is the most likely cause of faster glacier flow. This kind of ice loss is so poorly understood that it remains the most unpredictable part of future sea level rise."

"Reporting this week (Thursday 26 April 2012) in the journal ***Nature,*** an international team of scientists led by British Antarctic Survey (BAS) has established that warm ocean currents are the dominant cause of recent ice loss from Antarctica. New techniques have been used to differentiate, for the first time, between the two known causes of melting ice shelves — warm ocean currents attacking the underside, and warm air melting from above. This finding brings scientists a step closer to providing reliable projections of future sea-level rise.

In most places in Antarctica, we can't explain the ice-shelf thinning through melting of snow at the surface, so it has to be driven by warm ocean currents melting them from below. We've looked all around the Antarctic coast and we see a clear pattern: in all the cases where ice shelves are being melted by the ocean, the inland glaciers are speeding up. It's this glacier acceleration that's responsible for most of the increase in ice loss from the continent and this is contributing to sea-level rise. What's really interesting is just how sensitive these glaciers seem to be. Some ice shelves are thinning by a few metres a year and, in response, the glaciers drain billions of tons of ice into the sea. This supports the idea that ice shelves are important in slowing down the glaciers that feed them, controlling the loss of ice from the Antarctic ice sheet. It means that we can lose an awful lot of ice to the sea without ever having summers warm enough to make the snow on top of the glaciers melt — the oceans can do all the work from below."
SOURCE: http://www.antarctica.ac.uk/press/press_releases/press_release.php?id=1799

US NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION WEBSITE
"Sea Ice and Ocean Summary - November 9, 2011
Sea ice and ocean observations over the past decade (2001-2011) suggest that the Arctic Ocean climate has reached a new state with characteristics different than those observed previously. The new ocean climate is characterized by less sea ice (both extent and thickness) and a warmer and fresher upper ocean than in 1979-2000. The persistence of these changes is having a measureable impact on Arctic marine and terrestrial ecosystems.

An anticyclonic (clockwise) wind-driven circulation regime has dominated the Arctic Ocean for at least 14 years (1997-2011), in contrast to the typical 5-8 year pattern of anticylonic/cyclonic circulation shifts observed from 1948-1996. Under the recent persistent anticyclonic circulation regime with relatively warm air temperatures the summer extent of the sea

ice cover has been at least 15-20% below the 1979-2000 average. The decline in total sea ice extent has been accompanied by an unprecedented loss of old, thick multiyear ice. Melting sea ice has released additional fresh water into the upper ocean. Influenced by strong anticyclonic winds, fresh water has accumulated in the Beaufort Gyre region, where the fresh water content has increased by approximately 5,000 km^3 relative to 1970s climatology. The loss of sea ice has also resulted in the warming of the upper ocean and ocean expansion, leading to an increase in the rate of sea level rise."
SOURCE: http://www.arctic.noaa.gov/reportcard/sea_ice_ocean.html

NATIONAL SNOW & ICE DATA CENTRE

Sea ice young and thin as melt season begins (taken from March 2009 update)
"How vulnerable is the ice cover as we go into the summer melt season? To answer this question, scientists also need information about ice thickness. Indications of winter ice thickness, commonly derived from ice age estimates, reveal that the ice is thinner than average, suggesting that it is more susceptible to melting away during the coming summer.

As the melt season begins, the Arctic Ocean is covered mostly by first-year ice, which formed this winter, and second-year ice, which formed during the winter of 2007 to 2008. First-year ice in particular is thinner and more prone to melting away than thicker, older, multi-year ice. This year, ice older than two years accounted for less than 10% of the ice cover at the end of February. From 1981 through 2000, such older ice made up an average of 30% of the total sea ice cover at this time of the year.

While ice older than two years reached record lows, the fraction of second-year sea ice increased compared to last winter. Some of this second-year ice will survive the summer melt season to replenish the Arctic's store of older ice; however, in recent years less young ice has made it through the summer. To restore the amount of older ice to pre-2000 levels, large amounts of this young ice would need to endure through summer for several years in a row.

