Scattered Notes and 400+ References on the Physical Basis for Climate Change, by Ray Kamada, 2009 to 10/1/2017

Our current global power consumption and thus our waste heat production stands now at about 18 terawatts. However, we have exhausted additional greenhouse gases, principally CO2, to our atmosphere so as to disrupt our once rough equilibrium between incoming and outgoing energy flux. We are now trapping excess heat at a rate of about 400 terawatts, roughly 22 times our waste heat production rate. Excessive trapped heat leading to global warming is not sustainable. And it is thermodynamically obvious that to remain sustainable, any highly technological, civilization must reduce this simple metric, the trapped to waste heat ratio, to near-zero, fairly quickly.

So, the basic logic behind global warming runs thusly:

1. Since Earth is absorbing more energy than it is losing, it is globally warming.

No significant incoming or outgoing energy sources exist other than radiation. For example, we estimate that the incoming kinetic energy flux from meteors and interplanetary dust is at least five orders of magnitude smaller than the net downward radiative flux imbalance, which is about 400 terawatts.

2011: J. Hansen, et al., Earth's energy imbalance and implications, Atmos. Chem. Phys., 11, 13421-13449, 2011
http://www.atmos-chem-phys.net/11/13421/2011/acp-11-13421-2011.pdf

2009: D. M. Murphy, et al., Observationally based energy balance for the Earth since 1950, J. Geophys. Res., 114, D17107, 14 pp.
http://onlinelibrary.wiley.com/doi/10.1029/2009JD012105/pdf

2009: K. E. Trenberth, et al., Earth's Global Energy Budget, Bull. Am. Met. Soc., 90, 311-323, 2009
http://journals.ametsoc.org/doi/abs/10.1175/2008BAMS2634.1

1993: S. G. Love, D. E. Brownlee, A direct measurement of the terrestrial mass accretion rate of cosmic dust, Science, 262, 5133, 550-553
http://science.sciencemag.org/content/262/5133/550

2004: T. Yada, et al., The global accretion rate of extraterrestrial materials in the last glacial period, estimated from te abundance of micrometeorites in Antarctic glacier ice, Earth Planets Space, 56, 67-79, 2004
http://www.terrapub.co.jp/journals/EPS/pdf/2004/5601/56010067.pdf

2004: L. P. Dyrud, et al., Meteor velocity determination with plasma physics, Atmos. Chem. Phys., 4, 817-824, 2004
http://www.atmos-chem-phys.net/4/817/2004/acp-4-817-2004.pdf

2004: I. P. Williams, The velocity of meteoroids, Atmos. Chem. Phys. Discuss., 4, 109-119, 2004
http://www.atmos-chem-phys-discuss.net/4/109/2004/acpd-4-109-2004.pdf

2007: G. Stober, Ch. Jacobi, Meteor head velocity determination, Wiss. Mitteil. inst. f. Meteorol. Univ. Leipzig

http://www.uni-leipzig.de/~jacobi/docs/2007_LIM_5.pdf

Meanwhile, though it had been waning slightly through 2010, the incoming solar energy has been essentially nearly static.

2009: J. L. Lean, D. H. Rind, How will Earth's surface temperature change in future decades?, Geophys. Res. Letts., 36, L15708, Aug. 2009
http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=35AA98168C51B07B78EB838189356229?doi=10.1.1.380.8708&rep=rep1&type=pdf

2009: R. E. Benestad, G. A. Schmidt, Solar trends and global warming, J. Geophys. Res, 114, D14101,18 pp., 2009
https://pubs.giss.nasa.gov/docs/2009/2009_Benestad_be02100q.pdf

2008: M. Lockwood, Recent changes in solar outputs and the global mean surface temperature. III. Analysis of contributions to global mean air surface temperature rise Proc Roy Soc. v.46-4, 2094, 1387-1404, 2008
http://rspa.royalsocietypublishing.org/content/464/2094/1387.abstract

However, nearly 40 years of satellite measurements show that the decrease in the outgoing thermal radiative flux, along with changes in its spectrum, are wholly consistent with the simultaneous rise in the concentration of CO2 and other man-made greenhouse gases. For lack of any other plausible explanation for these changes, the rise in greenhouse gases, centrally CO2, appears to be the primary cause of the current global warming.
http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.131.3867

Absolute Spectrally Resolved Radiance:A Benchmark for Climate Monitoring, James G. Anderson, Richard M.Goody, Yuk L. Yung, John Dykema, Xianglei Huang, Daniel B. Kirk-Davidoff, December 21, 2001
http://yly-mac.gps.caltech.edu/Radiance/Anderson_Arr01.pdf
http://www.nature.com/nature/journal/v410/n6826/full/410355a0.html#B8

Man-made CO2 is double what's needed to drive all of the current rate of CO2 rise.

http://en.wikipedia.org/wiki/Airborne_fraction
http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf
http://www.pnas.org/content/104/47/18866.full.pdf

Plants incorporate carbon12 preferentially. Burning dead plants buried for eons (fossil fuels) releases that extra C12. Falling C13/C12 ratio and O2 depletion say nearly all excess CO2 is man-made.

http://www.publish.csiro.au/?paper=FP08216
http://www.atmos-chem-phys.net/11/1685/2011/acp-11-1685-2011.html
http://www.bgc.mpg.de/service/iso_gas_lab/publications/PG_WB_IJMS.pdf

So, global warming is conclusively almost entirely man-made.

Again, here's the basic logic:

1. A variety of satellite-based studies suggest that any incoming kinetic energy from interplanetary dust and meteors remains orders of magnitude less than the net incoming/outgoing radiative imbalance at the top of our atmosphere, and that the magnitude of that imbalance is presently ~400 terawatts. Thus, as numerous near-surface temperature studies have also confirmed, the Earth is warming globally.

2. The solar radiation, though nearly constant, has in fact been waning very slightly. However, the outgoing radiative flux during the past 30 years has been decreasing, which accounts for nearly all of the radiative imbalance. Moreover, our greenhouse gases: water vapor, CO2, methane, O3, N2O, etc., together provide a spectral signature for outgoing thermal radiative flux. And over a 30 year period, the deepening absorption in the outgoing radiative flux remains entirely consistent with that expected from the increase in those greenhouse gases.

Plausible alternative hypotheses such as: solar, cosmic ray, Earth orbital changes, and natural climatic cycles cannot explain these changes. The solar hypothesis also cannot explain the evident cooling of the stratosphere; no evidence exists that galactic cosmic rays can generate terrestrial clouds sufficient to impact the Earth's radiative balance; Earth orbital and rotational (Milankovitch) cycles are far too slow to explain current changes; and climatic cycles like the Pacific Decadal Oscillation are out of phase.

3. From carbon inventories, we know that humans induce, via fossil fuel burning, deforestation/ desertification and cement production, about twice as much atmospheric CO2 as the average annual increase of ~2.3ppmv. Thus, if natural CO2 emissions have increased by 2.3ppmv, Earth must be absorbing all the anthropogenic CO2, but no natural CO2. If natural CO2 has increased 4.5ppmv, Earth must be absorbing half the natural CO2 emissions, but again ALL of the anthropogenic emissions, etc.

Yet, there's no evidence for such preferential absorption.

Indeed, the carbon isotope data show the opposite.

4. As they grow, plants on the whole absorb more carbon isotope C23 than C13, releasing it when they die and decay, to maintain the atmospheric C13/C12 ratio w/i a narrow range. But when dead plant materials buried for eons are dug up and burned, excess C12 is released, lowering the atmospheric C13/C12 ratio. Numerous studies confirm an on-going decrease in the C13/C12 ratio, consistent with fossil fuel burning.

Thus, the evidence suggests that all or nearly all of the increase in atmospheric CO2 is caused by human activity.

Here's what we know from direct measurements:

a) Directly measured temperature records since 1870, plus UV/visible/IR/microwave satellite data since the 1970's, plus tree rings, ice core, coral reef temperature reconstructions, etc., all show ~ 0.9 degs C of global temperature rise since we started burning fossil fuels in earnest;

b) CO2, a principal greenhouse gas, has risen nearly 44% since 1850 and is still rising. W/o GHGs Earth would be ~59 degs F (33 degs C) colder, meaning GHGs are tropospheric insulators.

c) The satellite/buoy-measured global net radiation at the top of our atmosphere (TOA) is a positive several hundred terawatts. So, Earth has to be warming;

d) The measured shift in outgoing IR spectra at TOA is consistent only with rising CO2 and other GHGs;

e) Decreasing atmospheric C13/C12 carbon isotope ratio. Plants prefer to incorporate C12 over C13, which strongly implies that the excess CO2 comes mainly from digging up and burning fossil fuels.

f) Earth absorbs only about half the annual, human-induced, 36 billion tons of excess CO2. So, man-made CO2 more than suffices to be the sole cause of the build-up.

Links supporting the above points:

a) https://www.climate.gov/news-features/understanding-climate/global-warming-frequently-asked-questions
https://data.giss.nasa.gov/gistemp/graphs_v3/
https://crudata.uea.ac.uk/cru/data/temperature/
https://crudata.uea.ac.uk/cru/data/temperature/HadCRUT4.pdf
https://ds.data.jma.go.jp/tcc/tcc/products/gwp/temp/ann_wld.html
http://ds.data.jma.go.jp/tcc/tcc/products/gwp/temp/mar_wld.html

b) https://www.scientificamerican.com/article/earths-co2-could-spike-to-a-level-not-seen-since-the-dinosaurs/
https://www.giss.nasa.gov/research/briefs/schmidt_05/
https://pubs.giss.nasa.gov/docs/2010/2010_Schmidt_sc05400j.pdf
https://pubs.giss.nasa.gov/docs/2010/2010_Lacis_la09300d.pdf
https://climate.nasa.gov/evidence/
http://www.noaanews.noaa.gov/stories2008/20080423_methane.html
http://cdiac.ornl.gov/ndps/ndp006.html
http://tinyurl.com/yb4gmgs

c)http://journals.ametsoc.org/doi/abs/10.1175/2008BAMS2634.1
http://www.rmets.org/pdf/presentation/20110316-harries.pdf
http://onlinelibrary.wiley.com/doi/10.1029/2009JD012105/pdf
http://www.atmos-chem-phys.net/11/13421/2011/acp-11-13421-2011.pdf
http://onlinelibrary.wiley.com/doi/10.1029/2009JD012105/pdf
http://journals.ametsoc.org/doi/abs/10.1175/2008BAMS2634.1
http://science.sciencemag.org/content/262/5133/550
http://www.terrapub.co.jp/journals/EPS/pdf/2004/5601/56010067.pdf
http://www.atmos-chem-phys.net/4/817/2004/acp-4-817-2004.pdf
http://www.uni-leipzig.de/~jacobi/docs/2007_LIM_5.pdf
http://advances.sciencemag.org/content/3/3/e1601545.full
http://journals.ametsoc.org/doi/full/10.1175/JCLI-D-16-0339.1
http://onlinelibrary.wiley.com/doi/10.1002/2014GL060962/full

d) http://www.nature.com/nature/journal/v410/n6826/full/410355a0.html#B8
http://onlinelibrary.wiley.com/doi/10.1029/2009JD012105/pdf
http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.131.3867
http://yly-mac.gps.caltech.edu/Radiance/Anderson_Arr01.pdf
http://www.nature.com/nature/journal/v410/n6826/full/410355a0.html#B8
http://www.rmets.org/pdf/presentation/20110316-harries.pdf

https://www.eumetsat.int/cs/idcplg?IdcService=GET_FILE&dDocName=pdf_conf_p50_s9_01_harries_v&allowInterrupt=1&noSaveAs=1&RevisionSelectionMethod=LatestReleased
http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=1690262

e) http://europa.agu.org/?uri=/journals/jd/JD089iD07p11731.xml&view=article
http://tinyurl.com/7qakbxx
http://www.publish.csiro.au/?paper=FP08216
http://www.atmos-chem-phys.net/11/1685/2011/acp-11-1685-2011.html
http://www.bgc.mpg.de/service/iso_gas_lab/publications/PG_WB_IJMS.pdf
https://www.bgc-jena.mpg.de/service/iso_gas_lab/publications/PG_WB_IJMS.pdf
https://en.wikipedia.org/wiki/Carbon-13
http://onlinelibrary.wiley.com/doi/10.1029/JD089iD07p11731/full
http://adsabs.harvard.edu/abs/1999TellB..51..170F
https://www.ocean.washington.edu/courses/oc400/Quay%201992.pdf

f) Is the airborne fraction of anthropogenic CO2 emissions increasing?
http://onlinelibrary.wiley.com/doi/10.1029/2009GL040613/pdf
http://www.pnas.org/content/104/47/18866.full.pdf
http://en.wikipedia.org/wiki/Airborne_fraction
https://www.nature.com/articles/ncomms13428

Meanwhile, all other competing theories have been "falsified" (disproved) REPEATEDLY, leaving man-made global warming as the only theory left standing.

E.g.,

a) solar forcing (current trend's the wrong way. 2010 was then the hottest year in directly recorded history, yet also a solar minimum)

b) natural climatic fluctuations (too small)

c) solar orbital (Milankovitch) fluctuations (at least 100x too slow)

d) cosmic rays (trendless for the past 30 years, plus no real theoretical support)

e) CO2 from volcanoes (100 to 300x too small)

f) cloud cover (CO2 feedback's actually positive, not negative)

g) water vapor: The hydrologic cycle's time scale is days to weeks - very rapid. So , global mean water vapor level is controlled by global mean temperature. Ergo, it just amplifies the CO2 heating effect, by roughly a factor of 3; I.e., if CO2 rises, water vapor quickly rises; if CO2 falls, water vapor quickly falls to match. But the global average water vapor level can't rise and fall on its own. It has to be forced by temperature changes. And those temperature changes are caused mostly by increases in other greenhouse gases, principally CO2.

a) The Sun's been cooling, while Earth's been warming. So solar forcing doesn't explain global warming. E.g.,

"Our analysis shows that the most likely contribution from solar forcing a global warming is 7 ± 1% for the 20th century and is negligible for warming since 1980."

