The Divergence of Sea-Level Reports

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Points to be covered in this article:

1: Long-term Tide Gauges reporting sea level trends all over in the world show generally straight-line linear trends.

2: Local tectonics are the major factor underlying the upward or downward direction of reported shoreline sea level.

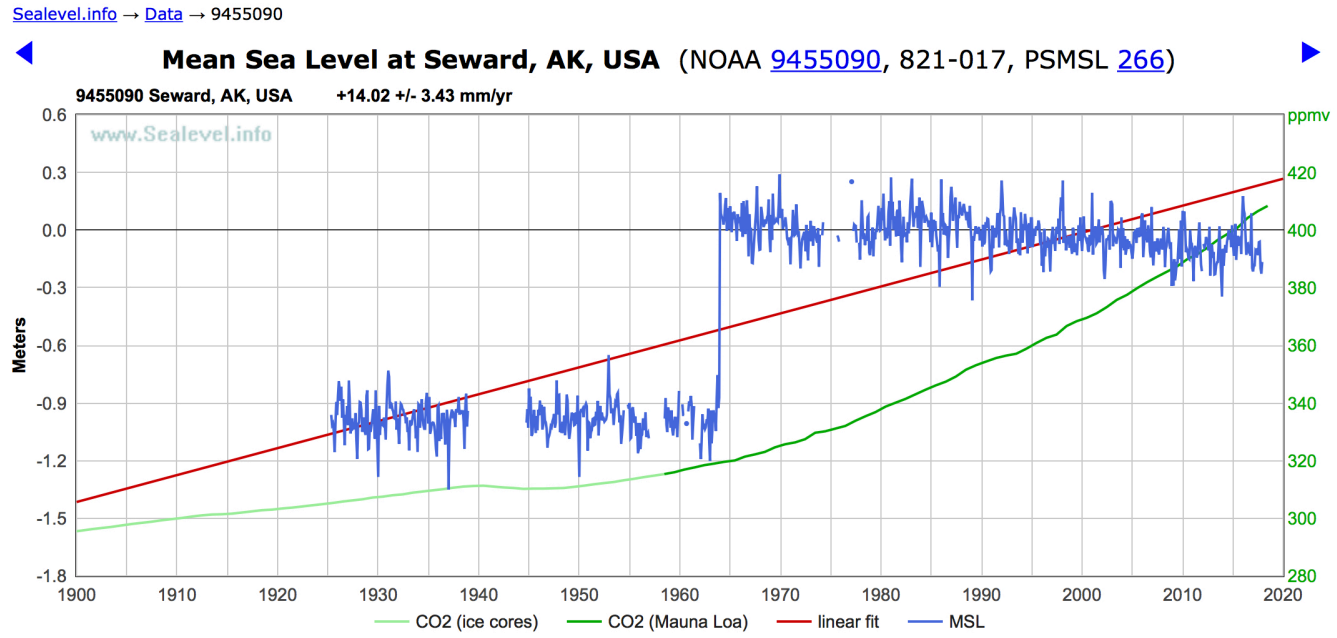
3: Satellite altimeter readings since 1993 show generally straight-line linear trends, but in an upward direction two and a half times greater than the upward trend observed in tide gauges located in tectonically inert zones.

4: As there is only one ocean, differences must arise out of instrumentation or software used to analyze it. We have measured, verified, and validated tide gauges in Tectonically Inert zones. Not so with Satellite Altimeters. Their instrumentation may have resolution problems, but software issues totally eclipse them.

5: Quoting Sir Arthur Conan Doyle: "...when you have eliminated the impossible, whatever remains, *however improbable*, must be the truth!**" An error has been made, & I believe, found!**

6: A PS looks at NYC and Florida.

Tide gauges are located on the coastal shorelines or within harbors of every country in the world having either. Long-term gauges (> 100 years) are numerous. With very few exceptions, all show straight-line linear trends – some trending upwards, others downward, and a few bifurcated as a result of a split in the record resulting from rapid earth movement due to local earthquakes. Here's an example from Seward Alaska:



Notice that on either side of the 1964 earthquake, the trend is basically linear. The red trend line shown in the graphic is wholly inappropriate for the Seward Alaska region. The actual sea level trend over the years has been in slight decline, sourced from regional uplift. The uplift has been gradual over the years and the 1964 earthquake added a sharp spike to the sea-level as Seward actually and suddenly dropped.

Source data for these tide gauges can be found at the Permanent Service for Mean Sea Level (PSMSL) website: https://www.psmsl.org/ , and the excellent "Sea level info" website http://www.sealevel.info managed by Dave Burton. Dave juxtaposes CO_2 readings on the actual sea level readings recorded by individual tide gauges.

The striking linearity is in sharp contrast to accelerating carbon dioxide levels recorded during the past 100 years. Here's a slide showing a random subset of NOAA Tide gauges:

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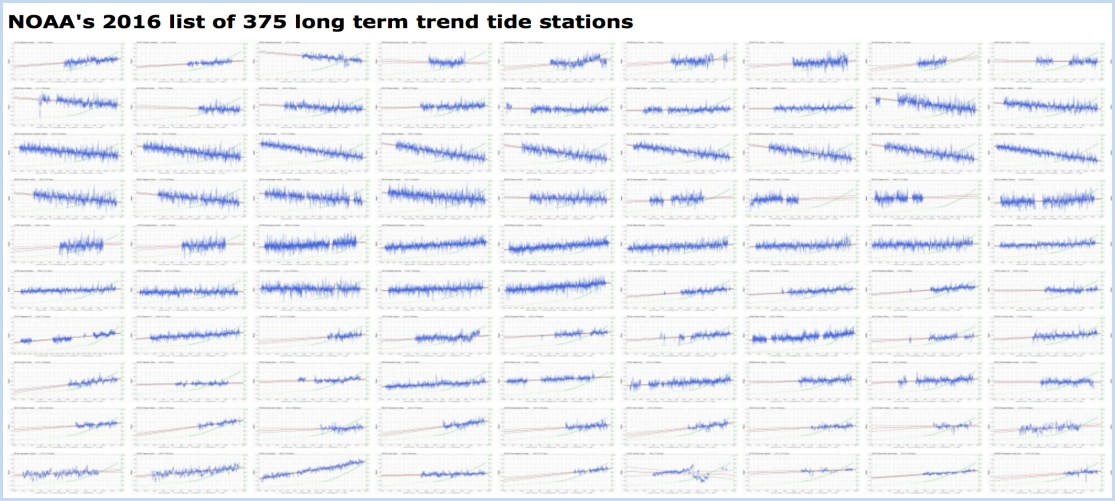
Massive 44% CO_2 Increase Since 1880

Any sign of Sea-Level Rise Acceleration?