But conditions may not always favour the survival of second-year and older ice. Each winter, winds and ocean currents move some sea ice out of the Arctic Ocean. This winter, some second-year ice survived the 2008 melt season only to be pushed out of the Arctic by strong winter winds. Based on sea ice age data from Jim Maslanik and Chuck Fowler at the University of Colorado, since the end of September 2008, 390,000 square kilometers (150,000 square miles) of second-year ice and 190,000 square kilometers (73,000 square miles) of older (more than two years old) ice moved out of the Arctic."
SOURCE: http://nsidc.org/arcticseaicenews/2009/05/a-slow-start-to-the-spring-melt-season/

NATIONAL SNOW & ICE DATA CENTRE 4 MAY 2009 UPDATE

"Arctic sea ice extent declined quite slowly in April; as a result, total ice extent is now close to the mean extent for the reference period (1979 to 2000). The thin spring ice cover nevertheless remains vulnerable to summer melt.

Sea ice extent averaged over the month of April 2009 was 14.58 million square kilometers (5.63 million square miles). This was 710,000 square kilometers (274,000 square miles) above the record low for April in 2007, and 420,000 square kilometers (162,000 square miles) below the 1979 to 2000 average.

The decline rate for the month of April was the third slowest on record. The Arctic lost sea ice cover at a rate of 27,300 square kilometers per day (10,500 square miles), compared to an average of 41,600 square kilometers (16,000 square miles) per day for 1979 to 2000. Ice extent was well above normal in the Bering Sea, but below normal in the Barents Sea and the Sea of Okhotsk.

For the past few years, Arctic sea ice extent for most months has been more than two standard deviations below the 1979 to 2000 mean, particularly in summer. Two standard deviations provide an estimate of the expected range of natural variability. Because of cooler than average temperatures, Arctic sea ice extent at the end of April 2009 was within the expected range of natural variability."

NANSEN ENVIRONMENTAL AND REMOTE SENSING CENTRE PRESS RELEASE EXTRACT
http://arctic-roos.org/Members/webadmin/newsbox/press-release-from-the-nansen-center-bergen-norway-1 "During the first half of August, Arctic ice extent declined more slowly than during the same period in 2007 and 2008. The slower decline is primarily due to a recent atmospheric circulation pattern, which transported ice toward the Siberian coast and discouraged export of ice out of the Arctic Ocean. Therefore there will be no new record minimum in September 2009, but the minimum summer ice extent in 2009 will still be much lower than the 1979 to 2000 average."

HADLEY CENTRE: Arctic summer sea-ice

"Since the late 1970s, when systematic monitoring of Arctic sea-ice began, there has been a marked decline in the extent of the ice, but with significant variations from year to year. There was a dramatic loss in 2007, followed by a partial recovery. 2008, 2010 and 2009 rank second, third and fourth lowest, respectively. Highly variable atmospheric circulation in the Arctic summer plays an important part in sudden changes to sea-ice and can explain the dramatic drop which led to a minimum in sea-ice extent in summer 2007 and the low sea-ice in subsequent years. But climate models can only explain the decrease in ice extent if they take account of man-made factors as well as natural variations, strongly suggesting that human activity has contributed to the decline."

DR. PARKINSON SPOKE OF THE LOSS OF SEA ICE COVER IN THE ARCTIC, PROJECT SCIENTIST FOR NASA'S AQUA SATELLITE MISSION

"We can see a clear long-term trend, which is a trend toward lesser sea ice coverage. And it turns out that its overall about 3 to 4% per decade reduced sea ice coverage since the late 1970s. That means that, every year since the 1970s, we've lost an area of Arctic sea ice about the size of Switzerland. "

NASA WEBSITE CURRENT: SHRINKING ICE SHEETS
"The Greenland and Antarctic ice sheets have decreased in mass. Data from NASA's Gravity Recovery and Climate Experiment show Greenland lost 150 to 250 cubic kilometers (36 to 60 cubic miles) of ice per year between 2002 and 2006, while Antarctica lost about 152 cubic kilometers (36 cubic miles) of ice between 2002 and 2005."
http://climate.nasa.gov/evidence/