2009: R. E. Benestad and G. A. Schmidt, Solar trends and global warming, Journal of Geophysical Research
http://www.agu.org/pubs/crossref/2009/2008JD011639.shtml

"It is shown that the contribution of solar variability to the temperature trend since 1987 is small and downward; the best estimate is −1.3% and the 2σ confidence level sets the uncertainty range of −0.7 to −1.9%. The result is the same if one quantifies the solar variation using galactic cosmic ray fluxes (for which the analysis can be extended back to 1953) or the most accurate total solar irradiance data composite. The rise in the global mean air surface temperatures is predominantly associated with a linear increase that represents the combined effects of changes in anthropogenic well-mixed greenhouse gases and aerosols, although, in recent decades, there is also a considerable contribution by a relative lack of major volcanic eruptions"

M. Lockwood, 2008, Proceedings of the Royal Society,
"Recent changes in solar outputs and the global mean surface temperature. III. Analysis of contributions to global mean air surface temperature rise"

http://rspa.royalsocietypublishing.org/content/464/2094/1387.abstract

When natural climatic fluctuations are filtered out, the continued global warming signal becomes even more distinctive.

http://deepeco.ucsd.edu/~george/publications/09_long-term_variability.pdf
http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=35AA98168C51B07B78EB838189356229?doi=10.1.1.380.8708&rep=rep1&type=pdf

For THIS decade, G. Foster and S. Rahmstorf, Environmental Research Letters, v.6, #4, 2011:

"We analyze five prominent time series of global temperature (over land and ocean) for their common time interval since 1979:"

"three surface temperature records (from NASA/GISS, NOAA/NCDC and HadCRU) and two lower-troposphere (LT) temperature records based on satellite microwave sensors (from RSS and UAH)."

"All five series show consistent global warming trends ranging from 0.014 to 0.018 K yr−1."

"When the data are adjusted to remove the estimated impact of known factors on short-term temperature variations (El Niño/southern oscillation, volcanic aerosols and solar variability), the global warming signal becomes even more evident as noise is reduced."

"The adjusted data show warming at very similar rates to the unadjusted data, with smaller probable errors, and the warming rate is steady over the whole time interval. In all adjusted series, the two hottest years are 2009 and 2010.

The climatological consensus is that ice ages derive from alignments of the Milankovitch (Earth

orbital/precession) cycles, but which require tens of thousands of years to occur. AND only when CO2 levels fall below 280 parts per million by volume. Note that we are at 407ppmv and climbing at ~2.3ppmv per year, with no end in sight.

http://www.columbia.edu/~jeh1/mailings/2011/20110118_MilankovicPaper.pdf
http://www.sciencemag.org/content/297/5585/1287.summary
https://www.researchgate.net/profile/Alan_Mix2/publication/230890578_On_the_Structure_and_Origin_of_Major_Glaciation_Cycles_2_The_100000-Year_Cycle/links/02e7e53c82b1c81f48000000/On-the-Structure-and-Origin-of-Major-Glaciation-Cycles-2-The-100-000-Year-Cycle.pdf
http://www.nature.com/ngeo/journal/v3/n5/full/ngeo828.html

Also, weather is known to be clearly chaotic, but except for shorter term fluctuations like El Nino/La Nina, there's no strong evidence that longer-term climate is actually unpredictably chaotic.

At

http://www.realclimate.org/index.php/archives/2005/11/chaos-and-climate/#comments

Climatologist, Ray T. Pierrehumbert, gives a brief but lucid review of why chaotic effects, plausible physical mechanisms or their synergies cannot combine to fully counteract the global warming impact of an anthropogenically induced doubling in CO2 from pre-industrial levels. See Response 37, et al.

STRATOSPHERIC COOLING CANNOT BE EXPLAINED BY SOLAR HEATING

Yet, while the Earth's surface has been warming, the upper stratosphere has been cooling due to increased CO2, therefore CO2 emissions from that region. Besides being non-existent, increased solar heating can't even begin to explain the fact of stratospheric cooling. Only increased CO2 does.

http://www.pnas.org/content/110/43/17235.full.pdf
http://journals.ametsoc.org/doi/pdf/10.1175/JCLI3585.1
http://www.sciencemag.org/content/301/5632/479.abstract
http://www.xplora.org/downloads/Knoppix/ESPERE/ESPEREdez05/ESPEREde/www.atmosphere.mpg.de/enid/0,55a304092d09/2__Ozone/-_Cooling_nd.html
http://www.realclimate.org/index.php/archives/2006/11/the-sky-is-falling/
https://www.csmonitor.com/Environment/Bright-Green/2009/1110/why-is-earths-upper-atmosphere-cooling

IS IT WARMING? SUPPORTING REFERENCES IN MORE DETAIL

Current Warming Rate 50x Faster than for Paleocene/Eocene Thermal Maximum (PETM)

http://www.nature.com/scientificamerican/journal/v305/n1/full/scientificamerican0711-56.html?WT.ec_id=SCIENTIFICAMERICAN-201107&foxtrotcallback=true
https://www.nature.com/articles/s41467-017-00292-2
http://www.bitsofscience.org/petm-climate-disaster-1588/
https://theconversation.com/mass-extinctions-and-climate-change-why-the-speed-of-rising-greenhouse-gases-matters-56675
https://physics.ucf.edu/~britt/Climate/Reading1-Last%20great%20warming.pdf

WARMING RATE IS ALSO 50x FASTER THAN COMING OUT OF AN ICE AGE

https://www.theguardian.com/environment/climate-consensus-97-per-cent/2016/feb/24/earth-is-warming-is-50x-faster-than-when-it-comes-out-of-an-ice-age
http://www.nature.com/nclimate/journal/v6/n4/full/nclimate2923.html

DELAWARE-SIZED ICEBERG IN JULY 2017
http://www.sciencemag.org/news/2017/07/delaware-sized-iceberg-splits-antarctica
https://www.nbcnews.com/science/environment/iceberg-about-size-delaware-breaks-antarctica-n782096
http://www.foxnews.com/science/2017/07/05/giant-delaware-size-iceberg-set-to-break-off-antarctica.html

SOOT from WILDFIRES DARKENING GREENLAND's ICE SHEET

https://www.washingtonpost.com/news/energy-environment/wp/2017/06/26/wildfires-can-cause-glaciers-to-melt-from-over-a-thousand-miles-away-scientists-find/
http://www.foxnews.com/science/2016/03/04/why-is-greenlands-ice-getting-darker.html
https://www.sciencedaily.com/releases/2016/03/160303145741.htm
https://www.forbes.com/sites/ericmack/2017/08/10/greenland-wildfire-ice-sheet-climate/#7dc537ca64a5

GREENHOUSE GAS EFFECT
https://en.wikipedia.org/wiki/Greenhouse_gas
https://en.wikipedia.org/wiki/Greenhouse_effect

36 GIGATONS OF CO2 PER YEAR
http://www.dailymail.co.uk/sciencetech/article-2764323/China-US-India-push-world-carbon-emissions-up.html
http://news.stanford.edu/2017/01/30/without-action-recent-co2-emissions-decline-wont-last/
http://www.nature.com/nclimate/journal/v7/n2/full/nclimate3202.html?foxtrotcallback=true

CO2 RISING AT ~2.3ppmv per year

https://books.google.com/books?id=QD754Y3C5uIC&pg=PA28&lpg=PA28&dq=CO2+2.3+ppmv&source=bl&ots=-MH3kRknTq&sig=xkXV6kaHDAyiIyD0t4UtUpSF7DA&hl=en&sa=X&ved=0ahUKEwiCgeW8o9DWAhVC32MKHR5CC5AQ6AEINjAE#v=onepage&q=CO2%202.3%20ppmv&f=false
https://wattsupwiththat.com/2015/05/07/noaa-announcement-co2-concentration-surpasses-400ppm-for-the-first-month-since-measurements-began/
https://tamino.wordpress.com/2016/04/17/co2-status-report/

Urban Heat Island Effects Quantified

http://www.sciencedirect.com/science/article/pii/S1470160X12000167
http://journals.ametsoc.org/doi/pdf/10.1175/JCLI3730.1
http://journals.ametsoc.org/doi/abs/10.1175/1520-0442%282003%29016%3C2941%3AAOUVRI

%3E2.0.CO%3B2
http://onlinelibrary.wiley.com/doi/10.1029/2011GL050576/abstract
https://www.scitechnol.com/2327-4581/2327-4581-1-104.pdf
https://www.epa.gov/heat-islands/measuring-heat-islands
https://en.wikipedia.org/wiki/Instrumental_temperature_record#Evaluation
http://onlinelibrary.wiley.com/doi/10.1029/2012JD018509/abstract;jsessionid=FFE90033A80F3616D66E3F7AB3EE9BAC.f04t03
http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-87-8-1073
https://www.coolrooftoolkit.org/wp-content/uploads/2012/04/rural-urban.pdf

COUNTER-INTUITIVE COOL BIAS DUE TO TEMPERATURE SENSOR SITING
https://www1.ncdc.noaa.gov/pub/data/ushcn/v2/monthly/menne-etal2010.pdf
https://www.ncdc.noaa.gov/ushcn/station-siting
http://onlinelibrary.wiley.com/doi/10.1029/2011JD016761/abstract
http://onlinelibrary.wiley.com/doi/10.1029/2011JD016187/full

TIME OF DAY OF TEMPERATURE DATA COLLECTION
http://science.sciencemag.org/content/early/2015/06/05/science.aaa5632
https://judithcurry.com/2015/02/09/berkeley-earth-raw-versus-adjusted-temperature-data/
https://www.stat.washington.edu/peter/593/Trewin.pdf

Ship Intake Port vs. Ambient Bucket Collection Method for recording sea surface temperatures

https://www.ocean-sci.net/9/695/2013/os-9-695-2013.pdf
https://granthaminstitute.com/2015/10/16/taking-the-planets-temperature-how-are-global-temperatures-calculated/
http://www.nature.com/nature/journal/v453/n7195/full/nature06982.html
http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-14-00006.1
http://science.sciencemag.org/content/early/2015/06/03/science.aaa5632.full
http://onlinelibrary.wiley.com/doi/10.1029/2010JD015220/full

SUMMARY OF FINDINGS BY RICHARD MULLER'S GLOBAL TEMPERATURE ANALYSIS GROUP AT UC Berkeley

Global land temperatures have increased by 1.5 degrees C over the past 250 years
Berkeley Earth has just released analysis of land-surface temperature records going back 250 years, about 100 years further than previous studies. The analysis shows that the rise in average world land temperature globe is approximately 1.5 degrees C in the past 250 years, and about 0.9 degrees in the past 50 years.

http://berkeleyearth.org/summary-of-findings/

9 Studies showing Solar changes and Cosmic Rays have little or nothing to do with current global warming

2012: M. Lockwood, Solar Influence on Global and Regional Climates, Surv. Geophys. 33, 503-534
http://link.springer.com/content/pdf/10.1007%2Fs10712-012-9181-3

From flask measurements and ice-core data, we can compute the radiative forcing caused by the observed rises in well-mixed trace (i.e. excluding water vapour) greenhouse gas (GHG) abundances over the same interval (Forster et al. 2007). The abundance of carbon dioxide has risen from 280 ppmv in pre-industrial times to 362.5 ppmv in 2000, which corresponds to ?1.56 W m^{-2}. The corresponding radiative forcing contributions for other trace GHG are the following: ?0.47 W m^{-2} for CH_4, ?0.28 W m^{-2} for CFCs/HCFs/halons, and ?0.14 W m^{-2} for NO_x. This gives a total radiative forcing by trace GHG of $Df_G = 2.45$ W m^{-2}, which is ten times larger than our best estimate of the solar forcing Df_s. Note that this estimate of Df_G is known with considerable certainty from the analysis of absorption spectra. Persistent reports, mainly in the media and on the Internet, that absorption lines are saturated (such that adding more GHG does not cause any radiative forcing change) ignore a huge body of research that extends back to the 1950s and are demonstrably false when one considers the whole IR spectrum (Shine et al. 1995). Energy balance shows that, for steady state, the observed GMAST rise since the Maunder Minimum would correspond to a total forcing, including feedbacks (which include water vapour effects), of Df = 5.15 W m^{-2} (Lockwood 2010). The uncertainty on this estimate is of order ±0.5 W m^{-2}, dominated by the uncertainty in the pre-industrial temperature, with a small contribution from the uncertainty in the power stored in the deep oceans."

2011: J. J. Love, et al., Are secular correlations between sunspots, geomagnetic activity, and global temperature significant?, Geophys.Res.Letts.,38,L21703,6 pp.

"Treated data show an expected statistically-significant correlation between sunspot number and geomagnetic activity, Pearson $p < 10{-}4$, but correlations between global temperature and sunspot number (geomagnetic activity) are not significant, $p = 0.9954$, ($p = 0.8171$). In other words, straightforward analysis does not support widely-cited suggestions that these data record a prominent role for solar-terrestrial interaction in global climate change."

http://web.gps.caltech.edu/~tsai/files/Love_etal_GRL2011.pdf

2010: G.Feulner, S.Rahmstorf, "On the effect of a new grand minimum of solar activity on the future climate on Earth", Geophys. Res. Letts. 37, L05707, 5pps.
http://www.pik-potsdam.de/~stefan/Publications/Journals/feulner_rahmstorf_2010.pdf

2009:R.E.Benestad,G.A.Schmidt,Solar trends and global warming,J.Geophys. Res.

http://onlinelibrary.wiley.com/doi/10.1029/2008JD011639/pdf

"Our analysis shows that the most likely contribution from solar forcing to global warming is 7±1% for the 20th century and is negligible for warming since 1980"

2008:M.Lockwood, Recent changes in solar outputs and the global mean surface temperature.ProcRoySoc.v.46-4,2094,387-1404,2008
http://rspa.royalsocietypublishing.org/content/464/2094/1387.abstract

"... the contribution of solar variability to the temperature trend since 1987 is small and downward; the best estimate is −1.3% and the 2σ confidence level sets the uncertainty range of −0.7 to −1.9%. The result is the same if one quantifies the solar variation using galactic cosmic ray fluxes (for which the analysis can be extended back to 1953)...The rise in the global mean air surface temperatures is predominantly associated with a linear increase that represents the combined effects of changes in anthropogenic well-mixed greenhouse gases and aerosols..."

"2008: M.Lockwood, C.Frohlich, Proc.Royal Society, A,463,2086,pp. 2447-2460,
http://rspa.royalsocietypublishing.org/content/463/2086/2447

"Recent oppositely directed trends in solar climate forcings and the global mean surface air

temperatures"

"There is considerable evidence for solar influence on the Earth's pre-industrial climate and the Sun may well have been a factor in post-industrial climate change in the first half of the last century. Here we show that over the past 20 years, all the trends in the Sun that could have had an influence on the Earth's climate have been in the opposite direction to that required to explain the observed rise in global mean temperatures."

