To: Dravis, Samantha[dravis.samantha@epa.gov]
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Sent: Wed 9/20/2017 5:17:27 PM
Subject: Paper
Hedke Sea Level Rise Ten Cities.pdf

FYI, please see attached, just released Monday.

Reviews have been favorable.

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POLICY BRIEF
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NONGOVERNMENTAL INTERNATIONAL PANEL ON CLIMATE CHANGE

CENTER FOR THE STUDY OF CARBON DIOXIDE AND GLOBAL CHANGE
THE HEARTLAND INSTITUTE
SCIENCE AND ENVIRONMENTAL POLICY PROJECT

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Data versus Hype: How Ten Cities Show Sea-level Rise Is a False Crisis

By Dennis Hedke*

Introduction

> We can test the rising-seas hypothesis with real data collected from ten coastal cities with long and reliable records of sea level.

Are the world's coastal cities destined to be inundated as ice melts at the top and bottom of the planet, causing the oceans to rise? Climate alarmists argue this will be the case if policymakers do not adopt draconian measures to eliminate fossil fuels, especially coal, which produce carbon dioxide (CO_2) emissions that, they allege, cause harmful global warming.

Alarmists have difficulty making this argument because global temperatures have risen very little during the past two decades despite increasing concentrations of CO_2 in the atmosphere.[1] Dire predictions made decades ago that the ice caps would be melted by now have not come to pass.[2] NASA found global average sea levels actually fell during the past two years.[3]

Despite all this, alarmists still push fear of inundations, most recently in the wake of hurricane-driven floods and President Donald Trump's rescission of the Obama-era requirement that government agencies take account of global warming-induced sea-level rise for federally funded projects.[4]

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* Dennis E. Hedke is a geophysicist, a partner in the firm Hedke-Saenger Geoscience, Ltd., and a former Kansas state representative. For a more complete bio, see page 12.

[1] Patrick J. Michaels, "2016 Record Warm Surface Temperatures: The Party's Over!" *Cato at Liberty*, August 10, 2017.

[2] Douglas Stanglin, "Gore: Polar Ice Cap May Disappear By Summer 2014," *USA Today*, December 14, 2009.

[3] "NASA Confirms Falling Sea Levels For Two Years Amidst Media Blackout," *The SPPI Blog*, July 28, 2017.

[4] Michael Bastasch, "Trump to Repeal Obama Executive Order on Sea Level Rise," *The Daily Caller*, August 15, 2017.

We don't need to wonder who is right and who is wrong in the debate over future sea-level rise. We can test the rising-seas hypothesis with real data collected from ten coastal cities with long and reliable sea-level records. Those cities are Ceuta, Spain; Honolulu, Hawaii; Atlantic City, New Jersey; Sitka, Alaska; Port Isabel, Texas; St. Petersburg, Florida; Fernandina Beach, Florida; Mumbai/Bombay, India; Sydney, Australia; and Stavanger, Norway.

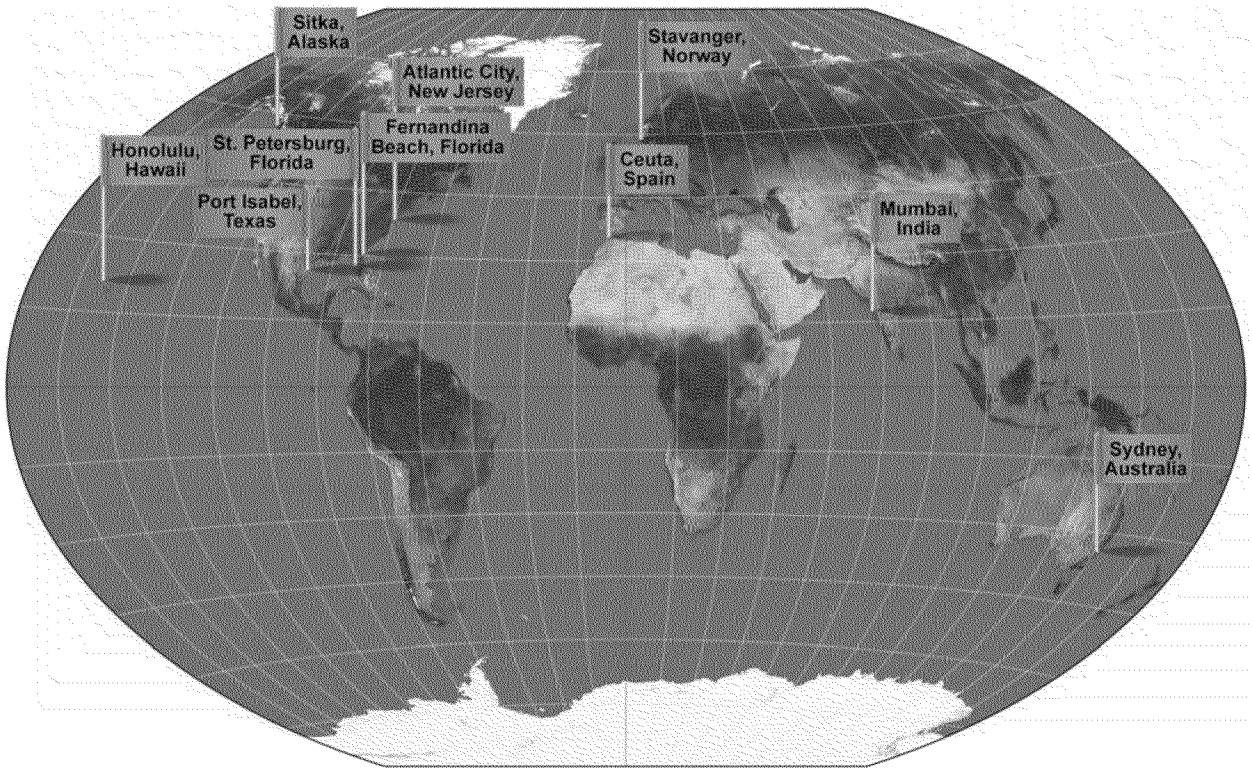
The cities appear on the map on this page, and data for each city are presented in ten graphs below. The graphs include the following elements:

- CO_2 concentrations measured in the atmosphere over the past century, signified by the green lines in the graphs. (This line is the same in all the graphs.)