MYTH 3: WE'VE NEVER HAD SUCH A BAD DROUGHT
Wrong. A study released this month by the **University of NSW Climate Change Research Centre** confirms not only that we've had worse droughts, but this Big Dry is not caused by "global warming", whether man-made or not. As the university's press release says, "The causes of south-eastern Australia's longest, most severe and damaging droughts have been discovered, with the surprise finding that they originate far away in the Indian Ocean.
"A team of Australian scientists has detailed for the first time how a phenomenon known as the Indian Ocean Dipole - a variable and irregular cycle of warming and cooling of ocean water - dictates whether moisture-bearing winds are carried across the southern half of Australia."

UNIVERSITY OF NSW CLIMATE CHANGE RESEARCH CENTRE
A further extract from the same media release that Andrew failed to note: "The study notes that the IOD has been in its positive or neutral phase since 1992, the longest period of its kind since records began in the late 19th Century. **To make matters worse, this period has coincided with a trend towards higher average air temperatures over the land, which may be linked to human-induced climate change."**

Re Andrew's assertion that the report "confirms not only that we've had worse droughts..." The report does not say this it states, "It also reveals the causes of **other iconic extreme droughts** in recorded history, notably the World War II Drought from 1937 to 1945 and the Federation Drought from 1895 to 1902..."
SOURCE: http://www.ccrc.unsw.edu.au/news/news/2009-02-05_dipole.html

CSIRO WEBSITE:

"The recent drought: Research in Phase 1 of SEACI found that the recent drought (1997 – 2009) was **unprecedented compared with other droughts on record,** being largely constrained to south-eastern Australia, having lower year-to-year rainfall variability and no 'wet years', and having a seasonal pattern of rainfall decline which was maximum in autumn. The 11 percent reduction in rainfall in the southern Murray-Darling Basin over the period 1997-2009 compared with long-term averages led to a 44 percent reduction in assessed stream-flow. This is significantly higher than in previously recorded droughts."
SOURCE: http://www.seaci.org/climate/index.html

MORE RECENT DETAIL: The relationship with global warming
SOURCE: South Eastern Australian Climate Initiative Report: The Millennium Drought and 2010/11 Floods, July 2011
"SEACI researchers have analysed the observed climate record and found that the El Niño – Southern Oscillation and other large-scale modes of variability cannot explain the observed decline in autumn and early-winter rainfall in south-eastern Australia.

SEACI researchers have, however, found a strong relationship between the rainfall decline in south-eastern Australia and the intensity of the sub-tropical ridge (STR), with the decrease in rainfall strongly associated with increasing surface pressure in the latitudes of the STR. The strengthening of the STR is estimated to account for around 80% of the recent rainfall decline in south-eastern Australia.

Research indicates that there are changes in the Hadley Cell (and hence changes in the STR) associated with global warming. In particular, the STR has intensified with increasing global surface temperature. This result implies that the rainfall decline in south-eastern Australia may have some link to global warming. To investigate this, SEACI researchers conducted simulations of the global climate over recent decades using a global climate model and different external forcings (natural and anthropogenic). In these simulations, the climate model was only able to reproduce STR increases and other modifications of the Hadley Cell when anthropogenic forcings (e.g. greenhouse gases) were present in the simulation along with the natural forcings.

This gives confidence that there is a link between the rainfall decline across south-eastern Australia and increasing greenhouse gas concentrations in the atmosphere."

MYTH 4: OUR CITIES HAVE NEVER BEEN HOTTER
Wrong. The alleged "record" temperature Melbourne set in January - 46.4 degrees - was in fact topped by the 47.2 degrees the city recorded in 1851. (See the Argus newspaper of February 8, 1851.) And here's another curious thing: Despite all this warming we're alleged to have caused, Victoria's highest temperature on record remains the 50.7 degrees that hit Mildura 103 years ago. South Australia's hottest day is still the 50.7 degrees Oodnadatta suffered 37 years ago. NSW's high is still the 50 degrees recorded 70 years ago.
What's more, not one of the world's seven continents has set a record high temperature since 1974. Europe's high remains the 50 degrees measured in Spain 128 years ago, before the invention of the first true car.