2006: P. Foukal, C. Froehlich, H. Spruit, and T.M. Wigley,

Variations in solar luminosity and their effect on the Earth's climate
https://www.researchgate.net/publication/6818975_Variations_in_solar_luminosity_and_their_effect_on_the_Earth%27s_climate

"In this Review, we show that detailed analysis of these small output variations has greatly advanced our understanding of solar luminosity change, and this new understanding indicates that brightening of the Sun is unlikely to have had a significant influence on global warming since the seventeenth century."

2006: I.G. Usoskin, M. Schussler, S.K. Solanki, K. Mursula
"Solar Activity over the Last 1150 Years: Does it Correlate with Climate?"
http://adsabs.harvard.edu/full/2005ESASP.560...19U

"During these last 30 years, the solar total irradiance, solar UV irradiance, and cosmic ray flux has not shown any significant secular trend, so that at least this most recent warming episode must have another source."

"Our analysis shows that the most likely contribution from solar forcing to global warming is 7±1% for the 20th century and is negligible for warming since 1980"

Even man-made global warming skeptics, Scafetta and West, 2006 say:
http://www.acrim.com/Reference%20Files/Sun%20&%20Global%20Warming_GRL_2006.pdf

"since 1975 global warming has occurred much faster than could be reasonably expected from the sun alone."

THE IMPACT OF VOLCANOES ON CLIMATE CHANGE OVER THE PAST 150 YEARS

CO2 from land-based volcanoes is less than 1% of human contributions."

https://www.newscientist.com/article/dn11638-climate-myths-human-co2-emissions-are-too-tiny-to-matter/

Also,

"...volcanic eruptions produce about 110 million tons of CO2 each year." - about 0.3% of CO2 from human activities."

http://www.scientificamerican.com/article.cfm?id=how-do-volcanoes-affect-w

Moreover, summarizes the U.S. Geological Service...

http://volcanoes.usgs.gov/hazards/gas/climate.php

"The half dozen or so published estimates of the global CO2 emission rate for all degassing subaerial and submarine volcanoes lie in a range from 132 million (minimum) to 378 million (maximum) metric tons per year (Gerlach, 1991; Varekamp et al., 1992; Allard, 1992; Sano and Williams, 1996; Marty and Tolstikhin, 1998; Kerrick, 2001). If estimate medians and author-preferred estimates of these studies are used to lessen the influence of outlier estimates, the range is restricted to about 150-270 million metric tons of CO2 per year. The current anthropogenic CO2 emission rate of some 36,300-million metric tons of CO2 per year is about 100 to 300 times larger than these estimated ranges for global volcanic CO2 emissions."

In fact, major volcanic eruptions like Pinatubo - 1991, Agung - 1963, Bezymianny - 1956 cool not warm the globe via stratospheric injection of aerosolized sulfates.

http://en.wikipedia.org/wiki/Climate_change#Volcanism
http://earthobservatory.nasa.gov/Features/Volcano/

Fig. 1C, Hansen et al., 2005, shows negative net radiation troughs expected from large volcanic eruptions:

https://pubs.giss.nasa.gov/docs/2005/2005_Hansen_ha00110y.pdf
https://pubs.giss.nasa.gov/docs/2005/2005_Hansen_ha01110v.pdf

~10 major volcanic eruptions since 1883 (Krakatoa), 5 from 1902-1912. (last being Mt. Pinatubo in 1991). But view

Table 2, C. F. Mass, D. A. Portman, Major Volcanic Eruptions and Climate: a Critical Evaluation, J. Clim., 566-593, June 1989

http://www.atmos.washington.edu/~dennis/Mass_Portman_89.pdf
Climate impact of the early 20th century volcanoes?

View the Mass/Portman summary:

"Only the largest eruptions (in terms of producing a stratospheric dust cloud) are suggested in the climatic record and modest cooling (~0.1 - 0.2 degs. C) is observed for 1 to 2 years after these large events. Previous suggestions of large cooling during the first few months after volcanic events appear to be unwarranted."

Also see:http://volcanoes.usgs.gov/hazards/gas/climate.php

Now view a graph of the historical temperature record from the HADCRUT4 data. It shows ~0.1 degs C cooling from Krakatoa, and ~0.2 degs C cooling from the FIVE MAJOR eruptions: 1902 - 1914

http://tinyurl.com/b4vor5d

Below shows more incoming than outgoing energy. Ergo, Earth's warming - no ifs, ands, or buts:

0.54 +/- 0.2 W/m^2 or 289 terawatts, 1850-2010

2011: M.Huber,R.Knutti,Anthropogenic and natural warming inferred from changes in earths energy balance,Nature Geosci.Letts.,Dec.4,2011,
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.397.5941&rep=rep1&type=pdf

1.1 +/- 0.4, or 589 terawatts, 1970-2000

2009: D.M.Murphy,et al.An observationally based energy balance for the Earth since 1950, J.Geophs.Res.,114-128,D17107, 2009,
http://tinyurl.com/7q8h622

0.9 +/- 0.3W/m^2 or 482 terawatts, 1998-2010

2012: B. Stevens, S.E. Schwartz, Observing and Modeling Earth's Energy Flows, Surv. Geophys.,33,779-816,p.783
http://tinyurl.com/lc9wq9b

0.9 +/- 0.5W/m^2 or 482 terawatts, 2000-2005

0.90 +/- 0.3 W/m^2 or 483 terawatts, 2005-2014

2016: K.E. Trenberth, J.T. Fasullo, K. Schuckmann, L. Cheng,
Insights into Earth's Energy Imbalance from Multiple Sources
http://journals.ametsoc.org/doi/full/10.1175/JCLI-D-16-0339.1

0.85 +/- 0.15W/m^2 or 456 terawatts, 2003

2010:K.E.Trenberth,J.T.Fasullo,Tracking-Earth's-energy-from-El Nino-to-Global Warming,Surv.Geophys.,DOI 10.1007/s10712-011-9150-2
http://tinyurl.com/nxnzc84

0.62 +/- 0.43W/m^2 or 333 terawatts, 2000 - 2012

Changes in global net radiative imbalance 1985–2012,
2014: R.P. Allan, C. Liu, N.G. Loeb, M. D. Palmer, M. Roberts, D. Smith, P.-L. Vidale
http://onlinelibrary.wiley.com/doi/10.1002/2014GL060962/full

0.75 +/- 0.15 W/m^2 or 456 terawatts, 1993 - 2003

2005:J. Hansen,et al.,Earth's-Energy-Imbalance: Confirmation and Implications, Science,208,5727,1431-1435
https://pubs.giss.nasa.gov/docs/2005/2005_Hansen_ha00110y.pdf

0.5 +/- 0.43W/m^2 or 268 terawatts, 2001-2010

2012:N.G.Loeb et al. Observed-changes in TOA radiation and upper ocean heating consistent within uncertainty, NatureGeosci.,5,110-113
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.601.4805&rep=rep1&type=pdf

0.71 +/- 0.1 W/m^2 or 381 terawatts, 2005-2015

2016: Johnson G. C., Lyman J. M., and Loeb N. G., Improving estimates of Earth's energy imbalance, Nat. Clim. Change, 6, 639–640.
http://www.nature.com/nclimate/journal/v6/n7/full/nclimate3043.html?WT.feed_name=subjects_climate-change

0.59 +/- 0.1 W/m^2 or 317 terawatts, 2006-2013

2017: C. L. Liu, et al. Evaluation of Satellite and reanalysis-based global net surface energy flux and uncertainty estimates, J. Geophys. Res. Atmos. 2017, Jun 27; 122(12), 6250-6272, doi: 10.1002/2017JD026616, PMCID: PMC5530441
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5530441/

5 STUDIES OF DECREASED OUTGOING LONGWAVE RADIATION (OLR, i.e., Earth's thermal radiation)

Consistent with the definition of a greenhouse gas (GHG), OLR decreases coincide, not just in sign and magnitude, but, like a fingerprint also with the spectral distribution of the decrease, as expected from GHG increases over a 43 year span of satellite-based measurements:

2001: J. E. Harries, et al., Increases in greenhouse forcing inferred from the outgoing longwave radiation spectra of the Earth in 1970 and 1997 : Nature, 410, 355-357, Mar. 2001

"Changes in the Earth's greenhouse effect can be detected from variations in the spectrum of outgoing longwave radiation[8, 9, 10], which is a measure of how the Earth cools to space and carries the imprint of the gases that are responsible for the greenhouse effect[11, 12, 13]. Here we analyse the difference between the spectra of the outgoing longwave radiation of the Earth as measured by orbiting spacecraft in 1970 and 1997. We find differences in the spectra that point to long-term changes in atmospheric CH_4, CO_2 and O_3 as well as CFC-11 and CFC-12. Our results provide direct experimental evidence for a significant increase in the Earth's greenhouse effect that is consistent with concerns over radiative forcing of climate."

https://www.atmos.washington.edu/~dennis/321/Harries_Spectrum_2001.pdf
http://www.grandkidzfuture.com/the-climate-problem/ewExternalFiles/Harries%202001%20GHG%20forcing%20change.pdf

2004: J. G. Anderson, et al., Absolute Spectrally Resolved Radiance: A Benchmark for Climate Monitoring (full text) J. Quant. Spect. Rad. Transfer, 85, 3–4, 15, 367–383
https://www.atmos.umd.edu/~dankd/AndersonEtAl2004.pdf

"Both the radiative forcing of the atmosphere resulting from greenhouse gas emissions and aerosols and the response of the atmosphere to that forcing are clearly observable in the spectral signal of

outgoing radiance."

http://yly-mac.gps.caltech.edu/Radiance/Anderson_Arr01.pdf
(full text)

2007: J. A. Griggs and J. E. Harries, Comparison of Spectrally Resolved Outgoing Longwave Radiation over the Tropical Pacific between 1970 and 2003 Using IRIS, IMG, and AIRS, J. Clim., 20, 3982-4001

“The observed difference spectrum between the years 2003 and 1970 generally shows the signatures of greenhouse gas forcing, and also shows the sensitivity of the signatures to interannual variations in temperature.”

http://journals.ametsoc.org/doi/abs/10.1175/JCLI4204.1
http://journals.ametsoc.org/doi/full/10.1175/JCLI4204.1

2007: C. Chen, J. Harries, H. Brindley, M. Ringer, Spectral signatures of climate change in the Earth’s infrared spectrum between 1970 and 2006, J. Clim., 20, 3982-4001.

“Previously published work using satellite observations of the clear sky infrared emitted radiation by the Earth in 1970, 1997 and in 2003 showed the appearance of changes in the outgoing spectrum, which agreed with those expected from known changes in the concentrations of well-mixed greenhouse gases over this period. Thus, the greenhouse forcing of the Earth has been observed to change in response to these concentration changes. In the present work, this analysis is being extended to 2006 using the TES instrument on the AURA spacecraft.”
https://www.eumetsat.int/cs/idcplg?IdcService=GET_FILE&dDocName=pdf_conf_p50_s9_01_harries_v&allowInterrupt=1&noSaveAs=1&RevisionSelectionMethod=LatestReleased

updated by:

2013: D. Chapman, P. Nguyen, M. Halem, A decade of measured greenhouse forcings from AIRS, Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIX, 874313,SPIE 8743, April 29, 2013

"Increased greenhouse gasses reduce the transmission of Outgoing Longwave Radiation (OLR) to space along spectral absorption lines eventually causing the Earth’s temperature to rise in order to preserve energy equilibrium. This greenhouse forcing effect can be directly observed in the Outgoing Longwave Spectra (OLS) from space-borne infrared instruments with sufficiently high resolving power [3, 8]. In 2001, Harries et. al observed significant increases in greenhouse forcings by direct inter-comparison of the IRIS spectra 1970 and the IMG spectra 1997[8]. We have extended this effort by measuring the annual rate of change of AIRS all-sky Outgoing Longwave Spectra (OLS) with respect to greenhouse forcings. Our calculations make use of a 2°x2° degree monthly gridded Brightness Temperature (BT) product. Decadal trends for AIRS spectra from 2002-2012 indicate continued decrease of -0.06 K/yr in the trend of CO2 BT (700cm^{-1} and 2250cm^{-1}), a decrease of -0.04 K/yr of O3 BT (1050 cm^{-1}), and a decrease of -0.03 K/yr of the CH4 BT (1300cm^{-1}). Observed decreases in BT trends are expected due to ten years of increased greenhouse gasses even though global surface temperatures have not risen substantially over the last decade."

http://proceedings.spiedigitallibrary.org/proceeding.aspx?articleid=1690262

Reference Lists for downward longwave, upward longwave, ocean heat budget, and Earth's net energy balance at TOA (top of atmosphere)

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http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-12-00436.12013: K. Wang, R. E. Dickinson, Global atmospheric downward longwave radiation at the surface from ground-based observations, satellite retrievals, and reanalyses
http://onlinelibrary.wiley.com/doi/10.1002/rog.20009/abstract
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> The upper 300 m of the world's oceans act as a giant heat sink and have absorbed the majority of

the excess energy generated by anthropogenic greenhouse gases. But the magnitude of the oceanic heat uptake is uncertain, and differing estimates have led to questions regarding the closure of the global energy budget. Here, a comparison of ocean heat content estimates is presented; the conclusion is that a robust warming of 0.64 W m-2 occurred from 1993 to 2008.

2009: A. Cazenave, et al., Sea level budget over 2003–2008: A reevaluation from GRACE space gravimetry, satellite altimetry and Argo
Simulation Tracks Ocean's Missing Heat - Science News

Total TOA (at top of Earth's atmosphere) Energy Balance

2014: R. P. Allan, et al., Changes in global net radiative imbalance 1985–2012, Geophys. Res. Lett., 41, 15, 5588-5597
2012: Full Text, B. Stevens, S. E. Schwartz, Observing and Modeling Earth's Energy Flows, Surv. Geophys., 33, 779-816
2012: Full Text, K.E. Trenberth, J.T. Fasullo, Tracking Earth's Energy: From El Niño to Global Warming, Surv. Geophys. DOI 10.1007/s10712-011-9150-2
2012: T Andrews, et al., Sensitivity of an Earth system climate model to idealized radiative forcing, Geophys. Res. Letts., 39, L10702, 6 pp., 2012
2012: Loeb et al. - Observed changes in TOA radiation and upper-ocean heating consistent within uncertainty Loeb, et al. Nature Geoscience Jan 22, 2012

> Global climate change results from a small yet persistent imbalance between the amount of sunlight absorbed by the Earth and the thermal radiation emitted back to space. A revised analysis of measured changes in the net radiation imbalance at the top of the atmosphere, and the ocean heat content to a depth of 1,800[thinsp]m, suggests that these two sets of observations are consistent within error margins.