- Monthly mean sea-level data for each city, signified by the blue lines, and

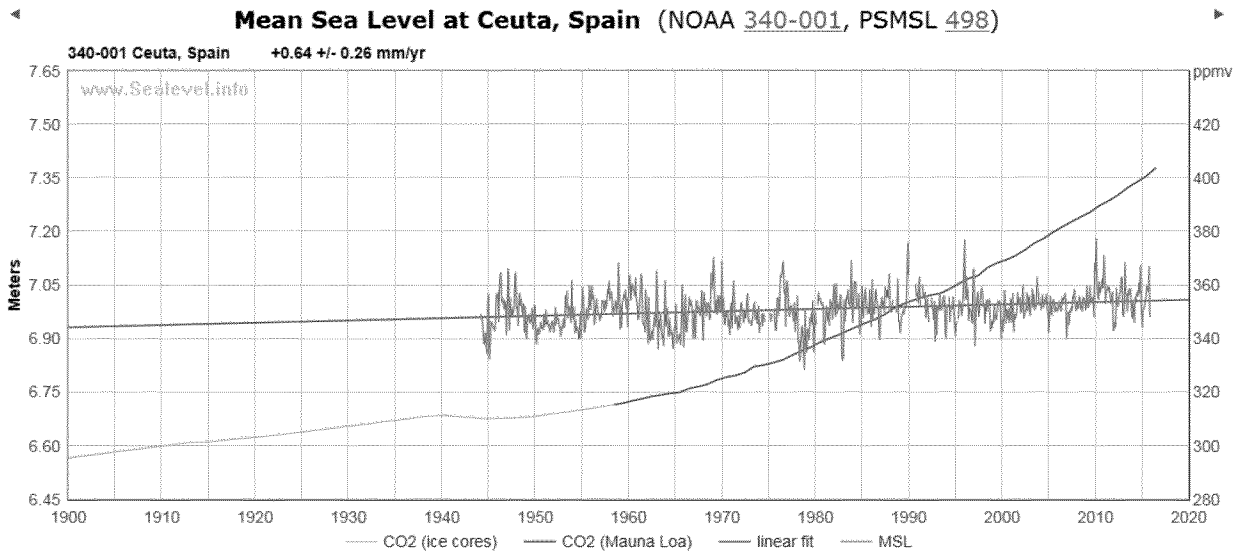
- The "linear fit," signified by the red line, representing the best estimate of past and projection of future average sea levels.

Sources for these data are reported in Appendix 1, along with the formulas for calculating the linear fit. Based on these data and formulas, we can report the rise in sea level dating as far back as 100 years for some cities, and we can project the sea-level rise over the next century for these locations.



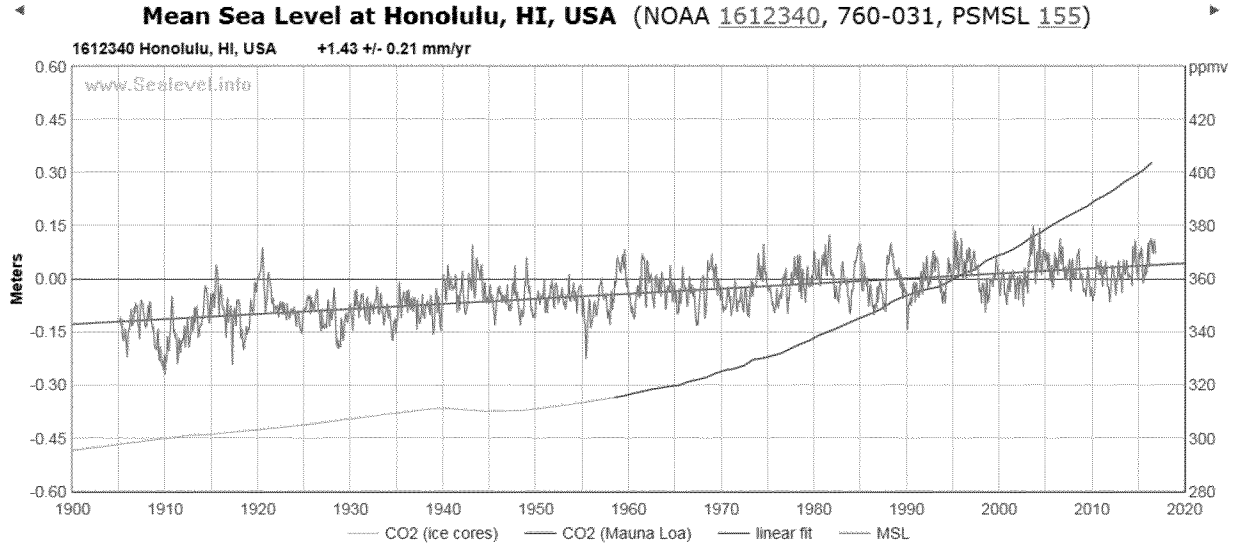
Source: https://en.wikipedia.org/wiki/World_map, modified.