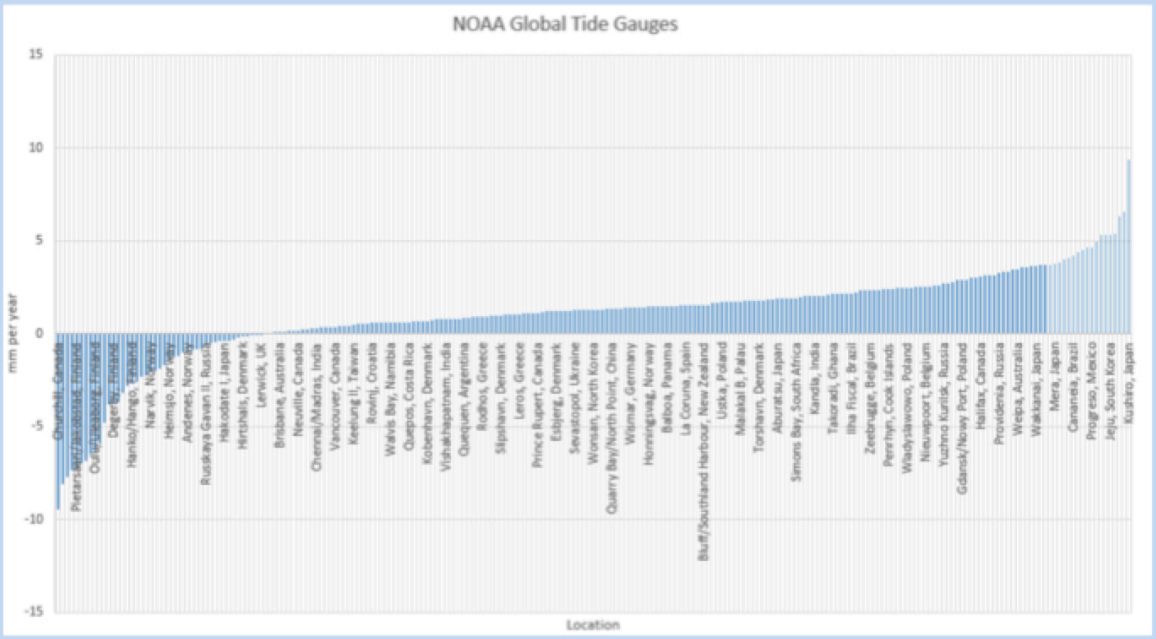
Guess What: They're all Basically Linear



The rising or falling trends recorded everywhere on the planet, are primarily affected by local tectonics. Trying to find the "real" sea level trend on the planet, as a whole, has been problematical.

For one thing, if you average all Tide gauges together, you will end up seeing an upward bias. Nations tend to put more tide gauges where land is subsiding. The Netherlands, for example, is concerned about ocean inundation, and is well known for its dike system holding back the sea. They maintain many tide gauges. In fact, the oldest continually monitored tide gauge in the world, dates from the 1600s in Amsterdam Harbor. Notice in the slide below, that the preponderance of tide gauges are showing sea levels rising while in fact, many are located in areas where land is subsiding:

Tide Gauge Bias



The great Swedish oceanographer, Nils-Axel Mörner, made a brilliant attempt to ascertain the "real" increase in sea level by carefully mapping the tectonics of northern Europe, and searching for a balance point where the land was neither rising nor subsiding. He provided the graphics in the following two slides.

The slides map the "Isotects" or lines where tectonics are similar, showing huge uplift in central Norway over the 20,000 year period within which the giant miles-deep ice sheets and glaciers of the last Ice Age melted and then disappeared. The tectonic rebound of Northern Europe was enormous, as was the subsidence occurring in the Netherlands and the surrounding ocean basins:

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Tectonics in the Baltic

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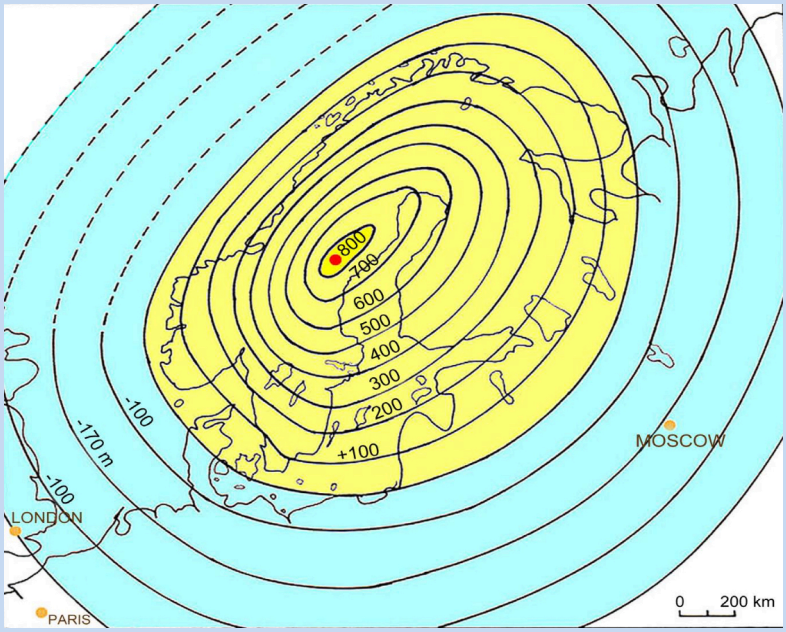

The following slide shows detail of the "zero Isotects" near Nyborg, Denmark:

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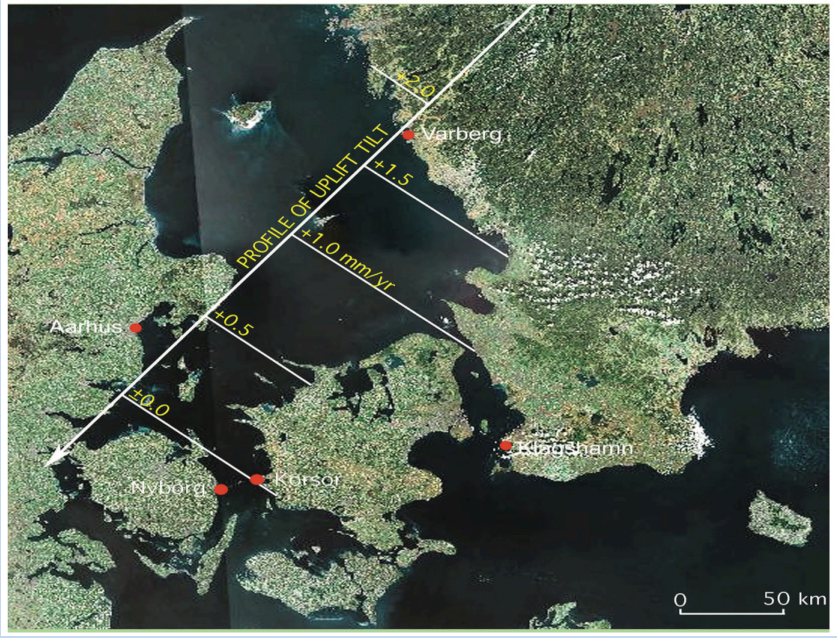
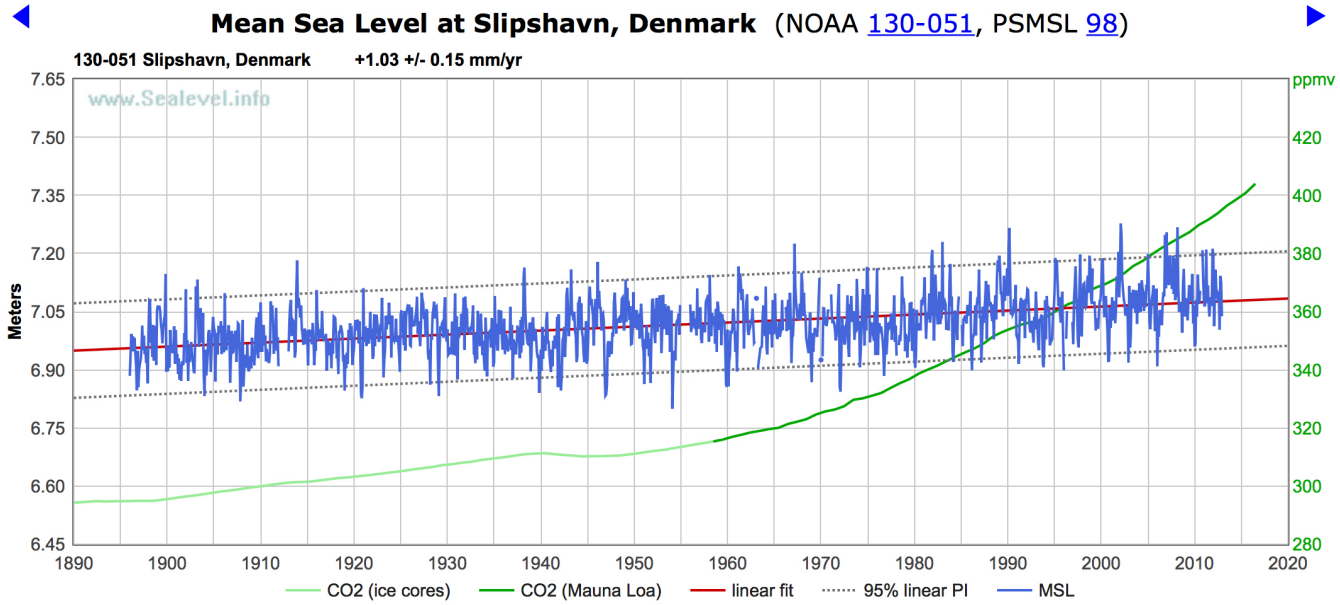
Baltic Sea Tectonic Detail

BASIC SCIENCE OF A CHANGING CLIMATE



Nyborg's Harbor, Slipshavn, shows the following steady and highly linear sea-level trend, rising a bit over 1mm per year for over 100 years.



The mean sea level (MSL) trend at Slipshavn, Denmark is +1.03 mm/year with a 95% confidence interval of ±0.15 mm/year, based on monthly mean sea level data from 1896/1 to 2012/12. That is equivalent to a change of 0.34 feet in 100 years. (R-squared = 0.242)

So in an area with no uplift and no subsidence, there is a methodical linear and relatively unchanging trend with no accelerating CO_2 signal visible within that trend.

We need to verify and validate this "Tectonically Inert" example of sea-level rise, and can do so quite well in areas where co-located GPS stations exist with a decade or more of continual monitoring.

A uniquely qualifying station meeting that criterion is Newlyn, England, near Cornwall. A detailed history can be found here:

https://www.tandfonline.com/doi/full/10.1080/01490419.2015.1121175

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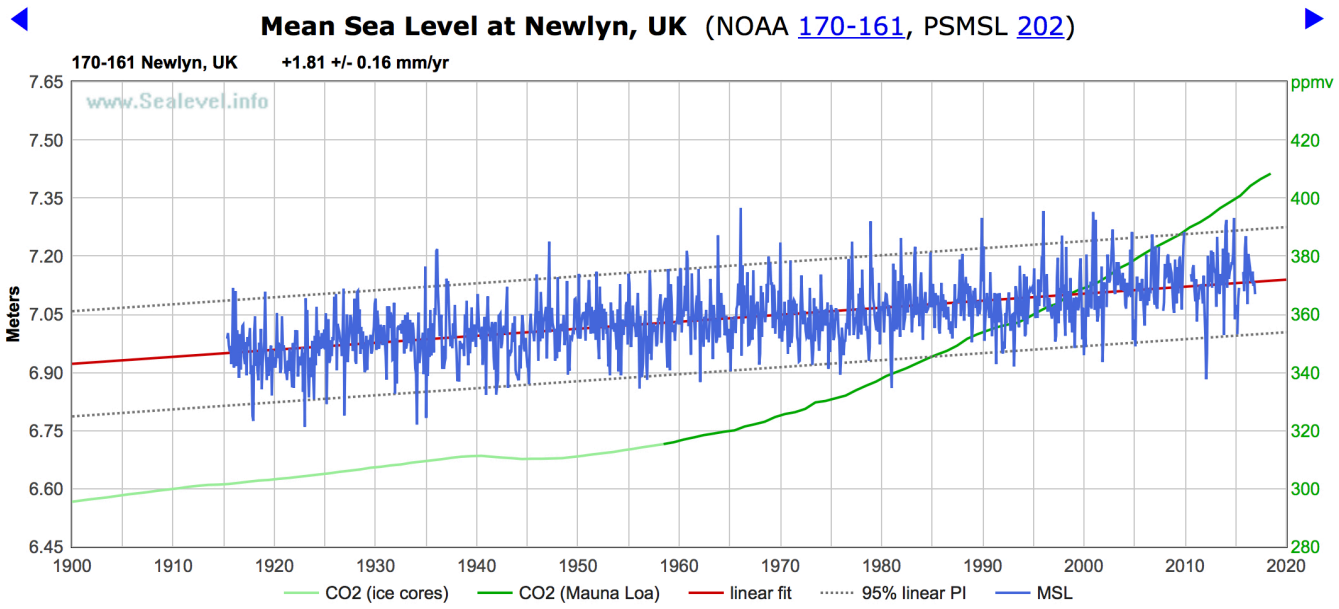
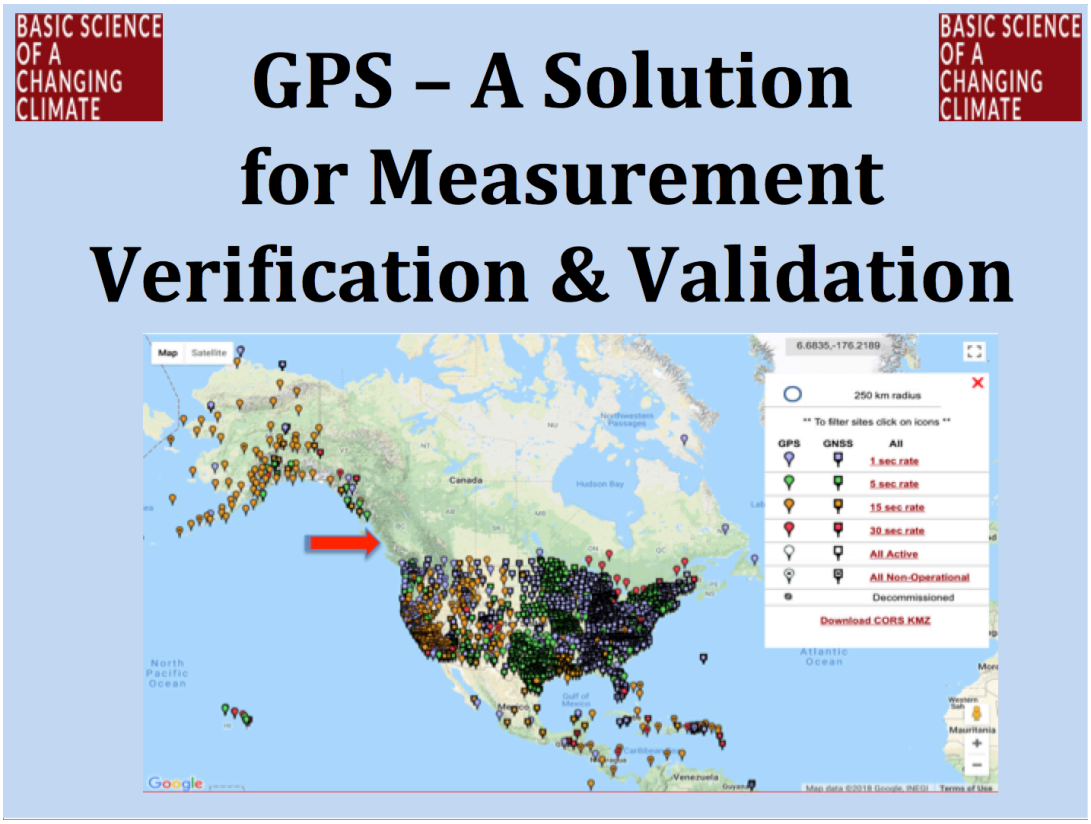
This location has also been selected and fixed as the datum for all of the British Isles for over 100 years. The tide gauge location is on solid bedrock, with a co-located GPS measuring station installed in 1998. The local subsidence is a linear 0.7mm/year. The tide gauge shows a straight-line linear trend of 1.8mm/year sea level rise. Subtracting the subsidence yields 1.1mm/year, virtually identical to that of Nyborg, and clearly validating the map put together by Professor Nils-Axel Mörner.