2012, G. L. Stephens, et al., An update on Earth's energy balance in light of the latest global observations, Nature, Geophys., 5, 691S
2011: full text, J. A. Church, et al., Revisiting the Earth's sea-level and energy budgets from 1961 to 2008, Geophys. Res.Letts.38,18,28
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2011: J. Hansen, et al., Earth's energy imbalance and implications, Atmos. Chem. Phys., 11, 13421-13449, 2011
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2011: Full Text, M. Huber, R. Knutti, Anthropogenic-and-natural-warming-inferred-from-changes-in-earths-energy-balance, Nature Geosci. Letts., online, Dec. 4, 2011
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2009: Full Text, D.M. Murphy, et al., An observationally based energy balance for the Earth since 1950, J. Geophs. Res., 114, D17107, 14 pps.
2009: K. E. Trenberth, et al., Earth's Global Energy Budget, Bull. Am. Met. Soc., 90, 311-323, 2009
2008: K. E. Trenberth, J. T. Fasullo - Changes in flow of Energy thru Earth's Climate System, Met. Zeitschrift, 18 Aug. 2008
2006: J. Hansen, Response to Pieklke and Christy on Planetary Heat Storage

2005: News on 0.85 Wm-2 energy imbalance - Columbia Univ., J. Hansen
2005: J. Hansen, et al., Earth's Energy Imbalance: Confirmation and Implications, 208, 5727, pp. 1431-1435, Science, 3 June 2005
2005: Full Text, J. Hansen, et al. Earth's Energy Imbalance: Confirmation and Impilcations
2003: R. A. Pielke, Sr., Heat Storage within the Earth System, Am. Met. Soc. Bull. March 2003, with Hansen response
1998: G. Myhre, et al., New Estimates of radiative forcing due to well mixed greenhouse gases, Geoophys. Res. Letts, 25, 14, 2715, 2718, July 15, 1998
1997: full text, J. T. Kiehl, K. E. Trenberth, Earth's Annual Energy Budget, Bull. Am. Met. Soc., 197
1997: J. T. Kiehl and K. E. Trenberth, Earth's Annual Global Mean Energy Budget, NCAR, Bulletin of the American Meteorological Society 78 (2): 197–208

CO2 is the Primary Greenhouse Gas, not Water Vapor because

Total mean global water vapor level depends exponentially on temperature. So, water vapor will simply amplify any GHG initiated temperature rise.

Confirmed as as early as Rind, et al., 1991,
http://tinyurl.com/7oeyntw

Again, by Held and Soden 2000
http://tinyurl.com/7dsxl4p

And by Dessler et al., 2008
http://geotest.tamu.edu/userfiles/229/Dessler_et_al_2008b.pdf

Global mean water vapor increases/decreases exponentially and rapidly with warming/cooling....

Also see:
http://www.realclimate.org/index.php/archives/2006/02/richard-lindzens-hol-testimony/

Several more peer-reviewed, data-based publications confirming these facts:

http://tinyurl.com/75grct2

http://www.nature.com/nature/journal/v449/n7163/full/nature06207.html

http://www.pnas.org/content/104/39/15248.full.pdf+html

http://www.appmath.columbia.edu/users/sobel/Papers/wright_jcli_09_submitted.pdf

http://www.sciencemag.org/cgi/content/abstract/310/5749/84

http://onlinelibrary.wiley.com/doi/10.1029/2008GL035333/full

http://www.realclimate.org/index.php/archives/2005/11/busy-week-for-water-vapor/

MICHAEL MANN “HOCKEY STICK” CLIMATE CHANGE CONTROVERSY

As of 2013: at least 11 “Climategate” exonerations, and 36 more “hockey sticks"

1. Feb. 2010, RA-10 Inquiry Report: Concerning the Allegations of Research Misconduct Against Dr. Michael E. Mann, Department of Meteorology, College of Earth and Mineral Sciences, The Pennsylvania State University

   “Finding 1: After careful consideration of all the evidence and relevant materials, the inquiry committee finding is that there exists no credible evidence that Dr. Mann had or has ever engaged in, or participated in, directly or indirectly, any actions with an intent to suppress or to falsify data.“ “Finding 2: After careful consideration of all the evidence and relevant materials, the inquiry committee finding is that there exists no credible evidence that Dr. Mann had ever engaged in, or participated in, directly or indirectly, any actions with intent to delete, conceal or otherwise destroy emails, information and/or data related to AR4, as suggested by Dr. Phil Jones. Dr. Mann has stated that he did not delete emails in response to Dr. Jones’ request. Further, Dr. Mann produced upon request a full archive of his emails in and around the time of the preparation of AR4. The archive contained e-mails related to AR4.

   “**Finding 3**. After careful consideration of all the evidence and relevant materials, the inquiry committee finding is that there exists no credible evidence that Dr. Mann had ever engaged in, or participated in, directly or indirectly, any misuse of privileged or confidential information available to him in his capacity as an academic scholar.

   http://www.psu.edu/ur/2014/fromlive/Final_Investigation_Report.pdf

   2. March 2010, House of Commons Science and Technology Committee

   “...insofar as we have been able to consider accusations of dishonesty—for example, Professor Jones’s alleged attempt to “hide the decline”— we consider that there is no case to answer. Within our limited inquiry and the evidence we took, the scientific reputation of Professor Jones and CRU remains intact. We have found no reason in this unfortunate episode to challenge the scientific consensus as expressed by Professor Beddington, that “global warming is happening [and] that it is induced by human activity”.

   http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/387/387i.pdf

3. April 2010, Lord Oxburgh Scientific Assessment Panel April:

"We saw no evidence of any deliberate scientific malpractice in any of the work of the Climatic Research Unit and had it been there we believe that it is likely that we would have detected it. Rather we found a small group of dedicated if slightly disorganised researchers who were ill-prepared for being the focus of public attention. As with many small research groups their internal procedures were rather informal."
http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/387/387i.pdf

4. May 2010, Netherlands Environmental Assessment Agency: “The PBL Netherlands Environmental Assessment Agency has investigated the scientific foundations for the IPCC summary conclusions of the Fourth Assessment Report of 2007 on projected regional climate-change impacts, at the request of the Dutch Minister for the Environment. Overall the summary conclusions are considered well founded, none have been found to contain any significant errors. The Working Group II contribution to

the Fourth Assessment Report shows ample observational evidence of regional climate change impacts, which have been projected to pose substantial risks to most parts of the world, under increasing temperatures."
http://www.pbl.nl/sites/default/files/cms/publicaties/500216002.pdf

5. June 2010 RA-10 Final Investigation Report Involving Dr. Michael E. Mann, The Pennsylvania State University June 4, 2010, "The Investigatory Committee, after careful review of all available evidence, determined that there is no substance to the allegation against Dr. Michael E. Mann, Professor, Dept. of Meteorology, The Pennsylvania State University. More specifically, the Investigatory Committee determined that Dr. Michael E. Mann did not engage in, nor did he participate in, directly or indirectly, any actions that seriously deviated from accepted practices within the academic community for proposing, conducting, or reporting research, or other scholarly activities."
http://live.psu.edu/pdf/Final_Investigation_Report.pdf

6. July 2010, Sir Muir Russell/Independent Climate Change Emails Review

13. Climate science is a matter of such global importance, that the highest standards of honesty, rigour and openness are needed in its conduct. On the specific allegations made against the behaviour of CRU scientists, **we find that their rigour and honesty as scientists are not in doubt.** 14. In addition, we do not find that their behaviour has prejudiced the balance of advice given to policy makers. In particular, we did not find any evidence of behaviour that might undermine the conclusions of the IPCC assessments.
http://www.cce-review.org/pdf/FINAL%20REPORT.pdf

7. July 2010, U.S. Environmental Protection Agency Report:

"petitioners have routinely misunderstood or mischaracterised the scientific issues, drawn faulty scientific conclusions, resorted to hyperbole, impugned the ethics of climate scientists in general, characterised actions as "falsifications" and "manipulation" with no basis for support, and placed an inordinate reliance on blogs, news stories, and literature that is often neither peer reviewed nor accurately summarized in their petitions. Petitioners often "cherry-pick" language that creates the suggestion or appearance of impropriety, without looking deeper into the issues or providing corroborating evidence that improper action actually occurred."
http://www.epa.gov/climatechange/endangerment/petitions.html

8. Sept. 2010, Deutsche Bank Report:

"There is no evidence that scientists have engaged in alleged conspiracies. Three investigations discerned no scientific misconduct in emails stolen from University of East Anglia's Climatic Research Unit." "The few errors identified in the latest IPCC report were primarily in referencing and not in content. Their existence does not support a conspiracy to misrepresent climate research."

https://www.slideshare.net/AAinslie/dbcca-columbia-skepticpaper090710

9. Sept. 2010, U.K. Government Response to the House of Commons Science and Technology Committee 8th Report of Session 2009-10:

The disclosure of climate data from the Climatic Research Unit at the University of East Anglia: "The Government agrees with, and welcomes, the overall assessment of the Science and Technology Committee that the information contained in the illegally-disclosed emails does not provide any evidence to discredit the

scientific evidence of anthropogenic climate change. We note that similar findings were returned by both Lord Oxburgh's and Sir Muir Russell's reviews. In particular, we note the findings of the Muir Russell Review: that the rigour and honesty of the scientists are not in doubt; that there is no evidence of bias in data selection; that there is no evidence of subversion of peer review and that allegations of misusing the Intergovernmental Panel on Climate Change (IPCC) process cannot be upheld."

http://www.official-documents.gov.uk/document/cm79/7934/7934.pdf

10. Feb. 2011, U.S. Dept. of Commerce Inspector General's Review (prompted by none other than Sen. James Inhofe (R-Utah):

"In our review of the CRU emails, we did not find any evidence that NOAA inappropriately manipulated data comprising the GHCN-M dataset or failed to adhere to appropriate peer review procedures. In addition, we found no evidence to suggest that NOAA was non-compliant with the IQA or the Shelby Amendment."
".. the CRU emails do nothing to undermine the conclusions drawn by climate scientists with regard to global warming because the emails involved just one of the many centers across the globe that analyzes climate information. … even if one were to discount the CRU's scientific assertions, other groups that analyze climate information have reached the same conclusion, and, as such, the fundamental science remains very strong."
https://www.oig.doc.gov/OIGPublications/2011.02.18-IG-to-Inhofe.pdf

11. August 2011, National Science Foundation, Office of Inspector General, Office of Investigations

"The research in question was originally completed over 10 years ago. Although the Subject's data is still available and still the focus of significant critical examination, no direct evidence has been presented that indicates the Subject fabricated the raw data he used for his research or falsified his results. Much of the current debate focuses on the viability of the statistical procedures he eniployed, the statistics used to confirm the accuracy of the results, and the degree to which one specific set of data impacts the statistical results. These concerns are all appropriate for scientific debate and to assist the research community in directing future research efforts to improve understanding in this field of research. Such scientific debate is ongoing but does not, in itself, constitute evidence of research misconduct.

Lacking any direct evidence of research misconduct, as defined under the NSF Research Misconduct Regulation, we are closing this investigation with no further action."

https://www.nsf.gov/oig/case-closeout/A09120086.pdf

39 more hockey stick graphs:

2007: 13 independent temperature reconstructions:
https://www.ipcc.ch/publications_and_data/ar4/wg1/en/figure-6-10.html
2006: 6 Surface Temperature Reconstructions spanning 2,000 Years
http://www.nap.edu/openbook.php?isbn=0309102251&page=2
1000 Year Temperature Comparison - 10 Reconstructions
http://en.wikipedia.org/wiki/File:1000_Year_Temperature_Comparison.png
2000 Year Temperature Comparison - 10 Reconstructions
http://commons.wikimedia.org/wiki/File:2000_Year_Temperature_Comparison.png

36 more hockey stick papers:

1. 1998: K. R. Briffa, et al., Influence of volcanic eruptions on Northern Hemisphere summer temperature over the past 600 years, Nature, 393, 450-455, 4 June 1998

http://www.atmosp.physics.utoronto.ca/people/guido/PHY2502/articles/climate-records/Crowley_2000.pdf
https://www.ncbi.nlm.nih.gov/pubmed/10894770
3. 2000: S. Huang, H. N. Pollack, P. Y. Shen, Temperature trends over the past five centuries reconstructed from borehole temperatures, Nature Letts., 403, 756-758
http://www.ldeo.columbia.edu/~peter/Resources/Seminar/readings/Huang_boreholeTemp_Nature%2700
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http://www.sciencemag.org/content/295/5563/2250.abstract
6. T. M. Cronin et al., MWP, LIA, and 20th century temperature variability from Chesapeake Bay, Global Planetary Change, 36, 2003, 17-29
http://holocene.meteo.psu.edu/shared/articles/Croninetal-GlobPlanChng03.pdf
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http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1025.7074&rep=rep1&type=pdf
9. 2005: A. Moberg et al. 2,000 Year Northern Hemisphere Temperature Reconstruction using low and high-res proxy data
ftp://ftp.ncdc.noaa.gov/pub/data/paleo/contributions_by_author/moberg2005/nhtemp-moberg2005.txt
10. 2005: S. Rutherford, et al., “Proxy-Based Northern Hemisphere Temperature Reconstructions”, J.Clim,18, 2308-2329,2005
http://journals.ametsoc.org/doi/pdf/10.1175/JCLI3351.1
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http://www.nature.com/nature/journal/v433/n7026/abs/nature03265.html
12. 2006: R. D'Arrigo, et al., On the long-term context for late twentieth century warming". J.Geophys.Res.,111(D3)
https://www.st-andrews.ac.uk/~rjsw/all%20pdfs/DArrigoetal2006a.pdf
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http://www.sciencemag.org/content/311/5762/841.abstract
14. 2007: A. Moberg, et al., Ch 6: Palaeoclimate, IPCC 4th Assessment Report, 2007
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15. 2007: R. Wilson, et al., "A matter of divergence:Tracking recent warming at hemispheric scales using tree ring data", J.Geophys.Res.,112,D17103,Sept2007
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http://www.rap.ucar.edu/projects/rc4a/millennium/refs/Wahl_ClimChange2007.pdf
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From Michael Mann v. the Competitive Enterprise Institute and the National Review Online.
'The court ruled that defendants are indeed liable for libel because they knew they were lying, yet kept at it.

"Two decisions handed down July 19 in DC Superior Court affirmed climate scientist Michael Mann's right to proceed in his defamation lawsuit against the Competitive Enterprise Institute and the National Review Online for their statements accusing him of data manipulation and fraud. The Court is not buying the Defendants arguments in their Motion to Dismiss that their statements are protected speech under the First Amendment, as mere "opinion," "rhetorical hyperbole," or "fair comment."