RE 1851 record: On Black Thursday, a northerly wind set in early and the temperature in Melbourne was reported to have peaked at 47.2 degrees C (117 degrees F) at 11:00am. This would have been the hottest temperature ever recorded in the city—although it has never been an official record, as there is no evidence the temperature was actually measured in full shade and the Stevenson screen had not yet been used in Australia so it was a non standard measurement. Further to that the measurement is based on anecdotal evidence and therefore may never have been measured at all.

The isolation of record temperatures without the context and trend analysis is a red herring. Changes in global average temperatures does not equate to the same daily temperature fluctuations.

Weather is the brief, rapidly changing condition of the atmosphere at a given place and time, influenced by the movement of air masses.
Climate, on the other hand, should more accurately be the term applied to the average weather conditions over longer periods of years to decades.
Climate variability refers to the year-to-year variations, or noise, in the average conditions – meaning that consecutive summers, for example, will not all be the same, with some cooler and some warmer than the long-term average.
Climate change refers to any long-term trends in climate over many years or decades, around which climate variability may be evident year on year. Hence, a single warmer or cooler year on its own is not sufficient evidence to assert that climate is changing, but systematic changes in average conditions over many years do provide evidence of a changing climate.

MYTH 5: THE SEAS ARE GETTING HOTTER
Wrong. If anything, the seas are getting colder. For five years, a network of 3175 automated bathythermographs has been deployed in the oceans by the Argo program, a collaboration between 50 agencies from 26 countries.
Warming believer Josh Willis, of NASA's Jet Propulsion Laboratory, reluctantly concluded: "There has been a very slight cooling . . ."

NASA WEBSITE: http://earthobservatory.nasa.gov/Features/OceanCooling/
In 2004, Willis published a time series of ocean heat content showing that the temperature of the upper layers of ocean increased between 1993-2003. In 2006, he co-piloted a follow-up study led by John Lyman at Pacific Marine Environmental Laboratory in Seattle that updated the time series for 2003-2005. Surprisingly, the ocean seemed to have cooled. This follow-up study for the years 2003 to 2005 showed a surprisingly large *decrease* in heat content—about 5 times as large as the previous decade's warming.

From 1993 to 2003, measurements of heat storage in the oceans agreed with satellite observations of net flux. After 2003, however, surface observations suggested that the ocean was losing heat, while satellite measurements of net flux showed the Earth was still slowly gaining energy. This mismatch was a hint that there might be a problem with one of the data sets.

For nearly a year after the 2006 ocean cooling paper was published, nothing obvious turned up. It wasn't until that next year of data came in that the cooling in the Atlantic became so large and so widespread that Willis accepted the cooling trend for what is was: an unambiguous sign that something in the observations was "clearly not right." Willis revisited the data in 2007 and with collaboration with other scientists using satellite data and other more accurate testing measures.

Willis' map of ocean temperature change from 2004 to 2006 originally showed drops of over 1.5° Celsius in the Atlantic Ocean. The apparent large drop in temperature was due to bad data from the Argo floats and XBTs(expendable bathythermographs) and it disappeared when errors in these data sets were corrected. (The remaining large swings in temperature visible in these maps are due to shifting positions of ocean currents.)