Example 1: Ceuta, Spain on the Mediterranean Sea



The Ceuta, Spain data show a nearly flat trend since 1944. Most notably, the data show no correlation between CO_2 concentration and sea-level rise. If the current trend continues for the next century, sea level in Ceuta will rise only three inches. This is in sharp contrast to the ten-foot global rise in sea levels recently predicted by former NASA scientist James Hansen.[5]

Example 2: Honolulu, Hawaii on the Pacific Ocean

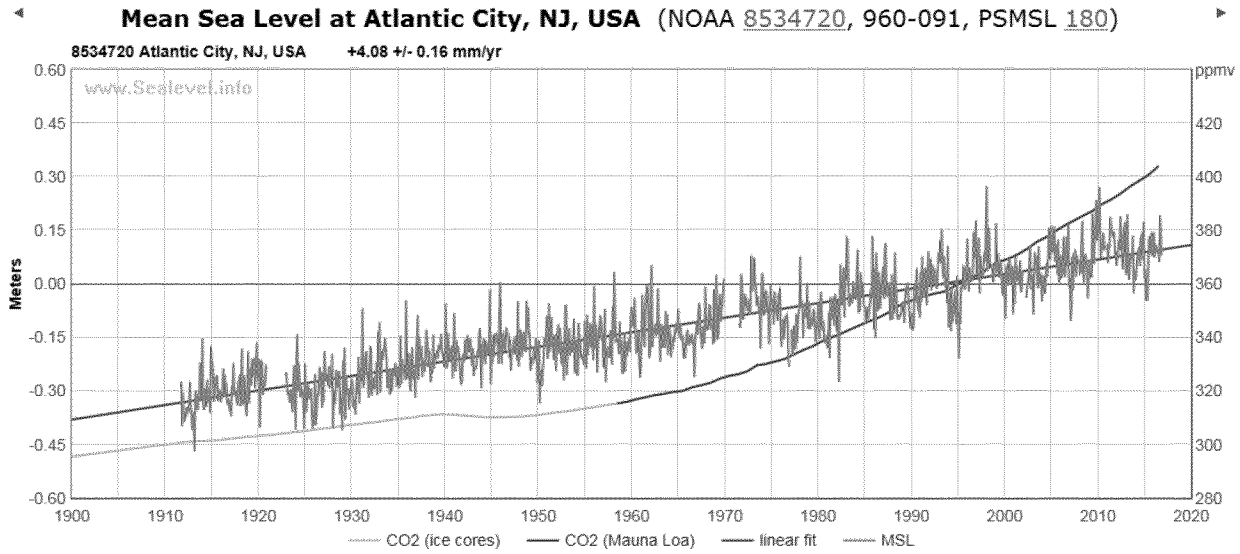


Hawaii, like some other regions, can see significant fluctuations in sea level because of global oceanic currents or local plate tectonic movements. The latter, on a global scale, have been

[5] Brian Clark Howard, "Prediction of Rapid Sea Level Rise Won't Change Global Climate Talks," *National Geographic*, July 21, 2015.

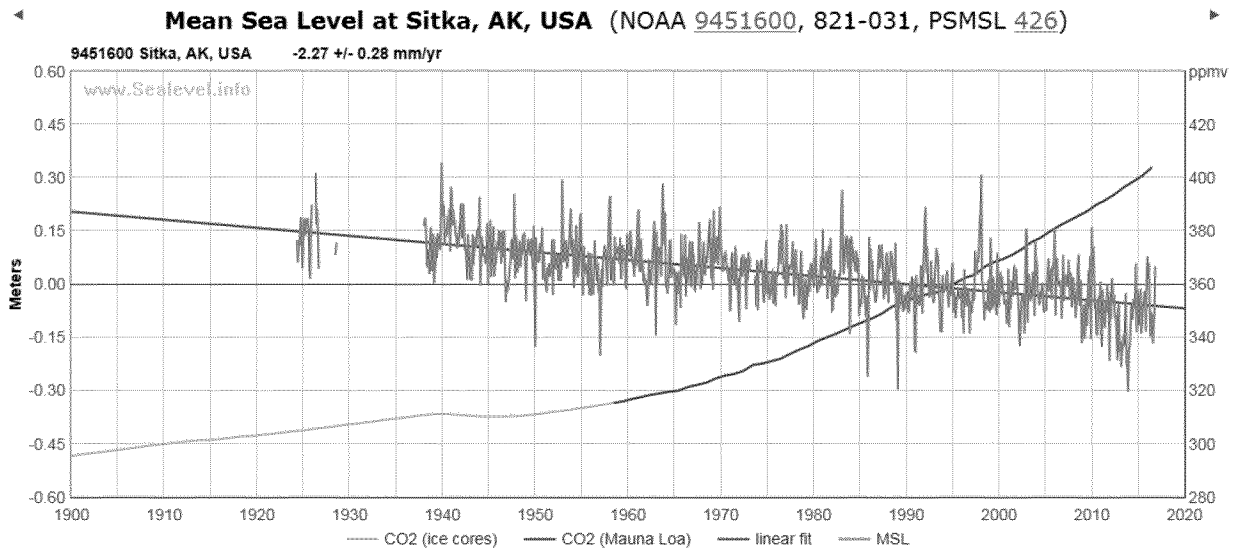
responsible for the breaking up of continents, reshaping of oceans, and rises and falls of sea levels over geologic time. However, Honolulu has seen an average sea-level rise of only 5.6 inches since 1900. The sea level around Honolulu is projected to rise a mere 5.6 inches in the next 100 years, once again with no correlation to CO_2 levels.