"Having been investigated by almost one dozen bodies due to accusations of fraud, and none of those investigations having found Plaintiff's work to be fraudulent, it must be concluded that the accusations are provably false. Reference to Plaintiff, as a fraud is a misstatement of fact." [at 19]"

"The CEI Defendants' persistence despite the EPA and other investigative bodies' conclusion that Plaintiff's work is accurate (or that there is no evidence of data manipulation) is equal to a blatant disregard for the falsity of their statements.

http://www.climatesciencewatch.org/wp-content/uploads/2013/07/Mann_Order_CEI_7-19-13.pdf and http://www.climatesciencewatch.org/wp-content/uploads/2013/07/Mann_v_Natl_Review_Order_7-19-13.pdf

Mann v. Tim Ball isn't going well for Tim.

Apparently, Ball/O'Sullivan wrote a global warming denial book in 2010. But when Ball claimed client/attorney privilege to avoid divulging conversations, turns out O'Sullivan's not really an attorney; never passed the bar, nor has a law degree.

http://www.desmogblog.com/affidavits-michael-mann-libel-suit-reveal-astonishing-facts-about-tim-ball-associate-john-o-sullivan

Apparently, Michael Mann's not the first scientist spurred toward politics by being libeled and harassed by Joe McCarthy types.

University of Victoria climate scientist and author of 190 peer-reviewed science papers, Canadian Prof. Andrew Weaver also decided, enough's enough.

While suing Tim Ball for defamation and libel

https://www.desmogblog.com/weaver-sues-tim-ball-libel

Weaver also chose to run for political office in British Columbia:

"On September 20, 2012, Weaver became a candidate for the Green Party of British Columbia for the riding of Oak Bay-Gordon Head in British Columbia's May 2013 provincial election.[8].

He is now the Deputy Leader of the Green Party of British Columbia. He was elected to represent the riding in the 2013 election, becoming the first member of the Legislative Assembly for the BC Green Party.[9] He was the only BC Green candidate elected in this election.

Weaver becomes the first Green ever elected in a provincial legislature in Canada."

http://en.wikipedia.org/wiki/Andrew_J._Weaver

Andrew Weaver won a $50,000 defamation lawsuit against the Canadian National Post in 2015
https://www.desmogblog.com/2015/02/06/climate-scientists-andrew-weaver-wins-50-000-defamation-suit-against-national-post-terence-corcoran

Besides U. Victoria climatologist Michael Mann and Andrew Weaver both suing Ball for libel
https://www.desmogblog.com/weaver-sues-tim-ball-libel

Whereupon, “The website *Canada Free Press* has issued a retraction and apology (full text below) to University of Victoria climate modeller Dr. Andrew Weaver for the content of an article written by Dr. Tim Ball.”

https://www.desmogblog.com/canadafreepress-apology-weaver

Tim Ball has other "legal issues". For example, Ball has tried to "enhance" his own resume, claiming,

"I was the first Canadian Ph.D. in Climatology and I have an extensive background in climatology, especially the reconstruction of past climates and the impact of climate change on human history and the human condition.. I have a Ph.D from the University of London, England and for 32 years I was a Professor of Climatology at the University of Winnipeg."

But U. of Winnipeg's Prof. Dan Johnson says they've never even had a climatology department.

For which remark Ball sued Johnson.

So, in response, Johnson added:

".. he was a junior Lecturer who rarely published, and spent 8 years as a GEOGRAPHY professor. His work does not show any evidence of research regarding climate and atmosphere and the few papers he has published concern other matters."

http://scienceblogs.com/deltoid/2007/06/ball_abandons_lawsuit.php
http://www.desmogblog.com/timothy-f-ball-tim-ball

Whereupon Ball withdrew his suit.

Tim Ball's peer-reviewed publications?

1983:"historical records of temperatures for Central Canada."
1982:"Changes in migration pattern of geese"
1981:"historical records of climate from Hudson Bay company.""

Sea Level links

General:

http://en.wikipedia.org/wiki/Current_sea_level_rise
http://www.cmar.csiro.au/sealevel/sl_data_cmar.html
http://www.skepticalscience.com/sea-level-rise-intermediate.htm
http://www.skepticalscience.com/sea-level-rise-predictions.htm

Satellite data:
http://sealevel.colorado.edu/

Tide data:
http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml
http://tidesandcurrents.noaa.gov/sltrends/sltrends_global.shtml

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Peer-reviewed literature:

* Church 2008: "Understanding global sea levels: past, present and future"

http://nora.nerc.ac.uk/5379/
http://academics.eckerd.edu/instructor/hastindw/MS1410-001_FA08/handouts/2008SLRSustain.pdf

* Church 2006: "A 20th century acceleration in global sea-level rise"

http://www.agu.org/journals/ABS/2006/2005GL024826.shtml
http://naturescapebroward.com/NaturalResources/ClimateChange/Documents/GRL_Church_White_2006_024826.pdf

* Church 2006: "Sea-level rise at tropical Pacific and Indian Ocean islands"

http://www.mendeley.com/research/sealevel-rise-at-tropical-pacific-and-indian-ocean-islands/
http://www.dssoftware.pl/~mpopkiewicz/Bin/ZiemiaNaRozdrozu/Materialy/OceanLevel(Maldives).pdf

* Jevrejeva 2008: "Recent global sea level acceleration started over 200 years ago?"

http://www.pol.ac.uk/psmsl/author_archive/jevrejeva_etal_1700/2008GL033611.pdf

"We provide observational evidence that sea level acceleration up to the present has been about 0.01 mm/yr2 and appears to have started at the end of the 18th century. Sea level rose by 6 cm during the 19th century and 19 cm in the 20th century."

* Nerem 2006: "Satellite Measurements of Sea Level Change: Where Have We Been and Where Are We Going"

http://earth.esa.int/workshops/venice06/participants/1092/paper_venice06.pdf

"The average rate of sea level change obtained from tide gauges over the last century is +1.8 mm/year. In comparison, altimeter measurements have shown an average rise of +3.2 ± 0.4 mm/year since 1992. The causes of the present-day rate are a combination of increases in ocean temperatures and land ice melt from mountain glaciers, Greenland, and Antarctica."

* Rahmstorf 2010: "A new view on sea level rise"

http://www.nature.com/climate/2010/1004/full/climate.2010.29.html

"A number of recent studies taking the semi-empirical approach have predicted much higher sea level rise for the twenty-first century than the IPCC, exceeding one metre if greenhouse gas emissions continue to escalate"

* Vermeera 2009: "Global sea level linked to global temperature"

http://www.pnas.org/content/early/2009/12/04/0907765106.full.pdf

As Glaciers Melt, Science Seeks Data on Rising Seas - NYTimes.com

Researchers have been startled to see signs of rapid melting in Greenland and Antarctica, but lack data to precisely calculate how much flooding could result.

File:Recent Sea Level Rise.png - Wikipedia, the free encyclopedia

Climate Change and Sea Level Rise
Climate Dynamics, Volume 34, Number 4 - SpringerLink
Current sea level rise - Wikipedia, the free encyclopedia
Global Sea Level Rise Graph tops 1990 IPCC projection
Global sea level linked to global temperature
Kinematic Constraints on Glacier Contributions to 21st-Century Sea-Level Rise
0907765106.full.pdf (application/pdf Object)
MG_Leuliette2004.pdf (application/pdf Object)

Millennial Scale Sea level Measurements

Reconstructing sea level from paleo and projected temperatures 200 to 2100 AD
Modern-day Sea Level Rise Skyrocketing - Science News
Increase began with the Industrial Revolution
Climate related sea-level variations over the past two millennia
Kemp et al. sea level variation over two millenia

NASA satellites detect pothole on road to higher seas
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.
sl_noib_global.jpg (JPEG Image, 1048x744 pixels)
SOTC: Sea Level
Relationship between cryosphere and global sea level
Sea Level
:: Sea-level Rise :: CSIRO & ACECRC ::
CSIRO Marine and Atmospheric Research/ACE CRC Sea level web site

SEA LEVEL RISE PROJECTIONS:
http://www.nature.com/nclimate/journal/v6/n4/full/nclimate2923.html

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"Skeptics": Dr. Nils-Axel Mörner

http://en.wikipedia.org/wiki/Nils-Axel_M%C3%B6rner

* Mörner asserts "a significant sea level fall in the last 30 years" in the Maldives:

Mörner 2003: "New perspectives for the future of the Maldives"

http://stephenschneider.stanford.edu/Publications/PDF_Papers/MornerEtAl2004.pdf

* Mörner's claim refuted twice in the scientific literature:

---- Woodworth 2005: "Have there been large recent sea level changes in the Maldive Islands?"

http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VF0-4GBD6SS-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_docanchor=&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=b8b8366517bac336789e3d2d6bb92039

"[T]he suggestion of such a fall [in sea level in the Maldives] has been examined from meteorological and oceanographic perspectives and found to be implausible"

--- Church 2006: "Sea-level rise at tropical Pacific and Indian Ocean islands"

http://www.dssoftware.pl/~mpopkiewicz/Bin/ZiemiaNaRozdrozu/Materialy/OceanLevel(Maldives).pdf

From Church 2006: "We find no evidence for the fall in sea level at the Maldives as postulated by Mörner et al. (2004)."
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* Mörner asserts that dowsing is real; as such he was elected "Deceiver of the Year" in 1995 by the Swedish Skeptics' Association:

http://en.wikipedia.org/wiki/Nils-Axel_M%C3%B6rner
http://translate.googleusercontent.com/translate_c?hl=en&ie=UTF8&prev=_t&rurl=translate.google.com&sl=auto&tl=en&twu=1&u=http://www.vof.se/visa-forvillare1995&usg=ALkJrhhlK09UMY7KJx_vgukAAiTbbXtRrA

* The International Union for Quaternary Research (INQUA), which Mörner is a former member of, formally rejects Mörner's position on climate change and reports that Mörner has "misrepresented his position" with them:

http://www.environmentaldefense.org/documents/3868_morner_exposed.pdf

Ice Caps Melting

2010 arctic ice cap summer minimum
: Melt isn't as bad as 2007, but still reaches number three in the record books

A541_3103.jpg - Science News
: Science News: the bi-weekly news magazine of the Society for Science & the Public

Arctic Sea Ice (Part 1): Is the Arctic Sea Ice recovering? A reality check
: Examines the science and arguments of global warming skepticism. Common objections like 'global warming is caused by the sun', 'temperature has changed naturally in the past' or 'other planets are

warming too' are examined to see what the science really says.

Arctic Change: Overview

Arctic Ice Still Thinning - Science News

Earth’s iron heart can melt, plus Atlantic weather and more ice thinning in this week’s news

Arctic Sea Ice News & Analysis

Year-round analysis of Arctic sea ice conditions, together with daily sea ice images and additional information.

Arctic Report Card - Sea Ice Cover - Perovich, et al.

Arctic Sea Ice Extent 2011-2012.png

Polar Science Center » Arctic Sea Ice Volume Anomaly, version 2

Arctic Sea Ice News & Analysis

Year-round analysis of Arctic sea ice conditions, together with daily sea ice images and additional information.

BPIOMASIceVolumeAnomalyCurrent.png (PNG Image, 1378x992 pixels)

climate-ice-seaice-extent-trend-sep09.png (PNG Image, 420x240 pixels)

Fits And Starts - Science News

What regulates the flow of huge ice streams?

Greenland Glacial Quakes Becoming More Common - Science News

Science News: the bi-weekly news magazine of the Society for Science & the Public

Increasing rates of ice mass loss from the Greenland and Antarctic ice sheets revealed by GRACE

Geophysical Research Letters publishes short, concise research letters that present scientific advances that are likely to have immediate influence on the research of other investigators. GRL letters can focus on a specific discipline or apply broadly to the geophysical science community.

Melting Arctic Ice: What Satellite Images Don't See - TIME

For scientists studying Arctic sea ice, satellite observations are essential. But high-altitude analyses can miss crucial information gathered on the ground.

Melting At The Microscale - Science News

Studying sea ice close-up may improve climate models

Polar Science Center - APL-UW - Arctic Sea Ice Volume

Really Bad Year For Arctic Sea Ice - Science News

New European data indicate this summer’s loss of ice cover matches the 2007 record

seaice2009fig2.jpg (JPEG Image, 1000x553 pixels)

Summer Arctic Melt Among Worst Ever - Science News

No obvious weather patterns explain near-record annual ice retreat

Toppling Icebergs Sped Breakup Of Larsen B Ice Shelf - Science News

Science News: the bi-weekly news magazine of the Society for Science & the Public

Longer growing seasons do not increase net carbon uptake in the northeastern Siberian tundra

JG_description

Arctic Amplification

2011: Chen, et al., Projected regime shift in Arctic cloud and water vapor feedbacks: Env. Res. lett. 6 (2011)044007 *8pps)

Accelerated Warming - Arctic Amplification

2012: Bintanja, linden, hazeleger, Boundary Layer Stability and Arctic Climate Change

2011: Yoo, Feldstein, Lee, The impact of the Madden-Julian Oscillation trend on the Arctic amplification of surface air temperature during the 1979–2008 boreal winter, Geophys. Res. Letts. 38,L24804,ppp, 2011

> Geophysical Research Letters publishes short, concise research letters that present scientific advances that are likely to have immediate influence on the research of other investigators. GRL letters can focus on a specific discipline or apply broadly to the geophysical science community.

2011:Chen, et al., Projected regime shift in Arctic cloud and water vapor feedbacks, Env.Res.Letts.6,4,044007

> IOPscience is a unique platform for IOP-hosted journal content providing site-wide electronic access to more than 130 years of leading scientific research, and incorporates some of the most innovative technologies to enhance your user-experience.

Shrinking lakes of the Arctic: Spatial relationships and trajectory of change

> Geophysical Research Letters publishes short, concise research letters that present scientific advances that are likely to have immediate influence on the research of other investigators. GRL letters can focus on a specific discipline or apply broadly to the geophysical science community

Methane Rise

2.3.2 Atmospheric Methane - AR4 WGI Chapter 2: Changes in Atmospheric Constituents and in Radiative Forcing

How rapidly is permafrost changing - Romanovsky

> Authoritative expert essay on Polar Bears in recent decades.

Methane catastrophe

The methane hydrate feedback revisited « Climate Progress

Permafrost : Weather Underground

> Weather Underground provides weather information for worldwide locations, including current conditions, hourly forecasts, radar and satellite maps. Specialized weather products include severe weather alerts, hurricane tracking, ski and sports weather, marine and aviation weather and user-contributed photographs.