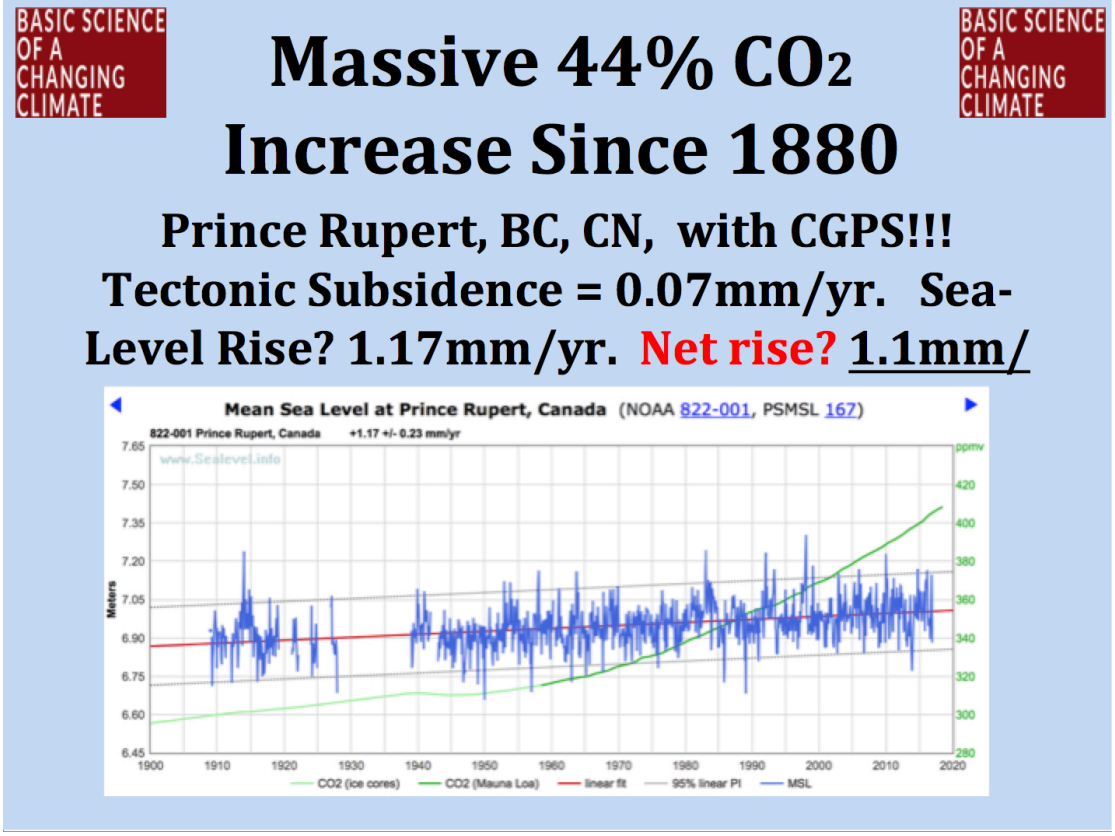
Sealevel.info → Data → 170-161



Another example can be found on the Canadian West Coast. The Alaska area has experienced a general tectonic rise, quite similar to what happened in Norway. The West Coast of United States, in contrast, has shown gentle subsidence, likely driven by Pacific Plate tectonic subduction along its entire length.

In between both, we find the Prince Rupert tide gauge, which like Newlyn, GB, has had a decade long co-located, bedrock fixed, GPS station. Here are two self-explanatory slides; the red arrow highlighting Prince Rupert's location:





So we have again verified and validated another "Tectonically Inert" example of sea-level rise, and did so in an area where a co-located GPS station existed with a decade of continual monitoring.

It has become clear that verified and validated sea level rise in tectonically inert zones is not only "…surprisingly straightforward linear," but about one third of the clearly linear sea level rise reported by the TOPEX/Poseidon, Jason-1, Jason-2, and Jason-3 satellite altimeters over the past quarter century. Recent claims of slight quadratic acceleration by the Colorado Sea-Level group are acknowledged, but:

They both cannot be right!!!

Radar resolution deficiencies of the satellite altimeters are well known and were brilliantly highlighted by the great Dr. Willie Soon, who did so thoroughly and at great length, at a Doctors for Disaster Preparedness Conference in 2013, here:

https://www.ddponline.org/2013/07/13/five-or-more-failed-experiments-in-measuring-global-sea-level-change-willie-soon-phd/

A few years ago, in 2014, following the lead of Dr. Soon I presented information on these differences, which included the wrongly discredited ESA ENVISAT satellite in a talk titled "Will the Real Sea Level Please Rise." That talk can still be found online at:

http://climateconferences.heartland.org/thomas-wysmuller-iccc9/

During a period of rising solar activity, I called for a Transit Test of the T/P, J series satellites, assuming that orbital degradation could underlie the clearly nonsensical differences between two measures, each claiming linearity, yet directionally divergent.

I was wrong.

Orbital degradation, although real, was corrected for, and subsequent sharp reductions in solar activity had no effect on the continual straight-line linear sea level rise reported by the University of Colorado team that managed the data.

The U of Col. research team, led by Dr. M. S. Nerem, have done their best to use intricate NASA developed technology and instrumentation to make sense of the sea level rise enigma. No one should underestimate the difficulties presented in trying to make sense of sea heights that change in single millimeters, measured by instruments that can only even measure 20 mm or over 50 mm at their best. Dr. Nerem and his colleagues have labored heroically in doing so. Some Glacial Isostatic Adjustment (GIA) curveballs were thrown their way too, adding to the team's difficulties.

They too, made mistakes.

The first of three (relating to statistical accuracy and precision) was wisely sidestepped, and I suspect, the second (relating to computer coding) was not. The third was jumping on the IPCC bandwagon, as evidenced in their latest paper.

Instrumentation capability on the Jason satellite is not suspect. The satellite's results were properly linear, and accurately recorded the anheric (water retaining) Australian weather events of 2011. Here huge storms extracted enormous amounts of water from the Western Pacific and dumped these copious amounts on the Australian continent, replenishing its aquifers. This water was retained and not returned to the sea. Tide gauges around the world also properly recorded this event, confirming the satellite instrumentation accuracy.

The radars used (13.575 GHz [Ku-band] and 5.3 GHz [C-band]) cannot resolve to sub-millimeter accuracy. Precision is achieved within the limits of their resolution capability, but they can't measure what they are unable to resolve. Multiple passes to improve accuracy don't work for a number of reasons. First and foremost is that they would need to measure exactly the same thing, and orbital movement prevents that from happening. Thus the hope of increasing accuracy probability density for the location of the actual signal return is unavailable.

Each pass in the satellite's orbit covers a different part of the ocean. Barometric pressure changes ocean height – lower pressure raises the ocean surface, and higher pressure depresses it. Moving over a raincloud weakens the accuracy of the highest resolution (Ku-band) radar. Here the wisdom of an additional, but lower resolution radar (C band) becomes apparent. This still doesn't solve the wave action problem requiring increase of the radar's "footprint" or area covered. Result? Lower resolution.

As the statistical process of multiple measurements of the same object isn't available, averaging the two radar returns is all that remains. This is the likely source of a crucial mistake, and one that has been unintentionally undetectable by the U Col's research team, and NASA contract specialists overseeing the project.

Instructing a computer to achieve results is accomplished by programming, and that programming is done using a "high level" programming language such as Fortran, C++, or any number of sophisticated, computer understandable languages. Each requires

employing a compiler to reduce the instructions into machine-readable code. Compilers create assembler instructions, which, in turn, allocate memory and allow the code to be executed.

Mistakes can happen.

If a memory location contains a binary "2" to be used in performing an "averaging" computation when two values are involved (such as summed results of two radar altimeters), and that location gets overwritten with a "1," then essentially the reported sea level result output ends up being inadvertently doubled. Bypassing the division subroutine is another possibility! One of these, almost certainly, is exactly what happened here!!! Some compilers use assembly subroutines that, when machine coded, could have avoided this by summing the combined result 5 times and performing a left decimal shift when outputting the final result used to come up with an average for the two values.