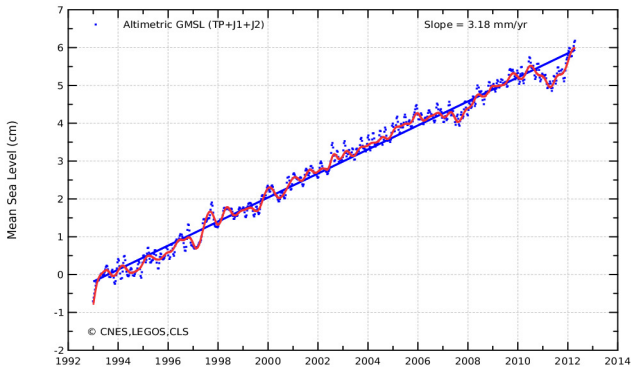
Josh Willis says: "A scientist could hardly be expected to be happy about finding a mistake in his work after he published it. But if you have to watch your research go down in flames, it may help to regard it as an offering on the sacrificial fire of scientific progress. In the case of "ocean cooling," Willis has plenty of reasons to consider the sacrifice worth it. The first payoff for finding and fixing the XBT errors was that it allowed scientists to reconcile a stubborn and puzzling mismatch between climate model simulations of ocean warming for the past half century and observations. The second was that it helped explain why sea level rise between 1961-2003 was larger than scientists had previously been able to account for."

Susan Wijffels and her colleagues from CSIRO, along with Josh Willis, provided a way to correct the XBT data, they took those corrections and made the first revised estimates of sea level rise due to ocean warming for the period 1961 to 2003. What they found was that ocean heating was larger than scientists previously thought, and so the contribution of thermal expansion to sea level rise was actually 50 percent larger than previous estimates."

NOTE: Even though this information came available to the public during 2007/2008 Andrew Bolt seemed to have missed it and so used old outdated data.

MYTH 6
THE SEAS ARE RISING
Wrong. For almost three years, the seas have stopped rising, according to the **Jason-1 satellite mission monitored by the University of Colorado**. That said, the seas have risen steadily and slowly for the past 10,000 years through natural warming, and will almost certainly resume soon. But there is little sign of any accelerated rises, even off Tuvalu or the Maldives, islands often said to be most threatened with drowning. Professor Nils-Axel Moerner, one of the world's most famous experts on sea levels, has studied the **Maldives** in particular and concluded there has been no net rise there for 1250 years. Venice is still above water.

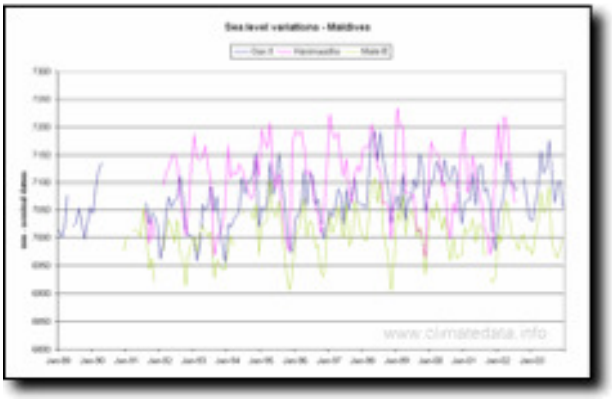
"With the *satellite altimetry* missions, the global mean sea level (GMSL) has been calculated on a continual basis since January 1993. 'Verification' phases, during which the satellites follow each other in close succession **(*Topex*/*Poseidon*--*Jason*-1, then *Jason*-1--*Jason*-2),** help to link up these different missions by precisely determining any bias between them. Envisat, *ERS*-1 and *ERS*-2 are also used, after being adjusted on these reference missions, in order to compute Mean Sea Level at high latitudes (higher than 66°N and S), and also to improve spatial resolution by combining all these missions together. In addition, permanent monitoring of quality during the missions (*Calval*) and studies of the necessary corrections of altimetry data regularly add to our understanding and knowledge. "