Sarah’s Tale Of Arctic Warming - Science News

> Observations from one remote village as its climate changes

Siberia's Climate Time Bomb: Thawing Permafrost Could Spell Disaster

> CHERSKY, Russia — The Russian scientist shuffles across the frozen lake, scuffing aside ankle-deep snow until he finds a cluster of bubbles trapped

under the ice. With a cigarette lighter in one hand and a knife in the other, he lances the ice like a blister.

Deforestation

improvedestimatesofnetcarbonemissionsfromlandcoverchangeinthetropicsforthe1990s, Global Biogeochemical Cycles, v18, 2004

Estimating tropical deforestation from Earth observation data from Carbon Management (2010) 1(2), 271-287

Carbon emissions fro tropical deforestation and regrowth based on satellite observations of the 1980s and 1990s, PNA, 2002

Forest Death, Loss of Climate Protectors - NYT

> Trees, natural carbon sponges, help keep heat-trapping carbon dioxide out of the atmosphere. But insect and human threats are taking a heavy toll on them.

Deforestation - Wikipedia, the free encyclopedia

linking deforestation to geology and agri demand

> Studies link deforestation to geology and agricultural demand

Map reveals extent of deforestation in tropical countries | Environment | guardian.co.uk

> Over five years millions of hectares of tropical forests have been cleared to make way for farming, almost half of it in Brazil

2011 Toomey et al. - Remotely sensed heat anomalies linked with Amazonian forest biomass declines, Geophys. Res. Lett. 38, L19704, 5pp., 2011

> Geophysical Research Letters publishes short, concise research letters that present scientific advances that are likely to have immediate influence on the research of other investigators. GRL letters can focus on a specific discipline or apply broadly to the geophysical science community.

Trees Have A Tipping Point - Science News

> Amount of forest cover can shift suddenly and unexpectedly

Poleward Migration

2011: Chen et al., Rapid Range Shifts of Species Associated with High Levels of Climate Warming, Science 19, Aug. 2011 v. 333, 6045, pp. 1024-1026

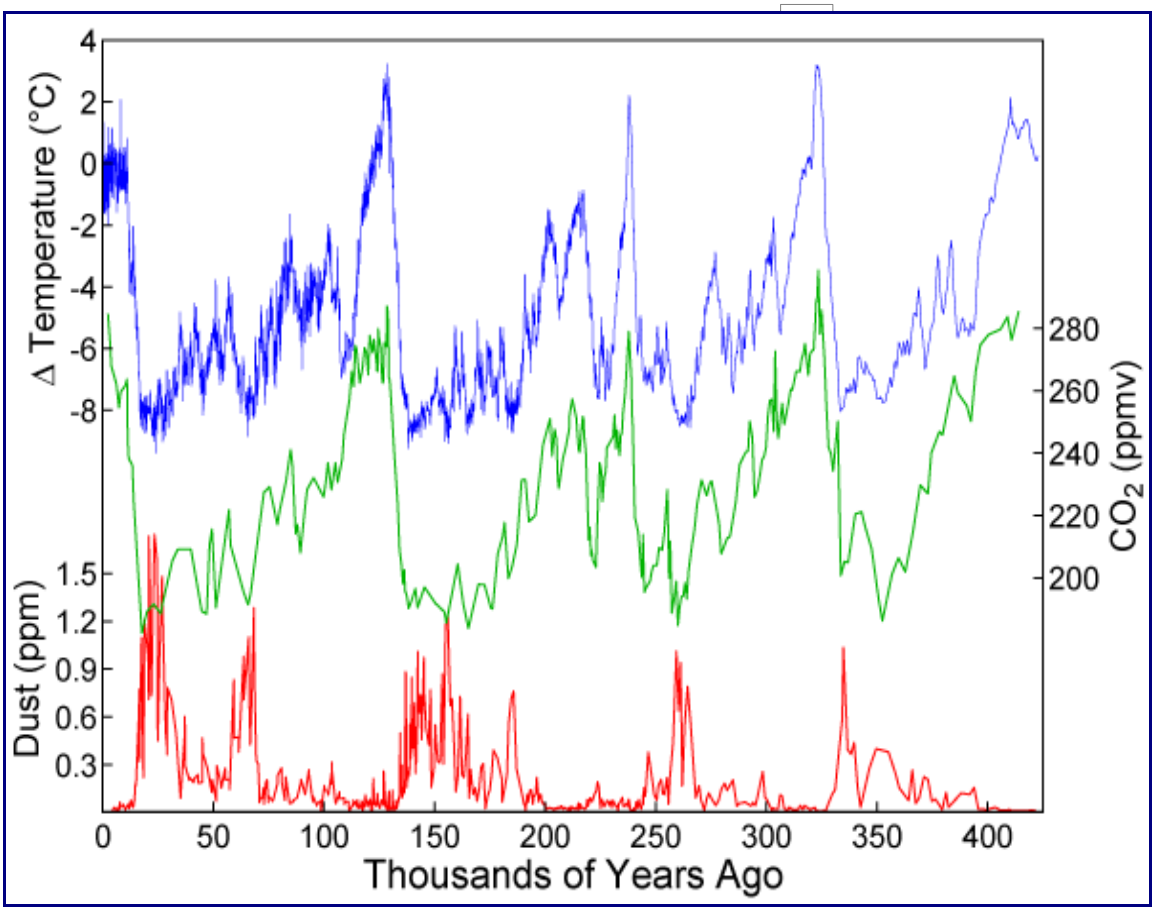
Plants And Animals Moving As Climate Changes, Study Finds

> A new study suggests that plants and animals are moving as the climate changes. Red Orbit reports on research published in the journal Science, showing that as temperatures rise, plants and animals are moving away from the equator and to higher elevations.

Climate Change May Favor Couch-potato Elk - Science News

> Heading for the hills every spring appears worse than staying put

According to the Vostok Antarctic ice core data, did geological temperatures rise before CO2 rose, or not? Ray Kamada's own analysis of this question shows that...



Check the 400k year Vostok Antarctic ice core graph during major warming periods: en.wikipedia.org/wiki/File:Vostok-ice-core-petit.png , from www.ncdc.noaa.gov/paleo/icecore/antarctica/vostok/vostok_data.html

Pull graph into Word. Set page to landscape/legal. Stretch graph to full screen for max time resolution (~300 years at 1600 pixels). Check lags by aligning vertical ruler against CO2/temperature start/peak. For the 4 warming eras that match or exceed current temperatures (what we want to check), the honest will see that:

305-340,000 BC. Start and peak of temperature rise lagged start and peak of CO2 rise.

230-245,000 BC. Start of temp rise lagged CO2 rise. Temp peak coincided with CO2 peak.

110-140,000 BC. Start of temp rise lagged start of CO2 rise. CO2 peak slightly lagged temp peak.

now - 15,000 BC. Start of temp rise lagged start of CO2 rise. CO2 and temperature haven't peaked yet.

So, CO2 lagged temperature just once at seven critical points. Five of six display the opposite. Ergo: that - CO2 increases lagged temperature by ~800 years during past warming periods appears to be yet another myth.

However, the science consensus is that solar orbit variations tens of thousands of years long drive ice

age/warming cycles. And we're already in a warming period. Plus, current CO2 exceeds prior Vostok CO2 peaks by a huge 100 ppm, with +250ppm looming. So, we're now in uncharted territory with humans as the new X factor.

CO2 Data from Ice Cores from 800,000 years to recent from 8 Antarctic Stations:

EPICA Dome C, EPICA Dronning Maud Land, Law Dome, Siple Dome, Talos Dome Taldice, Vostok, and WAIS Divide WDC06A

https://www.ncdc.noaa.gov/paleo-search/study/17975

Current 400+ ppmv CO2 Levels and 36 gigatons global CO2 Emissions Data

https://www.esrl.noaa.gov/gmd/ccgg/trends/global.html
http://www.globalcarbonproject.org/carbonbudget/16/highlights.htm

https://www.washingtonpost.com/news/energy-environment/wp/2016/11/13/stunningly-good-news-for-the-planet-carbon-emissions-were-flat-for-the-third-straight-year/
https://www.sciencedaily.com/releases/2013/11/131118193127.htm
http://www.dailymail.co.uk/sciencetech/article-2764323/China-US-India-push-world-carbon-emissions-up.html

My Updated Calculation of Global CO2 Emissions Showing 36 Gigatons or 4.5 ppmv per Year

The Global Carbon Atlas shows that Americans now emit ~14.9% of global anthropogenic CO2,

http://www.globalcarbonatlas.org/en/CO2-emissions

~25% via auto exhaust, 40% for home heat/light/appliances, the rest for industrial/commercial, etc.

Average American drives ~13.5k miles/year and gets ~24.8mpg.

https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_04_23.html
https://www.fhwa.dot.gov/ohim/onh00/bar8.htm
https://phys.org/news/2016-11-average-fuel-economy-high-mpg.html

13.5k miles/24.8mpg = ~544 gls of gas/year, ~a tank/week.

Gasoline weighs ~6 lbs/gl. So, we burn ~6 x 544 = 3,266 lbs of gasoline per year.

Gasoline is mostly iso-octane - C8H18 (C=12, H=1, molecular weight = 114); heptane is C7H16 (molecular. Weight = 100). So, 89 octane yields an average molecular weight of ~113.

Burning a molecule of gasoline yields ~7.9 molecules of CO2 (O=16; ergo, molecular weight 7.9 x 44 = ~348).

So, the average U.S. auto emits ~(348/113) x 3,266 = ~10,000 lbs or ~ 5.0 tons of CO2/year.

We have ~253 million U.S. cars/trucks, that's an annual 253m x 5.00 = 1.26 billion tons CO2.

https://www.google.com/search?source=hp&q=how+many+cars+in+the+U.S.&oq=how+many+cars+in+the+U.S.&gs_l=psy-ab.3..0i22i30k1.1569.6890.0.8011.25.23.0.0.0.0.199.2815.1j20.21.0....0...1.1.64.psy-ab..4.21.2812...0j0i131k1j0i22i10i30k1.0.ngdccu8Gwzc

So, the U.S. total yearly CO2 output is 1.26/0.25 = 5.06 billion tons, which is ~19% of the annual global total, or

5.06/0.149 = ~33.9 billion tons of CO2.

Add 5% for cement production and we get **~36 billion tons.**

And here's how 36 billion tons of anthropogenic, EXCESS CO2 translates to an annual 4.5 parts per million by volume (ppmv) in emissions, about double the annual CO2 rise rate of 2.3 ppmv.

Earth's radius = ~6,370 kms.

Scale Height of the atmosphere (height if it were all at sea level pressure) ~8 km.

Sea Level Air Density: ~1.29 kg per cubic meter

Mass of the atmosphere is: ~4pi x 6,370,000m2 x 8,000m x 1.29 kg/m3 = ~5.26 quadrillion metric tons.

How much of that is CO2?

At a current 404 ppmv, it's (404/1,000,000) x 5.26 quadrillion tons = ~2.12 trillion tons.

So, 1 ppm of CO2 is 2.12T/404 = 5.26 billion tons. But by volume 1 ppmv of CO2 is 44/29 (relative molecular weights CO2 vs. air) x 5.26 = 8 billion tons.

Thus, consistent with far more detailed carbon inventories, humans are adding 36/8 = ~4.5ppmv of CO2 annually.

http://en.wikipedia.org/wiki/Airborne_fraction

So, about half of that 4.5ppmv of annual, man-made CO2 remains in our air to increase yearly CO2 levels. When coupled with the fact that natural sinks and sources for CO2 remained in close balance from ~10,000 BC to ~1850, this also suggests that humans are wholly and unequivocably responsible for all of the rise in CO2 since 1850.

Ergo, we have increased global CO2 by 44% from ~280 to 404 ppmv in ~170 years.

Regarding THE SCIENTIFIC CONSENSUS ON MAN-MADE CLIMATE CHANGE

Over a 25-year period, surveys of climatologists and allied fields generally show increasing consensus regarding global warming and its man-made cause.

2016: J. Cook, et al., Consensus on consensus: a synthesis of consensus estimates on human-caused global warming

John Cook[1,2,3,16], Naomi Oreskes[4], Peter T Doran[5], William R L Anderegg[6,7], Bart Verheggen[8], Ed W Maibach[9], J Stuart Carlton[10], Stephan Lewandowsky[11,2], Andrew G Skuce[12,3], Sarah A Green[13], Dana Nuccitelli[3], Peter Jacobs[9], Mark Richardson[14], Bärbel Winkler[3], Rob Painting[3] and Ken Rice[15]

Environmental Research Letters, Volume 11, Number 4
http://iopscience.iop.org/article/10.1088/1748-9326/11/4/048002/meta

2013: J. Cook, et al., Quantifying the consensus on anthropogenic global warming in the scientific literature, Env. Res. Lett., 8, 024024

http://iopscience.iop.org/1748-9326/8/2/024024/article

"We analyze the evolution of the scientific consensus on anthropogenic global warming (AGW) in the peer-reviewed scientific literature, examining 11 944 climate abstracts from 1991–2011 matching the topics 'global climate change' or 'global warming'. We find that 66.4% of abstracts expressed no position on AGW, 32.6% endorsed AGW, 0.7% rejected AGW and 0.3% were uncertain about the cause of global warming."

"Among abstracts expressing a position on AGW, 97.1% endorsed the consensus position that humans are causing global warming."

"In a second phase of this study, we invited authors to rate their own papers. Compared to abstract ratings, a smaller percentage of self-rated papers expressed no position on AGW (35.5%)."

"Among self-rated papers expressing a position on AGW, 97.2% endorsed the consensus."

"For both abstract ratings and authors' self-ratings, the percentage of endorsements among papers expressing a position on AGW marginally increased over time. Our analysis indicates that the number of papers rejecting the consensus on AGW is a vanishingly small proportion of the published research."

2011: Stephen J. Farnsworth, S. Robert Lichter (October 27, 2011). "The Structure of Scientific Opinion on Climate Change". International Journal of Public Opinion Research.

http://ijpor.oxfordjournals.org/content/early/2011/10/27/ijpor.edr033.short

Either American Meteorological Society or American Geophysical Union members and listed in American Men and Women in Science. “97% of the 489 scientists surveyed agreed that global temperatures have risen over the past century. Moreover, 84% agreed that “human-induced greenhouse warming” is now occurring.” Only 5% disagreed with the idea that human activity is a significant cause of global warming.”