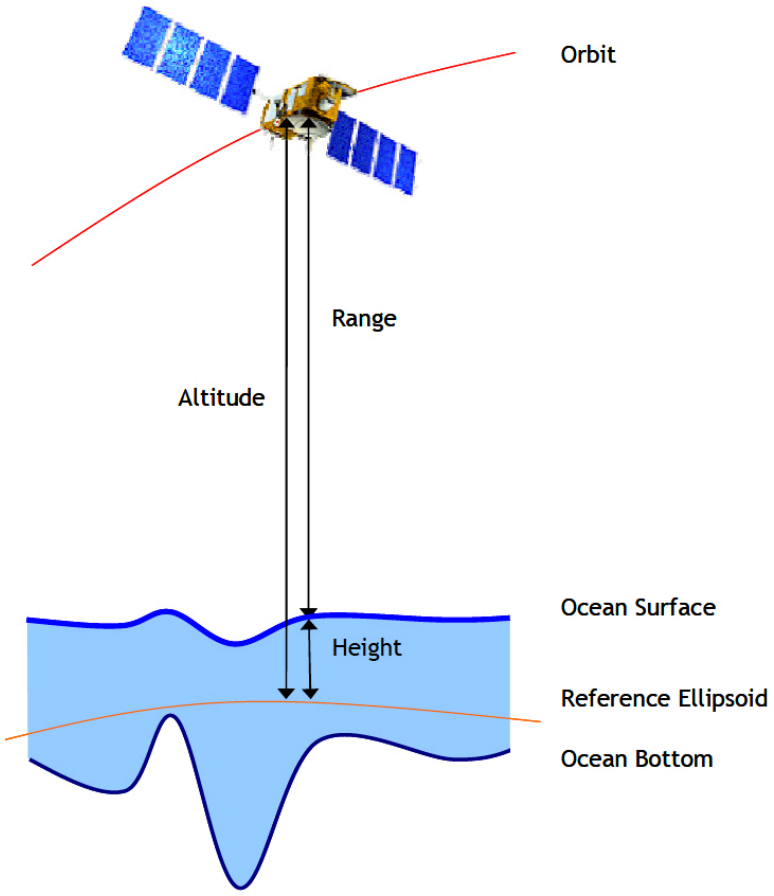


Figure 1 : Altimetric distances - Altitude, Range and Height

This slide, taken from the Jason Products Handbook, could be improved by drawing a second set of arrow points where the leftmost line intersects the sea surface (representing the fact that two radars are being used) from the satellite to the ocean surface and up from the reference ellipsoid.

Were the two radars summed and not divided by two? Was this hidden in the compiler and assembler instructions? Were memory locations "clashed? Only machine code analysis can help arrive at answers, as the programmers and managers were comfortable with the

results!!! The output was delightfully confirming their expectations, assuring unawareness of this possible turn of events.

This is a "likelihood" that would have stunning results, as the halving of reported satellite results and subtracting (rather than adding) the Glacial Isostatic Adjustment (GIA), brings their results totally in line with measured, GPS validated, and verified tectonically inert tide gauge readings. It is very interesting that the first "correction" of the ESA ENVISAT Radar results also zeroed in on precisely the same readings!!!

The dashed lines in Professor Nils-Axel Mörner's sourced "Tectonics in the Baltic" slide represent deepening of the ocean basin off the Norwegian coast. As Norway rose through its 20,000 years long uplift, the blue areas on the slide subsided, and a deeper ocean basin made room for more water, serving to reduce what would have been an even higher sea level. But the deepening was even greater, as the additional enormous weight of now melted ice also pressed upon the thin crust supported ocean floor, deepening it even further.

How is this ever going to be resolved?

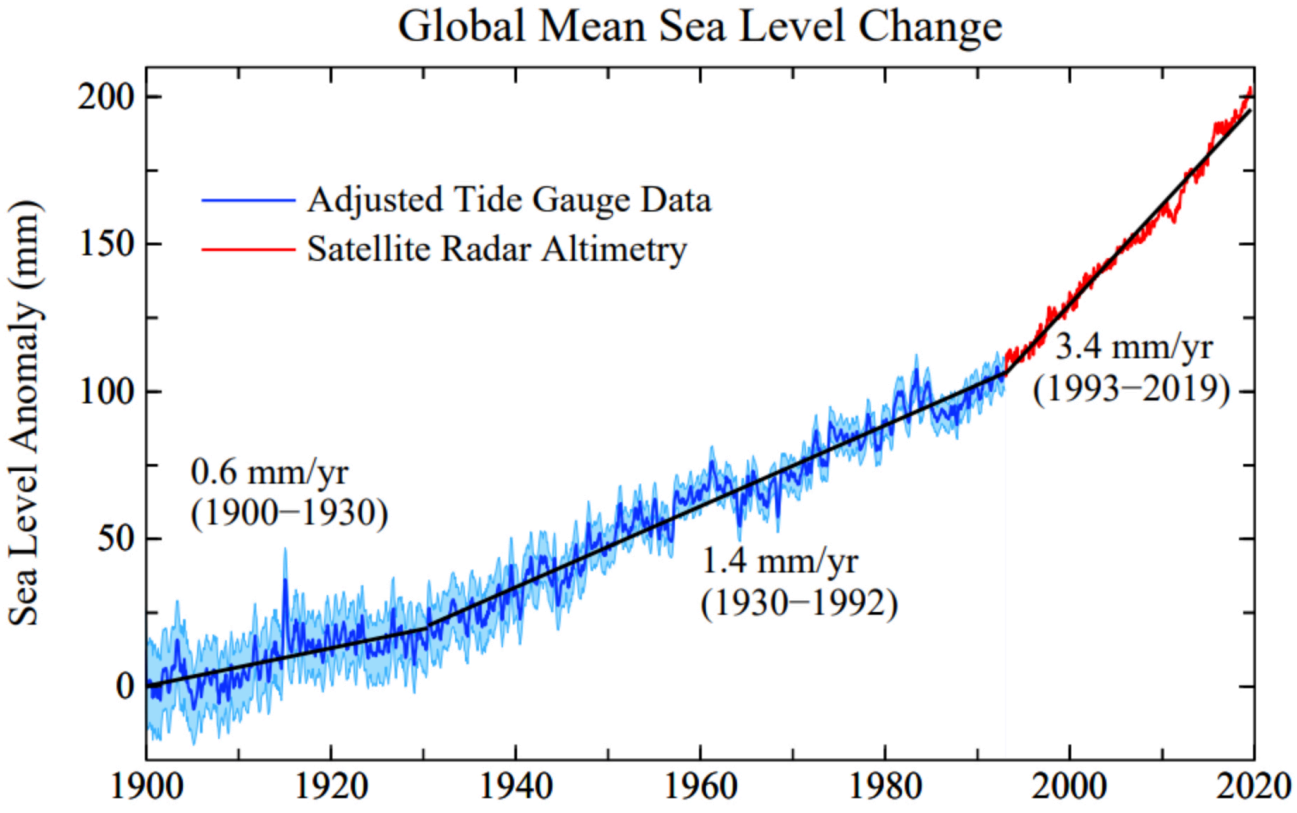
Dr. Nerem and his colleagues need to dig deeply into the code – find the error, acknowledge the mistake, and deal with it. The doubling mistake, though intricately masked, is real, and it will be found.