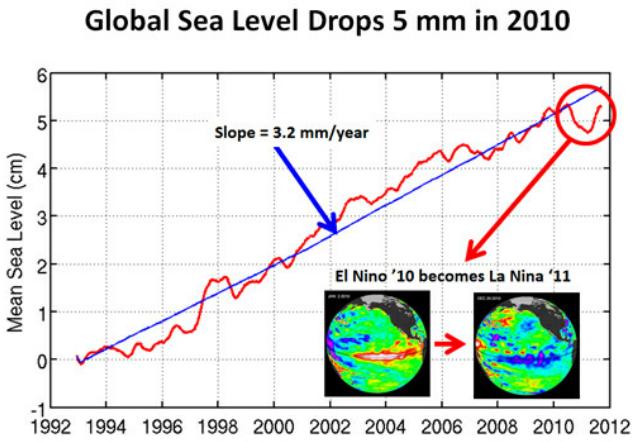
"Although the global trend indicates a rise in the mean level of the oceans, there are marked regional differences that vary between -10 and 10 mm/year. These spatial patterns are not stationary. As a result, sea level trends patterns observed by *satellite altimetry* are transient features. Comparisons between these altimetry data and those obtained using independent techniques, such as the drifting buoys of the *Argo* network, the GRACE gravimetry satellite, or the network of tide gauges, **can not only corroborate these results but also help us establish which of the possible sources of variation in mean sea level might explain the rise observed. "**
SOURCE: http://www.aviso.oceanobs.com/en/news/ocean-indicators/mean-sea-level/index.html

"There is concern that sea level rises might lead to the submergence of some small Indian Ocean Islands such as the **Maldives.** Figure 1 shows levels from four data sets. The one marked Jason/Topex uses satellite data. The other three are based on levels observed at tide gauges. The **data sets show a rate of rise of around 3mm a year over last 20 years. This is similar to the global average rate for the previous 150 years.**

The tide gauge data for the Maldives were extracted from the file "prints.rlr" downloaded fromhttp://www.psmsl.org/data/obtaining/. The satellite data were downloaded fromhttp://sealevel.colorado.edu/content/regional-sea-level-time-series."



August 23, 2011
An Update from NASA's Sea Level Sentinels:



"Like mercury in a thermometer, ocean waters expand as they warm. This, along with melting glaciers and ice sheets in Greenland and Antarctica, drives sea levels higher over the long term. For the past 18 years, the U.S./French Jason-1, Jason-2 and Topex/Poseidon spacecraft have been monitoring the gradual rise of the world's ocean in response to global warming.

While the rise of the global ocean has been remarkably steady for most of this time, every once in a while, sea level rise hits a speed bump. This past year, it's been more like a pothole: between last summer and this one, global sea level actually fell by about a quarter of an inch, or half a centimeter.

So what's up with the down seas, and what does it mean? Climate scientist Josh Willis of NASA's Jet Propulsion Laboratory, Pasadena, Calif., says you can blame it on the cycle of El Niño and La Niña in the Pacific.

Willis said that while 2010 began with a sizable El Niño, by year's end, it was replaced by one of the strongest La Niñas in recent memory. This sudden shift in the Pacific changed rainfall patterns all across the globe, bringing massive floods to places like Australia and the Amazon basin, and drought to the southern United States.

Data from the NASA/German Aerospace Center's twin Gravity Recovery and Climate Experiment (Grace) spacecraft provide a clear picture of how this extra rain piled onto the continents in the early parts of 2011. "By detecting where water is on the continents, Grace shows us how water moves around the planet," says Steve Nerem, a sea level scientist at the University of Colorado in Boulder.

So where does all that extra water in Brazil and Australia come from? You guessed it--the ocean. Each year, huge amounts of water are evaporated from the ocean. While most of it falls right back into the ocean as rain, some of it falls over land. "This year, the continents got an extra dose of rain, so much so that global sea levels actually fell over most of the last year," says Carmen Boening, a JPL oceanographer and climate scientist. Boening and colleagues presented

these results recently at the annual Grace Science Team Meeting in Austin, Texas.

But for those who might argue that these data show us entering a long-term period of decline in global sea level, Willis cautions that sea level drops such as this one cannot last, and over the long-run, the trend remains solidly up. Water flows downhill, and the extra rain will eventually find its way back to the sea. When it does, global sea level will rise again.

"We're heating up the planet, and in the end that means more sea level rise," says Willis. "But El Niño and La Niña always take us on a rainfall rollercoaster, and in years like this they give us sea-level whiplash."

For more information on NASA's sea level monitoring satellites.
”visit: http://sealevel.jpl.nasa.gov/ ,http://sealevel.colorado.edu , http://www.csr.utexas.edu/grace/ and http://grace.jpl.nasa.gov/ .