Example 3: Atlantic City on the Atlantic Ocean



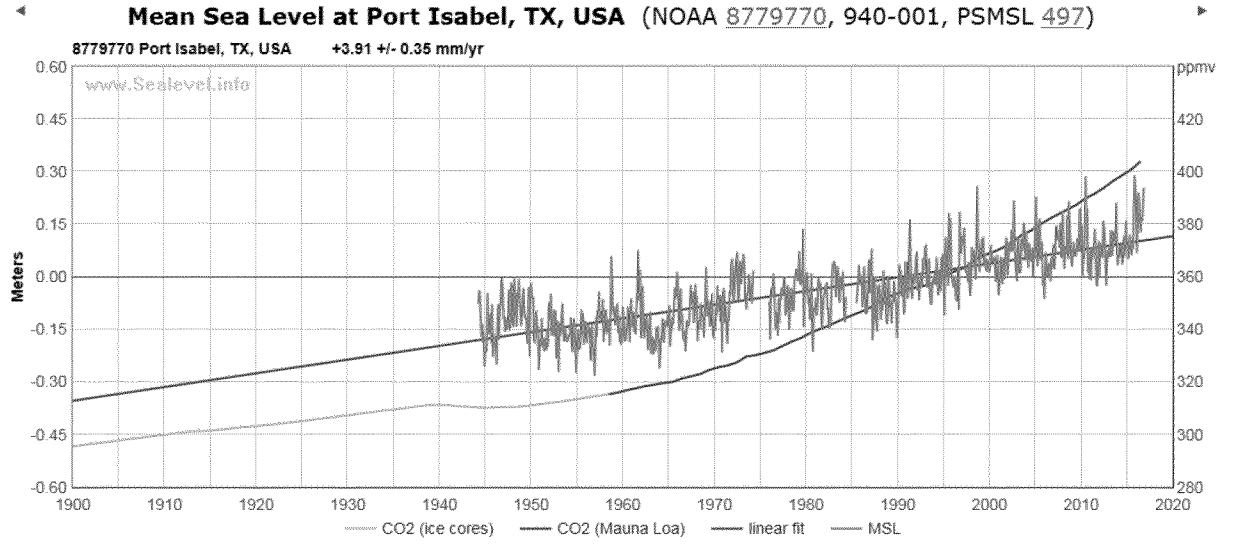
Atlantic City represents one of the more significant upward trends. The average sea level there has risen about 16 inches in the past 100 years. Notice, however, the spike at 1998, when the El Niño event took place in the Pacific Ocean, and then the subsequent drop in sea level that persisted for the next five years. Obviously, factors other than CO_2 levels were responsible for both the spike and the drop.

Example 4: Sitka, Alaska in the Northern Pacific



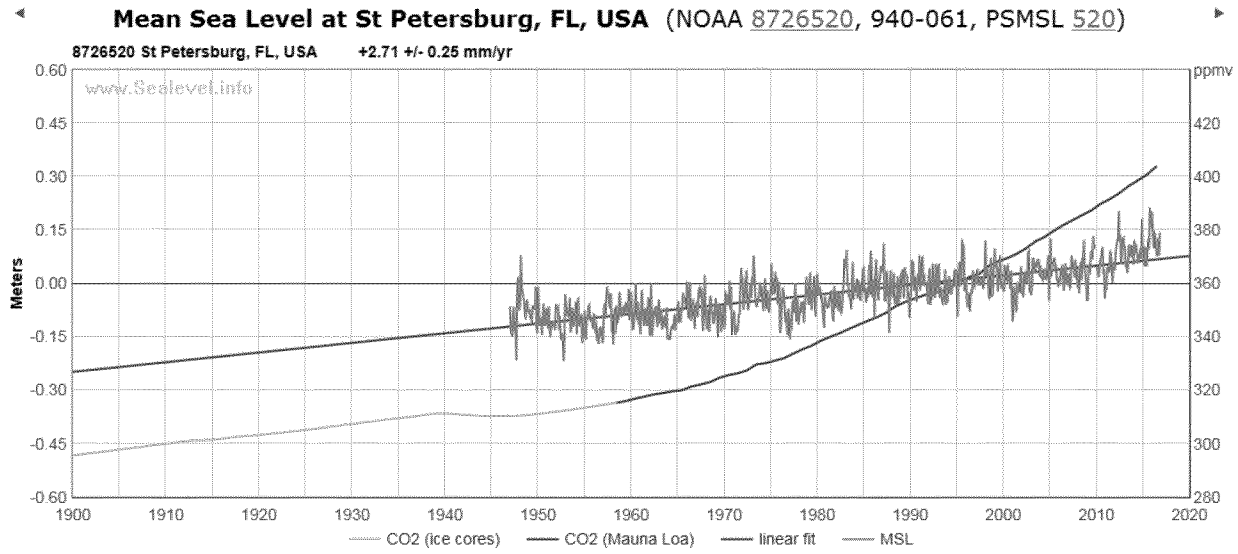
The sea-level trend in Sitka, Alaska has been downward, not upward, as the alarmists' theory would seem to predict. If the rate of change continues, sea level will fall nine inches over the next 100 years. Note Sitka is only about 100 miles from Glacier Bay and 200 miles from the Hubbard Glacier on Disenchantment Bay. If melting glaciers were causing sea levels to rise, one might expect to see it in Alaska.

Example 5: Port Isabel, Texas in the Western Gulf of Mexico



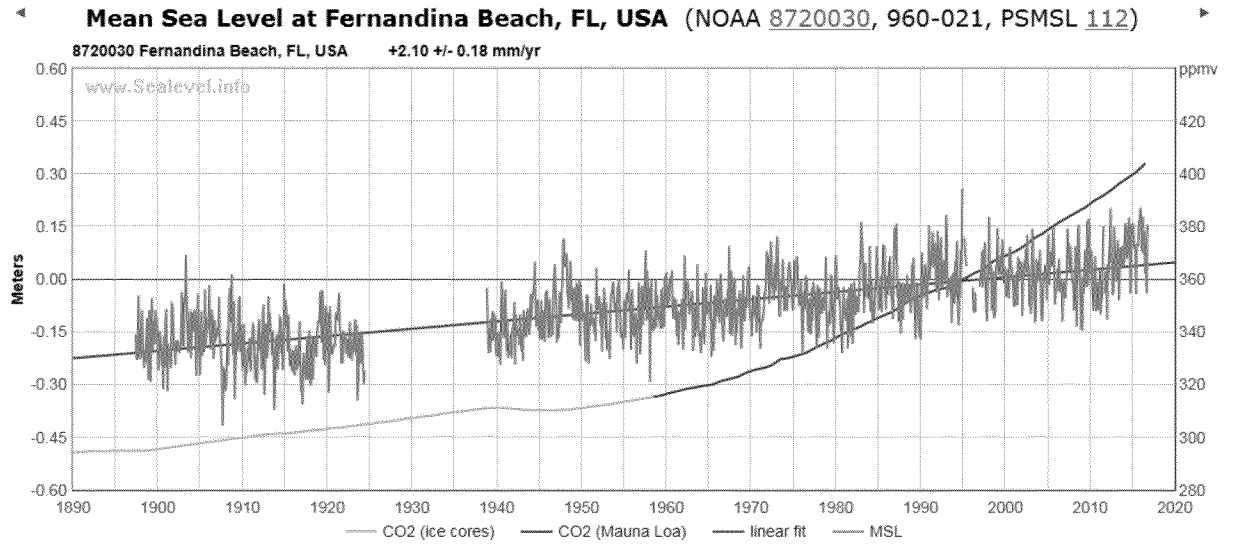
Port Isabel, Texas shows an upwardly inclined sea-level trend, although the record reaches only as far back as 1944. If the current trend continues, sea level will rise 15.4 inches over the next 100 years.

Example 6: St. Petersburg, Florida, Eastern Gulf of Mexico



At St. Petersburg, on the other side of the Gulf of Mexico from Port Isabel, Texas, sea level is also rising but more slowly. Once again, the record is shorter than other sites, dating back only to 1947. Here, the projected sea-level rise is only 10.7 inches over the next 100 years.

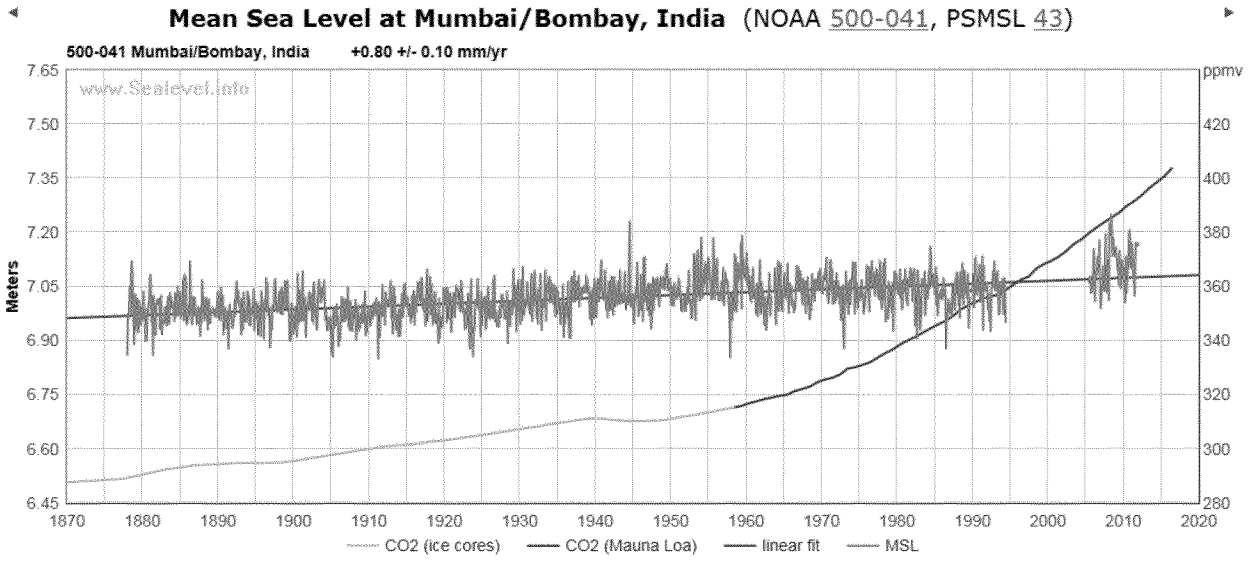
Example 7: Fernandina Beach, Florida on the Atlantic Coast



On the opposite side of Florida from St. Petersburg, the Fernandina Beach sea-level rise is projected at only 8.3 inches over the next 100 years. Miami Beach officials have been formulating policies to combat a rising ocean, even though the data for that area are spotty and incomplete. The real problem might well be land subsidence, which is unrelated to CO_2

concentrations. Miami officials would do better to consider the possible impact of incredibly heavy infrastructure concentrated along the coastline, built upon former swampland.[6]

Example 8: Mumbai/Bombay, India, on the Indian Ocean

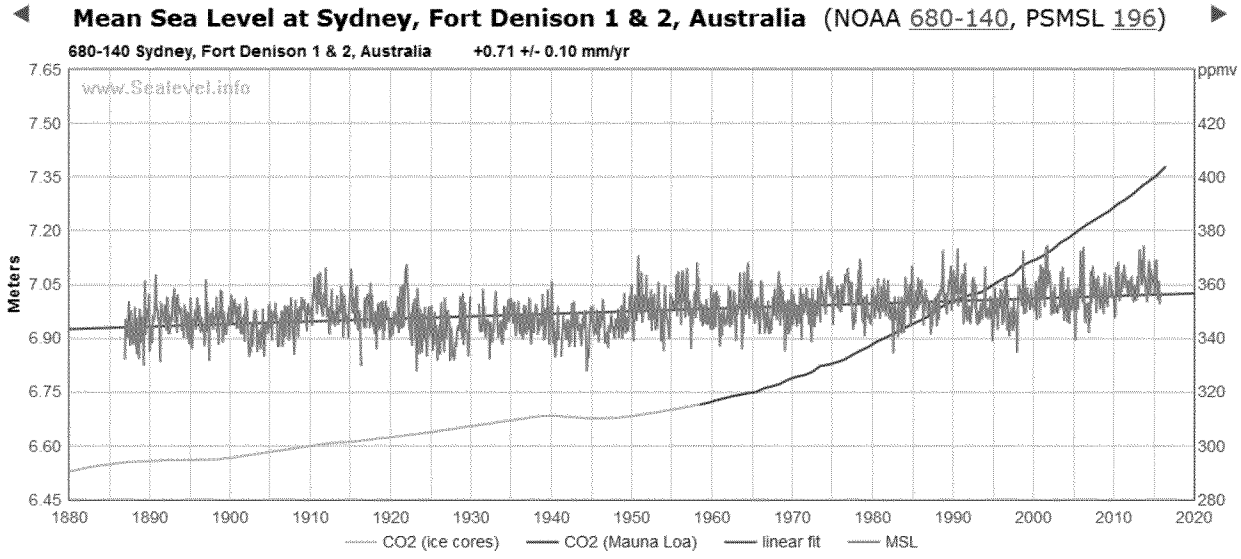


Reliable sea-level records at Mumbai/Bombay, India, stretch back to the 1870s. The slight upward trend in Mumbai/Bombay means if current trends continue, sea level there will rise a mere 3.12 inches in the next 100 years. If glaciers in the Himalayas are melting, as was reported in 2009, why did average sea level in Mumbai *drop* from 2006 to 2009, as indicated in the figure above? Despite the absence of a threat from sea-level rise, the people of India are paying millions and even billions of dollars to increase reliance on alternative energy sources to reduce CO_2 emissions.[7]

[6] Simone Fiaschi and Shimon Wdowinski, "The Contribution of Land Subsidence to the Increasing Coastal Flooding Hazard in Miami Beach," Miami, FL: Rosenstiel School of Marine and Atmospheric Science, no date.

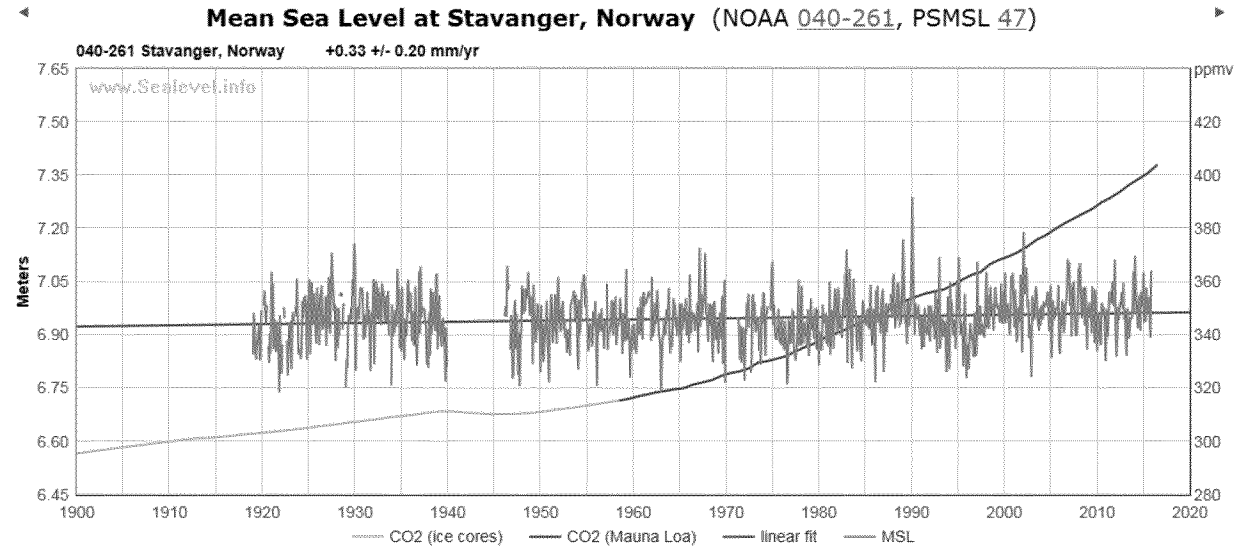
[7] James Lamont, "Himalayan Glaciers Melting Fast, Says Nepal," *Financial Times*, September 1, 2009.

Example 9: Sydney, Australia on the Pacific Ocean



Australia has taken drastic measures to mitigate perceived CO_2 issues, and the people of that country have suffered significant electricity blackouts in the past year. The shift from reliable coal-fired power plants to unreliable renewable energy has raised electricity rates in Australia to be among the highest in the world.[8] Estimated sea-level rise over the next 100 years: 2.76 inches.

Example 10: Stavanger, Norway on the North Sea



As was the case with Sitka, Alaska, one might think global warming would melt glaciers in Norway, causing a rise in sea level, but data from the coastal city of Stavanger, Norway don't bear out that projection. Average sea level has been nearly unchanged there for the past 100 years, and at the current rate will rise a mere 1.3 inches over 100 years, virtually flat.

Analysis

The data and projected trends for these ten well-documented and widely distributed coastal cities point to two conclusions:

- There has been no dramatic and consistent sea-level rise in the past century, and projections show no dramatic rise is likely to occur in the coming century.

- There is no correlation between CO_2 concentrations in the atmosphere and sea-level rise.

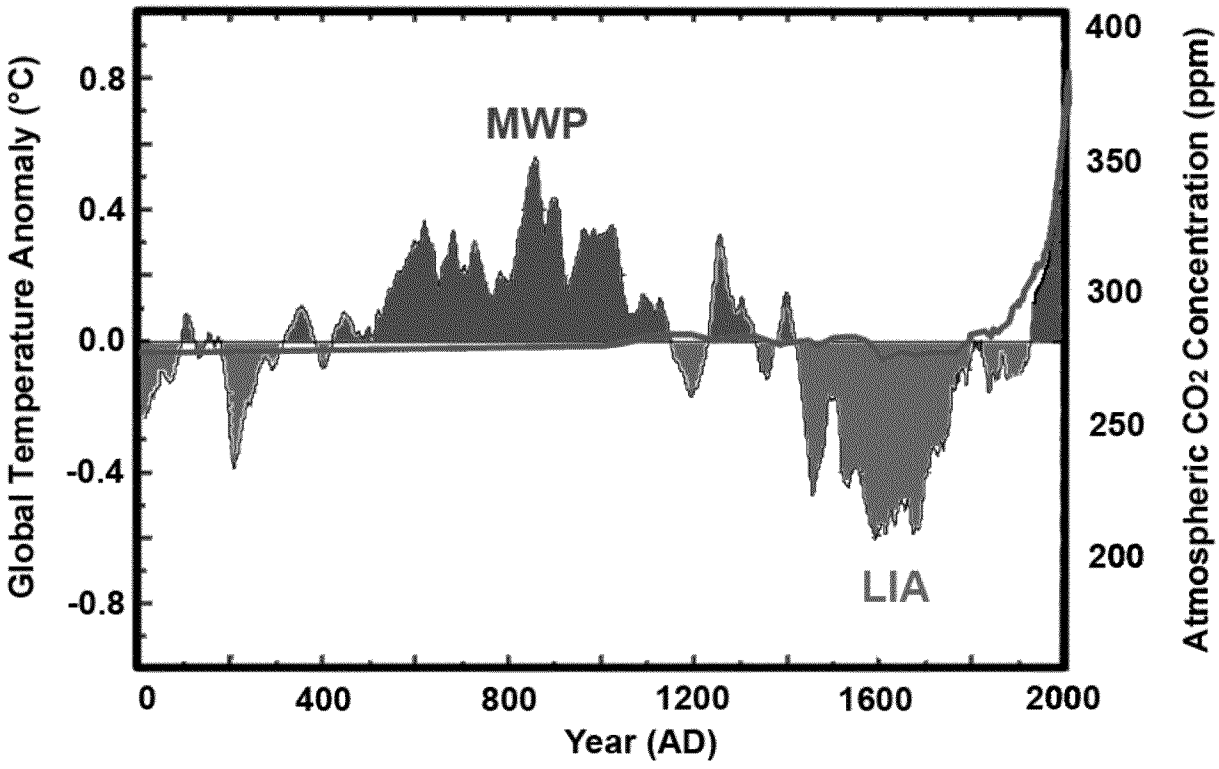
These locations demonstrate sea-level rise is a local or localized phenomenon affected mainly by sea currents, plate tectonics, and land subsidence. Estimates of average global sea-level rise are controversial and subject to manipulation, but they also show only a low rate of rise and a trend that preceded significant human CO_2 emissions.[8]

Sea-level rise is alleged to be caused by global warming due to higher levels of CO_2 in the atmosphere. All measures show Earth has warmed since about 1800, beginning well before atmospheric CO_2 levels rose due to human activities. The data going back a millennium show a Medieval Warm Period, with very warm temperatures, followed by a Little Ice Age starting around the fourteenth century. The world has been coming out of that cool period for the past 200 years.[9] (See Figure 1 below.)

[8] Nils-Axel Mörner, "Sea Level Manipulation," *International Journal of Engineering Science Invention* **6** (August 2017): 48–51. ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726; Albert Parker and Clifford D. Ollier, "California Sea Level Rise: Evidence Based Forecasts vs. Model Predictions," *Ocean & Coastal Management*, July 2017.

[9] "Medieval Period Was Warmer Than Expected," *Antarctica Journal*, July 18, 2017.