Are the altimeter results "too big to fail?" Dozens upon dozens of papers, and research grants have tried to tie altimeter "results" to panic driven "tipping points." Papers trying to claim tide gauge agreement to the altimeter reports abound, using "semi-empirical data," which concatenates model output to measured tide gauges. Some, attempting to validate the satellite reportage, are so blather filled, obfuscational, and drivel strewn that they serve as models for how not to write a paper!

The alternative is much worse. Paraphrasing a time honored NASA quip: "We did not fail up there, we failed down here!!!" Within a few years, the linear divergence of Satellite altimeter reported sea level from measured, GPS validated, and verified tectonically inert tide gauge readings will become horribly severe. NASA's credibility, already beginning to show strains in the sea level area, will be "impaired," and that is an understatement. The IPCC and other "Global Warming" oriented organizations, will still defend the "Emperor's Clothes" but after a quarter century, the results are now increasingly naked for all to see.

We are at the point where the error has become stunningly obvious.

The following GISS graphic shows the evidence for all to see:



Source: http://www.columbia.edu/~mhs119/SeaLevel/

In 1992 there was no Earth targeted meteor strike; no Ice Sheet collapse; no Earth orbital perturbation, or any such planet-wide event that could have forever changed the direction of sea-level rise all over our planet. The coding errors described earlier and subtraction (in place of addition) of the GIA bring back the reported 3.4 mm rate of rise (recently downgraded to 2.9 mm) to the 1.1 to 1.4 mm range. The GIA subtraction is warranted as

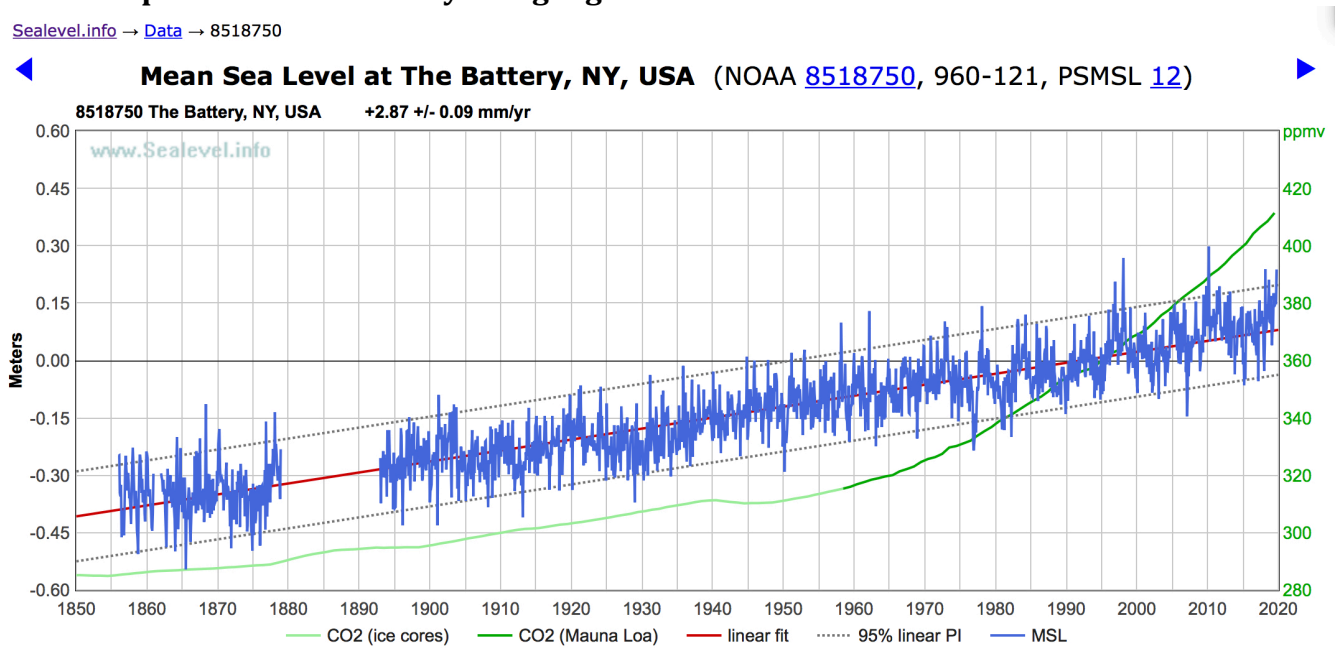
the addition of melted land ice to the oceans serves to further depress the ocean basins, enlarging them to hold more water over a thinner portion of the Earth's crust.

Something else to keep in mind: Nowhere on this planet can we find a tide gauge with over a 100 year record that shows a sudden linear change in direction starting in 1992 from 1.1 to 1.4mm/yr. jumping to 2.9 to 3.4mm/yr. per the chart above. Even where violent tectonics intervene, such as Seward Alaska (first graphic in this article), the rate of change remains consistent in direction and remains linear, before and after the event!

Simply said: The purported post 1992 "new" acceleration is FALSE!!!

PS: New York City observations:

First the up-to-date NYC Battery tide gauge chart:



The mean sea level (MSL) trend at The Battery, NY, USA is +2.87 mm/year with a 95% confidence interval of ±0.09 mm/year, based on monthly mean sea level data from 1856/1 to 2019/10. That is equivalent to a change of 0.94 feet in 100 years. (R-squared = 0.831)

The plot shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. By default, the long-term linear trend is also shown, in red, along with its 95% confidence interval. The plotted values are relative to the most recent Mean Sea Level datum established by NOAA CO-OPS.