2010: William R. L. Anderegg, James W. Prall, Jacob Harold, and Stephen H. Schneider (April 9, 2010). "Expert credibility in climate change". Proceedings of the National Academy of Sciences of the United States of America.

http://www.pnas.org/content/107/27/12107.abstract
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2901439/

“97–98% of the climate researchers most actively publishing in the field support the tenets of ACC (Anthropogenic Climate Change) outlined by the Intergovernmental Panel on Climate Change, and (ii) the relative climate expertise and scientific prominence of the researchers unconvinced of ACC are substantially below that of the convinced researchers.“

2009: Doran, P T; MK Zimmerman, "Examining the Scientific Consensus on Climate Change". EOS90(3):22–23.

“from 3,146 of the 10,257 polled Earth scientists. Results were analyzed globally and by specialization. 76 out of 79 climatologists who "listed climate science as their area of expertise and who also have published more than 50% of their recent peer-reviewed papers on the subject of climate change" believe that mean global temperatures have risen compared to pre-1800s levels, and 75 out of 77 believe that human activity is a significant factor in changing mean global temperatures. Among all respondents, 90% agreed that temperatures have risen compared to pre-1800 levels, and 82% agreed that humans significantly influence the global temperature.”

http://www.ucsusa.org/sites/default/files/legacy/testfolder/aa-migration-to-be-deleted/assets-delete-me/documents-delete-me/ssi-delete-me/ssi/DoranEOS09.pdf

2008: Bray, D; von Storch, H. "A Survey of the Perspectives of Climate Scientists Concerning Climate Science and Climate Change".

Question 20 "How convinced are you that climate change, whether natural or anthropogenic, is occurring now?" got 67.1% very much agree, 26.7% to some large extent (5–6), 6.2% said to some small extent (2–4), none said not at all. Question 21 "How convinced are you that most of recent or near future climate change is, or will be, a result of anthropogenic causes?"

received 34.6% very much agree, 48.9% agreeing to a large extent (5–6), 15.1% to a small extent (2–4), and 1.35% not agreeing at all.

https://ncse.com/files/pub/polls/2010--Perspectives_of_Climate_Scientists_Concerning_Climate_Science_&_Climate_Change_.pdf

2008: from a Harris Interactive poll of 489 randomly selected members of the American Meteorological Society or American Geophysical Union, Lichter, S. Robert (2008-04-24).

"Climate Scientists Agree on Warming, Disagree on Dangers, and Don't Trust the Media's Coverage of Climate Change". Statistical Assessment Service, George Mason University.

97% agreed that global temperatures have increased during the past 100 years; 84% say they personally believe human-induced warming is occurring, and 74% agree that “currently available scientific evidence” substantiates its occurrence. Only 5% believe that human activity does not contribute to greenhouse warming; and 84% believe global climate change poses a moderate to very great danger."

https://www.desmogblog.com/sites/beta.desmogblog.com/files/STATS_%20Climate%20Scientists%20Agree%20on%20Warming,%20Disagree%20on%20Dangers,%20and%20Don%E2%80%99t

%20Trust%20the%20Media%E2%80%99s%20Coverage%20of%20Climate%20Change.pdf

2004: Naomi Oreskes (December 3, 2004 "Beyond the Ivory Tower: The Scientific Consensus on Climate Change" (PDF). Science 306 (5702): 1686.

“Oreskes analyzed 928 abstracts of papers from refereed scientific journals between 1993 and 2003, listed with the keywords "global climate change". Oreskes divided the abstracts into six categories: explicit endorsement of the consensus position, evaluation of impacts, mitigation proposals, methods, paleoclimate analysis, and rejection of the consensus position. 75% of the abstracts were placed in the first three categories, thus either explicitly or implicitly accepting the consensus view; 25% dealt with methods or paleoclimate, thus taking no position on current anthropogenic climate change; none of the abstracts disagreed with the consensus position, which the author found to be "remarkable"

http://ijpor.oxfordjournals.org/content/early/2011/10/27/ijpor.edr033.short

citing the San Francisco Chronicle, 9/27/92.

“In 1991, the Center for Science, Technology, and Media commissioned a Gallup poll of 400 members of the American Geophysical Union and the American Meteorological Society along with an analysis of reporting on global warming by the Center for Media and Public Affairs, a report on which was issued in 1992. Accounts of the results of that survey differ in their interpretation and even in the basic statistical percentages: Fairness and Accuracy in Reporting states that the report said that 67% of the scientists said that human-induced global warming was occurring, with 11% disagreeing and the rest undecided.”

So, as I stated initially, the above sampling shows that over a 22 year period there's been a trend toward increasing consensus on man-made global warming among active research climatologists and those in closely allied fields.

man-made global warming

1991: 67%
1996: (the 1996 von Storch survey is too complex to provide a single value)
2004: 75%
2008: 84%
2008: 85%
2009: 97%
2010: 97-98%
2011: 95%
2013: 97%
2016: 97%

61 Climate Change Position Statements from Science Organizations of National and/or International Standing. As has happened in the past, many of the following links may eventually become out of date. Thus, lists of other supporting policy statements may be found at:

https://climate.nasa.gov/scientific-consensus/
http://en.academic.ru/dic.nsf/enwiki/193789
https://skepticalscience.com/print.php?n=3642

http://scienceblogs.com/significantfigures/index.php/2017/01/17/joint-statements-on-climate-change-from-national-academies-of-science-around-the-world/
http://www.opr.ca.gov/facts/list-of-scientific-organizations.html

The last reference above lists 198 such organizations

Meanwhile, as of Oct. 2017, here are some direct links to current policy statements from national and international science organizations:

1. Academy of Science of South Africa (ASSAf)
http://www.assaf.co.za/wp-content/uploads/2012/05/G-Science-Emission-Statement-FINAL.pdf
http://www.assaf.org.za/files/statements/COP22F1i%20Statement.pdf
American Association of Pediatrics
https://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/Parisclimatechangeagreement.aspx

American Association for the Advancement of Science:

https://www.aaas.org/news/aaas-reaffirms-statements-climate-change-and-integrity
4. American Association of State Climatologists:

http://www.stateclimate.org/publications/files/aascclimatepolicy.pdf
It seems the AASC has removed its prior climate change statement and policy.

5. American Association of Wildlife Veterinarians:
https://aawv.net/wp-content/uploads/2017/05/AAWV_PS_ClimateChange.pdf

6. American Astronomical Society
http://aas.org/about/governance/council-resolutions#climate

7. American Chemical Society:
https://www.acs.org/content/acs/en/policy/publicpolicies/sustainability/globalclimatechange.html

8. American Geophysical Union
https://news.agu.org/press-release/american-geophysical-union-releases-revised-position-statement-on-climate-change/

9. American Institute of Biological Sciences:
http://www.aibs.org/position-statements/20091021_scientists_issu.html

10. American Institute of Physics
https://www.aip.org/fyi/2016/scientific-societies-issue-statement-congress-reaffirming-climate-science-consensus
11. American Medical Association:

https://www.ama-assn.org/sites/default/files/media-browser/public/about-ama/councils/Council%20Reports/council-on-science-public-health/i08-csaph-climate-change-health.pdf

12. American Meteorological Society
https://www.ametsoc.org/ams/index.cfm/about-ams/ams-statements/statements-of-the-ams-in-force/climate-change/

13. American Physical Society:
http://www.aps.org/policy/statements/07_1.cfm

14. American Public Health Association:

https://www.apha.org/search-results?q=policy%20statement%20climate%20change

15. American Quaternary Association (paleontologists) supports 2008 AGU position statement
http://www.agu.org/fora/eos/pdfs/2006EO360008.pdf

16. American Society on Agronomy, Crop Science Society of America, Soil Science Society of America – joint statement

https://www.soils.org/files/science-policy/asa-cssa-sssa-climate-change-policy-statement.pdf

17. American Society for Microbiology:

http://www.asm.org/images/docfilename/0000006005/globalwarming%5B1%5D.pdf
18. American Statistical Association:

http://www.amstat.org/asa/files/pdfs/POL-ASAStatementonClimateChange.pdf

19. Australian Medical Association:
https://ama.com.au/position-statement/ama-position-statement-climate-change-and-human-health-2004-revised-2015

20. Australian Climate Data Center:
https://www.climatechangeinaustralia.gov.au/media/ccia/2.1.6/cms_page_media/168/CCIA_2015_NRM_TR_Chapter%203.pdf

21. Australian Meteorological Society:
http://www.gci.uq.edu.au/learning-online-gci-uqx#denial

22. Engineers Australia:
https://www.engineersaustralia.org.au/sites/default/files/resource-files/2017-01/climate_change_final.pdf

23. Science and Technology, Australia, formerly the
Federation of Australian Scientific and Technological Societies
https://scienceandtechnologyaustralia.org.au/sta-welcome-fresh-government-support-for-climate-science/

24. Canadian Federation of Earth Sciences:
http://geoscience.ca/_ARCHIVE_jan7_2011/climatechange.html
http://sciencemediacentre.ca/site/?p=5646

25. Canadian Foundation for Climate and Atmospheric Science:
http://www.cfcas.org/wp-content/uploads/2010/09/pressrelease18Oct07e.pdf

26. Canadian Meteorological and Oceanographic Society

http://www.cmos.ca/document/1045/pressrelease1June2006.pdf

27. Environmental Protection Agency
https://search.epa.gov/epasearch/epasearch?typeofsearch=epa&client=new_frontend&epasearch&&filter&fld&url_directory&federated=no&max_results=200&result_template=2col.ftl&areaname&areapagehead=epafiles_pagehead&areapagefoot=epafiles_pagefoot&areasidebar=search_sidebar&stylesheet&sort=term_relevancy&faq=true&results_per_page=20&cluster=both&sessionid=5A42D30DAAEE2ACFEC8ED21320F76AC3&querytext=impacts%20climate%20change&q=climate%20change%20position%20statement

28. European Academy of Sciences and Arts:

https://en.wikipedia.org/wiki/European_Academy_of_Sciences_and_Arts#cite_note-9

http://www.eurasc.org/symposium/symposium_2015.asp

29. European Geosciences Union:

https://www.egu.eu/policy/science/climate-change-and-its-impacts/

30. European Federation of Geologists:

http://eurogeologists.eu/wp-content/uploads/2017/07/Position-Paper_Carbon-Capture-and-geological-Storage.pdf

31. European Physical Society:

http://www.eps.org/resource/resmgr/policy/eps_pp_energy_env_2009.pdf

32. European Science Foundation:
http://www.esf.org/publications/science-position-papers.html
http://archives.esf.org/fileadmin/Public_documents/Publications/MB_Climate_Change_Web.pdf

33. G8+5 Joint National Science Academies Statement (national science academies of: USA, United Kingdom, France, Germany, Japan, Russia, Canada, China, Italy, South Africa, Mexico, Brazil, and India):
http://www.nationalacademies.org/includes/G8+5energy-climate09.pdf

34. Geological Society of America:
http://www.geosociety.org/documents/gsa/positions/pos10_climate.pdf

35. Geological Society of London:
https://www.geolsoc.org.uk/climatechange

36. German Academy of Natural Scientists:
http://science.sciencemag.org/content/292/5520/1261

37. Institution of Professional Engineers, New Zealand:

http://www.coastalsociety.org.nz/Publications/Adapting%20to%20the%20Consequences%20of

%20Climate%20Change.pdf

38. International Association for Great Lakes Research:
http://www.iaglr.org/scipolicy/factsheets/iaglr_crossroads_climatechange.pdf

39. International Council of Academies of Engineering and Technological Sciences:
http://www.caets.org/cms/7122/7735.aspx

40. International Union of Geodesy and Geophysics (resolution 6):
Network of African Science Academies, Joint Statement:
http://www.interacademies.net/File.aspx?id=4825

41. NASA
http://climate.nasa.gov/evidence/

http://www.aip.org/history/climate/links.htm
42. National Academy of Sciences
https://www.nap.edu/search/?rpp=20&ft=1&term=climate+change+statement

43. National Association of Geoscience Teachers:
http://www.nagt.org/nagt/policy/ps-climate.html

44. National Center for Atmospheric Research

http://eo.ucar.edu/basics/cc_1.html

45. National Oceanographic and Atmospheric Admnistration:

https://www.climate.gov/teaching/resources/global-climate-change-effects-global-warming
46. National Research Council:

http://www.nap.edu/openbook.php?record_id=10139

47. Royal Irish Academy:
https://www.ria.ie/reports/climate-change-and-environmental-sciences-committee-reports

48. Royal Meteorological Society:
https://www.rmets.org/climate-resources

49. Royal Society of the UK
https://royalsociety.org/news/2009/climate-science-statement/

50. Royal Society of New Zealand
https://royalsociety.org.nz/what-we-do/our-expert-advice/all-expert-advice-papers/climate-change-implications-for-new-zealand/

51. Royal Swedish Academy of Sciences:
https://6702d.https.cdn.softlayer.net/assets/globalassets-vetenskap_samhallet-miljo_klimat-uttalanden-uttalande_klimat_eng_150410.pdf

52. Science Council of Japan:
http://www.scj.go.jp/ja/info/kohyo/pdf/kohyo-20-t34-1e.pdf#page=7

53. Society of American Foresters:

https://www.eforester.org/Main/Issues_and_Advocacy/Statements/Forest_Management_and_Climate_Change.aspx

54. Canadian Cryospheric Information Network
https://ccin.ca/home/search/node/climate%20change

55. (UK) Society of Biology:
https://www.rsb.org.uk/policy/policy-issues/environmental-sciences/climate-change

56. U.S. Arctic Research Commission:
https://storage.googleapis.com/arcticgov-static/publications/goals/usarc_goals_2017-2018_version_2.pdf

57. Union of Concerned Scientists:

http://www.ucsusa.org/global_warming/

58. U.S. Geological Survey:

https://www.usgs.gov/science/mission-areas/climate-and-land-use-change?qt-mission_areas_l2_landing_page_ta=0#qt-mission_areas_l2_landing_page_ta

59. The Wildlife Society:

http://wildlife.org/tag/climate-change/
http://wildlife.org/climate-change/

60. World Health Organization:
http://www.who.int/world-health-day/toolkit/report_web.pdf

61. World Meteorological Organization:
https://public.wmo.int/en/search?search_api_views_fulltext=climate%20change%20statement

By 2011, the 8 largest publicly-owned oil firms had conceded man-made global warming:

Conoco-Phillips CEO:

"The Intergovernmental Panel on Climate Change has concluded that global warming is unequivocal."... "Last year we became the only U.S. integrated energy company to call for a mandatory national framework to address greenhouse gas emissions."

http://www.conocophillips.com/EN/newsroom/other_resources/pages/cdp_speech_text.aspx
Note: the above link is no longer active. No replacement found yet.

BP:"Accepts findings of the Intergovernmental Panel on Climate Change"

http://www.bp.com/liveassets/bp_internet/china/bpchina_english/STAGING/local_assets/downloads_pdfs/press_share_0427_EN.pdf

SHELL:“CO2 emissions must be reduced to avoid serious climate change."

http://www.shell.com/home/content/environment_society/environment/climate_change/

EXXON:“The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC 2007) provides an update of scientific understanding regarding GHG emissions, global warming and the risks of climate change, and the way changes could unfold in the future. Emissions scenarios and results from climate models (see Figure 1) estimate that, without policy intervention, temperatures could increase 1 to 5 º C by 2100.”

http://www.exxonmobil.com/Corporate/safety_climate_mgmt_report.aspx

CHEVRON:“we recognize and share the concerns of governments and the public about climate change.The use of fossil fuels to meet the world's energy needs is a contributor to an increase in greenhouse gases(GHGs)—mainly carbon dioxide (CO2) and methane—in the Earth's atmosphere."

http://www.chevron.com/globalissues/climatechange/”

PETROBRAS

Petrobras believes that the global climate change, pointed out by a number of scientific studies as the result of the increased greenhouse gas (GHG) emissions, requires a comprehensive strategy focusing on mitigating the impacts of our activities and products

http://tinyurl.com/8a5jfc7

PETROCHINA:

The Company also worked towards creating a clean production and consumption process, and supporting carbon reduction and sequestration actions in the forestry industry, such as carbon sink and clean mechanism, which considerably contributed to mitigating the effects of global climate change.

http://tinyurl.com/7vygbax

leaving only PRIVATELY owned SAUDI ARABIAN-American Oil, the world's largest company by far, with assets dwarfing the world's two biggest public corporations. However, that seems to have changed recently, as both ARAMCO and GAZPROM have joined the rest.

https://www.reuters.com/article/us-oil-climatechange/exclusive-oil-majors-join-forces-in-climate-push-with-renewable-energy-fund-idUSKBN12X0WA

http://www.gazpromexport.ru/en/about/environment/

Climate Change Position Statements from the U.S. Dept. of Defense and National Security

Agencies

FY 2014 Climate Change Adaptation Roadmap

https://www.acq.osd.mil/eie/Downloads/CCARprint_wForward_e.pdf

"Among the future trends that will impact our national security is climate change. Rising global temperatures, changing precipitation patterns, climbing sea levels, and more extreme weather events will intensify the challenges of global instability, hunger, poverty, and conflict. They will likely lead to food and water shortages, pandemic disease, disputes over refugees and resources, and destruction by natural disasters in regions across the globe. In our defense strategy, we refer to climate change as a “threat multiplier” because it has the potential to exacerbate many of the challenges we are dealing with today – from infectious disease to terrorism. We are already beginning to see some of these impacts.

A changing climate will have real impacts on our military and the way it executes its missions. The military could be called upon more often to support civil authorities, and provide humanitarian assistance and disaster relief in the face of more frequent and more intense natural disasters. Our coastal installations are vulnerable to rising sea levels and increased flooding, while droughts, wildfires, and more extreme temperatures could threaten many of our training activities. Our supply chains could be impacted, and we will need to ensure our critical equipment works under more extreme weather conditions. Weather has always affected military operations, and as the climate changes, the way we execute operations may be altered or constrained. While scientists are converging toward consensus on future climate projections, uncertainty remains. But this cannot be an excuse for delaying action. Every day, our military deals with global uncertainty. Our planners know that, as military strategist Carl von Clausewitz wrote, “all action must, to a certain extent, be planned in a mere twilight.”

U.S.Dept.of Defense Quadrennial Defense Review,2014, p.8

"Climate change poses another significant challenge for the United States and the world at large. As greenhouse gas emissions increase, sea levels are rising, average global temperatures are increasing, and severe weather patterns are accelerating. These changes, coupled with other global dynamics, including growing, urbanizing, more affluent populations, and substantial economic growth in India, China, Brazil, and other nations, will devastate homes, land, and infrastructure. Climate change may exacerbate water scarcity and lead to sharp increases in food costs. The pressures caused by climate change will influence resource competition while placing additional burdens on economies, societies, and governance institutions around the world.

These effects are threat multipliers that will aggravate stressors abroad such as poverty, environmental degradation, political instability, and social tensions – conditions that can enable terrorist activity and other forms of violence."

http://archive.defense.gov/pubs/2014_Quadrennial_Defense_Review.pdf

Dept. of Defense: p.xi,DoD TaskForce,

"Trends and Implications of Climate Change for National and International Security", Oct. 2011

"...if all of the measures currently recommended to reduce emissions from human activity are

implemented, the predicted temperature rise will vary from a minimum of 2degs.C to as much as 7degs.C by the end of the 21st century. A rise of more than 2degs.C is likely to have serious consequences for the human habitat."

http://www.fas.org/irp/agency/dod/dsb/climate.pdf

National Security Council:

"The National Intelligence Council (NIC) has completed a new classified assessment that explores how climate change could threaten U.S. security in the next 20 years by causing political instability, mass movements of refugees, terrorism, or conflicts over water and other resources..."

http://www.sciencedaily.com/releases/2008/06/080625090302.htm

Rear Admiral David Titley, Oceanographer and Navigator of the Navy and Director, Task Force Climate Change: lecture on climate change

https://www.youtube.com/watch?v=7udNMqRmqV8
https://www.youtube.com/watch?v=LjA5naFfcgk

Republican Scientists who believe in man-made global warming

Republican MIT meteorology Prof. Kerry Emanuel sees himself as a conservative. He believes marriage is between a man and a woman. He backs a strong military and admires Ronald Reagan.

Emanuel concludes that the scientific data show a powerful link between greenhouse gas emissions and climate change.

http://articles.latimes.com/2011/jan/05/nation/la-na-scientist-climate-20110105
http://www.nytimes.com/2011/08/28/us/28climate.html

Texas Tech atmospheric scientist Katharine Hayhoe is an evangelical Christian who wrote a book with her husband, a pastor and former climate change denier, explaining climate change to skeptics.

Republicans for Environmental Protection:
https://www.facebook.com/katharine.hayhoe/

Solar physicist John Cook is an evangelical Christian who runs the website skepticalscience.com, which seeks to debunk climate change deniers' arguments."
http://blogs.vancouversun.com/2011/11/29/not-all-climate-skeptics-are-created-equal/

Barry Bickmore is a Mormon, professor of geochemistry at Brigham Young University and blogger behind Anti-Climate Change Extremism in Utah, where he rebuked Sen. Orrin G. Hatch (R-Utah) for his climate views and posted editorials mentioning his Republican affiliation.

http://redgreenandblue.org/2011/11/12/a-republican-ex-climate-skeptic-explains-how-people-avoid-the-truth-about-climate-change/

Richard Alley, a highly regarded geoscientist at Penn State University who has authored hundreds of peer-reviewed papers on climate change, testified in front of Congress several times about global warming between the late 1990s and 2010. Alley also spoke to cabinet level people in the George W. Bush White House, he said. In the past few years, however, Alley has largely stayed away from Washington. He has been hesitant to reach out to policymakers since it's not on their radar. He is also afraid it won't do much good since everyone is "yelling for their attention on so many issues."

"I think the door isn't open right now to contact them," Alley said.

The same goes for Calvin DeWitt, an environmental scientist who researches climate change at the University of Wisconsin-Madison. DeWitt is a vocal evangelical Christian and although he won't affiliate himself with a single party, he does admit his religious and cultural beliefs fall in line with the majority of Republicans. He has played a significant role in nearly every intersection of climate scientists with evangelicals and politicians, including the creation of the Evangelical Climate Initiative in 2006, a group of over 300 senior evangelical leaders who believe the nation needs to address global warming.

http://insideclimatenews.org/news/20120221/republicans-santorum-romney-gingrich-climate-scientists-scientific-consensus-skeptics-kerry-emanuel?page=4

A Message From a Republican Meteorologist on Climate Change
Paul Douglas: Meteorologist; Author, 'Restless Skies, the Ultimate Weather Book'

"My climate epiphany wasn't overnight, and it had nothing to do with Al Gore."

"I'm going to tell you something that my Republican friends are loath to admit out loud: climate change is real. I'm a moderate Republican, fiscally conservative; a fan of small government, accountability, self-empowerment and sound science. I am not a climate scientist. I'm a Penn State meteorologist, and the weather maps I'm staring at are making me very uncomfortable. No, you're not imagining it: we've clicked into a new and almost foreign weather pattern. To complicate matters I'm in a small, frustrated and endangered minority: a Republican deeply concerned about the environmental sacrifices some are asking us to make to keep our economy powered-up. It's ironic. The root of the word conservative is "conserve". A staunch Republican, Teddy Roosevelt, set aside vast swaths of America for our National Parks System, the envy of the world. Another Republican, Richard Nixon, launched the EPA. Now some in my party believe the EPA and all those silly "global warming alarmists" are going to get in the way of drilling and mining our way to prosperity. Well, we have good reason to be alarmed."

http://www.huffingtonpost.com/paul-douglas/republican-climate-change_b_1374900.html?show_comment_id=144704429#comment_144704429

Policy Statements from Major Corporations and Their Investors

63% of Fortune 100 companies have GREENHOUSE GAS MITIGATION PROGRAMS.

https://c402277.ssl.cf1.rackcdn.com/publications/1049/files/original/Power_Forward_3.0_-_April_2017_-_Digital_Second_Final.pdf?1493325339

including 11 of the world's 14 largest public corporations, AND the six biggest public oil firms + Conoco-Phillips:

https://www.nytimes.com/2015/10/17/business/energy-environment/oil-companies-climate-change-un.html

APPLE: https://www.apple.com/environment/climate-change/
EXXON: http://corporate.exxonmobil.com/en/current-issues/climate-policy/climate-perspectives/our-position
SHELL: http://www.shell.com/sustainability/environment/climate-change.html
PETROCHINA: http://www.petrochina.com.cn/petrochina/xhtml/images/shyhj/2015kcxfzbgen02.pdf
PETROBRAS: http://www.petrobras.com.br/en/society-and-environment/environment/climate-changes/
BP: https://www.bp.com/en/global/corporate/sustainability/climate-change.html
CHEVRON: https://www.chevron.com/corporate-responsibility/climate-change
WALMART: https://corporate.walmart.com/global-responsibility/sustainability/
MICROSOFT: https://www.microsoft.com/en-us/environment/carbon/default.aspx

NESTLE: http://www.nestle.com/ask-nestle/environment/answers/nestle-climate-change

BHP BILLITON: http://www.bhp.com/environment/climate-change

CHINA MOBILE: http://tinyurl.com/6mqpjvd
INTEL: https://www.intel.com/content/www/us/en/corporate-responsibility/environment-climate-change-policy-harper.html
IBM: https://www.ibm.com/ibm/environment/climate/ghg.shtml
CONOCO-PHILLIPS:http://www.conocophillips.com/sustainable-development/environment/climate-change/climate-change-action-plan/Pages/managing-operations-and-projects.aspx
GAZPROM: https://www.google.com/search?q=greenhouse+gas+policy+Gazprom&oq=greenhouse+gas+policy+Gazprom&gs_l=psy-ab.3..33i21k1j33i160k1.40988.43900.0.44178.11.10.0.0.0.0.324.842.2j2j0j1.5.0....0...1.1.64.psy-ab..6.5.839...0i22i30k1j33i22i29i30k1.0.UJtrjCgOVb4

ARAMCO finally joins in
http://www.saudiaramco.com/en/home/news-media/news/COP21.html

BUT NOT the last three of 14 - all major COAL INVESTORS:

(COMMUNIST) CHINA Construction Bank,
(COMMUNIST) Industrial and Commercial Bank of CHINA, or
Berkshire Hathaway (Geico, BNSF Railway),

http://tinyurl.com/cam7m7x
http://tinyurl.com/7xvvz9e
http://tinyurl.com/7ay8c26

About Industrial and Commercial Bank of China:
http://www.banktrack.org/download/bankrolling_climate_change/climatekillerbanks_final_0.pdf
http://www.grist.org/list/2011-11-30-giant-banks-screwing-the-economy-are-also-screwing-the-climate-s

About the China Construction Bank:

http://www.csrhub.com/CSR_and_sustainability_information/China-Construction-Bank-Corporation

About Berkshire Hathaway:
Although Warren Buffett (CEO of Berkshire Hathaway) has gone on record as a believer in global warming and its attendant risks to insurance companies by exacerbating extreme weather events,
http://www.thepanelist.net/neuberts-trades-finance-10059/304-berkshire-hathaway-on-global-warming
http://www.cnbc.com/id/35644956/page/2/
Buffett also opposed a Berkshire Hathaway carbon footprint disclosure initiative at their annual shareholders meeting on April 30th, 2011, citing state law complexity governing this issue.
http://dealbook.nytimes.com/2011/04/30/live-blogging-the-berkshire-annual-meeting/

Meanwhile, it should also be noted that Buffett completed the purchase of Burlington Northern Railway in 2010, which derives 1/4th of its revenue from transporting coal.

http://www.onearth.org/article/coal-on-a-roll?page=1

NOR, until very recently, did PRIVATELY owned SAUDI ARABIAN-American Oil, the world's largest company, whose assets dwarf the world's two biggest public corporations, Apple and Exxon, COMBINED.
http://en.wikipedia.org/wiki/Largest_companies

And roughly 200 CEOs who prepared a joint statement:

"Leaders of nearly 200 major companies around the world have called for tougher action on climate change. The 2C Challenge, co-ordinated by the Prince of Wales Corporate Leaders Group, says that climate change puts society's future prosperity at risk.

But the window to keep global warming below 2C has 'almost closed', it warns.

Firms signing up include UK retailer Tesco, energy provider EDF, electronics company Philips, chemicals giant Unilever, eBay and Rolls-Royce.

'If we do not act, climate change risks seriously undermining future global prosperity.'

Analyses show that at current rates, greenhouse gas emissions are not being curbed quickly enough to keep the global average temperature rise since pre-industrial times below 2C, which is what many governments say they want.

A majority prefer the tougher target of 1.5C, which is almost certainly out of reach without investment in climate "technical fixes".

http://www.bbc.co.uk/news/science-environment-15352764

And a coalition of investment groups controlling $25 Trillion in capital:
http://investorsonclimatechange.org/