Figure 1
Mean Relative Temperature History of the Earth

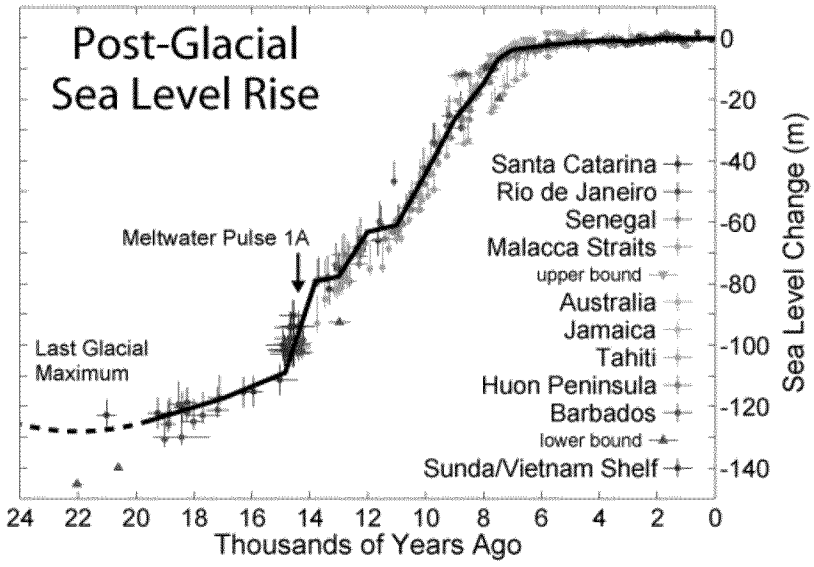


Mean relative temperature history of the Earth (blue, cool; red, warm) over the past two millennia highlighting the Medieval Warm Period (MWP) and Little Ice Age (LIA), together with a concomitant history of the atmosphere's CO_2 concentration (green).[10]

Global average sea level rose dramatically, not recently but following the end the last Ice Age, about 20,000 years ago. Sea levels after that time rose 120 meters but then, 8,000 years ago, the rate of increase leveled off, only inching up annually since then. (See Figure 2.) There is no evidence in this long-term record of an effect of CO_2 on sea levels.

[10] Adapted from C. Loehle and J.H. McCulloch, "Correction to: A 2000-Year Global Temperature Reconstruction Based on Non-Tree Ring Proxies," *Energy & Environment* **19** (2008).

Figure 2
Reconstructed Global Sea Level



Reconstructed global sea level since the Last Glacial Maximum, 20,000 years ago, based on dated worldwide coral and peat deposits.[11]

Conclusion

Fear of rising sea levels is not a justification for reducing CO_2 emissions or adopting policies that would have that effect. The ten case studies of sea-level rise at coastal cities, broadly representative of sites around the world, and the brief analysis that followed undercut a widely repeated but scientifically debunked claim in the climate change debate.

# # #

[11] Adapted from Fairbanks, R.G. 1989. A 17,000 year glacio-eustatic sealevel record: Influence of glacial melting rates on the Younger Dryas event and deep-ocean circulation. *Nature* **342**: 637–42; Toscano, M.A. and Macintyre, I.G., 2003. Corrected western Atlantic sea-level curve for the last 11,000 years based on calibrated 14C dates from Acropora palmate framework and intertidal mangrove peat. *Coral Reefs* **22**: 257–70.

About the Author

Dennis E. Hedke is a partner in the firm Hedke-Saenger Geoscience, Ltd., where he is a consulting geophysicist and conducts research related to Earth's climate, as well as policies that relate to energy and environmental interactions. He also served six years in the Kansas House of Representatives from 2011-16, during the last four of which he was chairman of the House Energy & Environment Committee. That committee initiated legislation that ultimately succeeded in reversing policy that mandated the expansion of renewable energy in Kansas, restoring free-market principles for electrical energy production. He has published multiple scientific articles related to seismic technology applied to oil and gas exploration and development.

Hedke has consulted for numerous companies engaged in hydrocarbon exploration and development in North America, South America, Africa and the Middle East. He has been an invited lecturer and panelist at Kansas State University, the University of Kansas, Wichita State University, community colleges, and high schools. He is past president of the Geophysical Society of Kansas and of the Kansas Geological Society. He has served as a board member of the Kansas Geological Foundation and holds active memberships in the Society of Exploration Geophysicists, American Association of Petroleum Geologists, Denver Geophysical Society, and Geophysical Society of Houston.

Appendix

The CO_2 concentration data in this survey come from three sources:

- 1958–present data are from measurements at the Mauna Loa Observatory in Hawaii, at 3,400 meters altitude in the Northern subtropics.[12]
- 1850–1958 data are from ice core data.[13]
- 1840–1850 CO_2 data are from a different ice core data set.[14]

Sea-level measurements for the ten coastal city graphs represent monthly data points compiled from the National Oceanic and Atmospheric Administration (NOAA) and the Permanent Service for Mean Sea Level (PSMSL), based in Britain. The entire database from which the graphs are drawn comes from 375 measuring stations around the globe.[15]

Sea levels vary widely across the globe. Values for the initial levels in the ten city graphs refer to Mean Sea Level data (MSL), established by the NOAA Center for Operational Oceanographic Products and Services (NOAA-CO-OPS).

The following equations provide the basis for the linear trends appearing on all sea-level curve graphics:

Linear: $y = B + M \cdot x$
$= -26.115 + 2.713 \cdot x$ mm

Quadratic: $y = B' + M \cdot x + A \cdot x^2$
$= -37.525 + 2.713 \cdot x + 0.0280 \cdot x^2$ mm

where:

Date range = 1947/1 to 2016/11
$x = (date - 1981.96)$ (i.e., 1981/12)
slope = M = 2.713 ±0.252 mm/yr
acceleration = $2 \cdot A = 2 \times 0.0280 = 0.0561 \pm 0.0272$ mm/yr²

[12] National Oceanic and Atmospheric Administration, Earth System Research Laboratory Global Monitoring Division, data set from ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_annmean_mlo.txt and ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_mm_mlo.txt .

[13] Data compiled by the NASA Goddard Institute for Space Studies.

[14] Law Dome Atmospheric CO2 Data, World Data Center for Paleoclimatology, and NOAA Paleoclimatology Program.

[15] National Oceanic and Atmospheric Administration, and the Permanent Service for Mean Sea Level, compiled at www.Sealevel.info.