As the sea level "rises" in NYC, the land is also subsiding and will continue to subside by one to 1.5 millimeters (0.04 to 0.06 inch) a year, according to S. Jeffress Williams, coastal marine geologist with the USGS Woods Hole and the University of Hawaii.

Subtracting the 1 to 1.5 mm subsidence from the 2.87 long term sea-level rise gets us back to 1.87 to 1.37 mm zone, and (as previously pointed out on Page 11) correcting the misapplied Glacial Isostatic Adjustment (GIA), and subtracting (rather than adding) it, brings NYC's results totally in line with measured, GPS validated, and verified tectonically inert tide gauge readings as shown above on pages 3 through 8.

From a sea level rise standpoint; although the validated "tectonically inert" SLR remains in the 1.1 to 1.4 mm/yr. zone, NYC must deal with its subsidence issues. The following graphic points out what the area is up against:

The inset shows the original "tip" of Manhattan Island, 400 years ago. The area surrounding is all land-fill accumulated over the centuries. Notice "Water Street" along the island's Eastern edge, is aptly named, as it was originally where the land met the water. The gray area at the top left of the inset is Castle Clinton, built in the early 1800s on an artificial island that used to be connected to Manhattan by a 150' fisherman's walkway over the water. It actually served as an immigration disembarkment point, performing a role later to be handled by Ellis Island.

Here's a modern day look, keeping in mind that all the trees you see are on that landfill:

Now NYC has a monthly tide range between 3 and 6 1/2 feet, depending upon lunar distance and Moon/Sun position. Most meteorologists advise doubling the range's maximum to take storm surge into account, and that's exactly what happened (13.7') during Hurricane Sandy's onslaught. So it is quite obvious that the post Civil War's landfill fell far short of what was really needed. A Dutch-style dike is an obvious solution, and far less expensive; billions of dollars less, than the damage that will be caused by the next Sandy-like event.

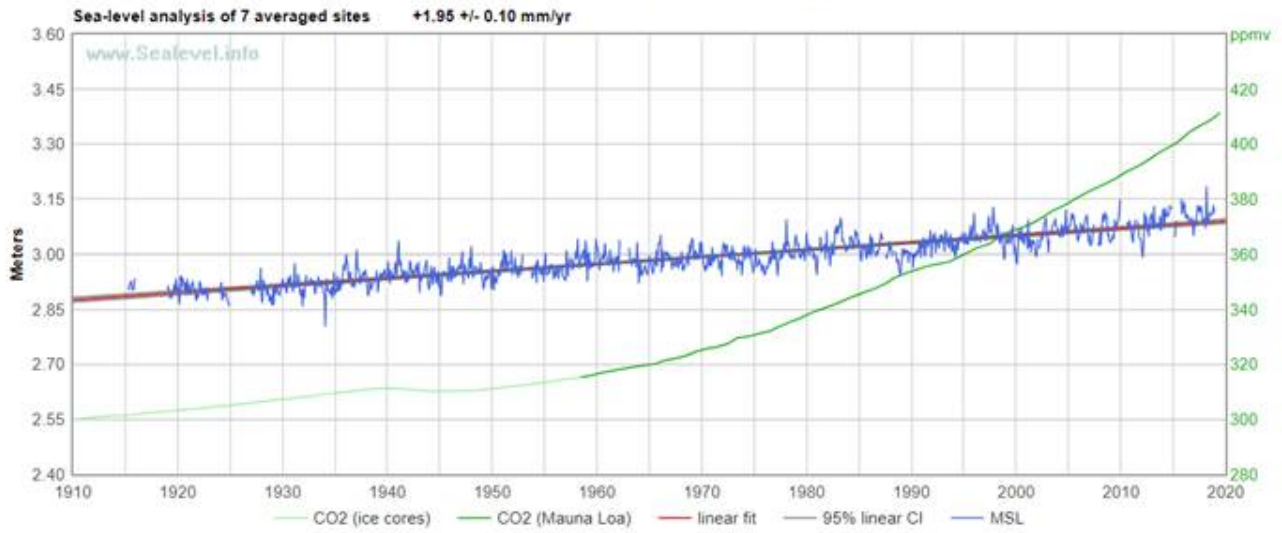
NYC, and its evident subsidence, is one among the seven long-term gauges that comprise the following world-spanning chart. Subsidence issues end up boosting the rate of "rise" to 1.95mm/yr., as tectonics have <u>not</u> been adjusted for in the reportage of tide gauges shown.

But it is the clear straight-line linear result that has remained unchanged after 1992, and clearly and <u>unmistakably, invalidates</u> the TOPEX/Poseidon/Jason reported results, while inadvertently confirming the correctness of the ENVISAT intermediate satellite readings.

Dave Burton of http://www.sealevel.info provided this compilation:

sealevel.info/MSL_weighted.php?g_date=1910/1-2019/12&c_date=1910/1-2019/12&s_date=1910/1-2019/12&id=154,%20202,%20155,%20163,%20158,%20188,%2012

Sea-level analysis of 7 averaged sites



The mean sea level (MSL) trend is +1.95 mm/year with a 95% confidence interval of ±0.10 mm/year, based on monthly mean sea level data from 1915/5 to 2018/12. That is equivalent to a change of 0.64 feet in 100 years. (R-squared = 0.805)

Weight	ID	PSMSL	Station name
0.1429	270-061	154	Trieste, Italy
0.1429	170-161	202	Newlyn, UK
0.1429	1612340	155	Honolulu, HI, USA
0.1429	840-011	163	Balboa, Panama
0.1429	9410170	158	San Diego, CA, USA
0.1429	8724580	188	Key West, FL, USA
0.1429	8518750	12	The Battery, NY, USA

The plot shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. By default, the long-term linear trend is also shown, in red, along with its 95% confidence interval. The plotted values are relative to the most recent Mean Sea Level datum established by NOAA CO-OPS or PSMSL.

This should surely add to the incentive needed for NASA to order a thorough programming review of the two radar's "averaging" that clearly did not take place!!!

PPS A look at the South Florida situation follows:

Questions? The card below has my contact information: