If the Dark Ages solar peak c.525CE caused a c.5m sea-level rise 50-100y later ("ocean memory"), the stronger 1958 solar "Grand Maximum" presages a >5m rise by 2058: literature review by an impartial geologist

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Poster presented 27th April 2017 at EGU (European Geosciences Union) General Assembly 2017, Vienna, Austria

ABSTRACT (p.1 of 4)

The 255 authors of IPCC's "Climate Change 2013: The Physical Science Basis" include no sedimentary geologists, specialists in ever-changing sea level (SL; PLATE 1 = p.6). According to IPCC the 0.3m SL rise (**ref. 1**) since tide-gauge records began (c.1700CE, Little Ice Age [LIA] acme) is unprecedented in >2ky, implicating mankind's CO2 emissions. On the contrary, a c.5m SL rise and fall between c.400CE and 1700 are indicated independently by three lines of evidence: British archaeology (**refs 2,3**; PLATES 2, 3); worldwide raised-shoreline benchmarks (**ref. 4** PLATE 4a-c); and Red Sea foraminifera O18 fluctuations (**ref. 5**; PLATE 4d). The c.5m fall is attributable to 590-1640CE cooling (ice growth) shown by a global proxy temperature graph (**ref. 6**; cf. **ref. 7;** PLATE 5). This 1ky-long cooling and ensuing 1850-2017 warming, both sawtooth-style, in turn mimic a 1ky solar decline then rise (**ref. 8**; PLATES 6, 7), moreso after aligning the 590CE peak temperature (**ref. 6**) with the c.525CE solar "Grand maximum" (GM) or near-GM (**ref. 8**; PLATE 8).

... continued

ABSTRACT (p.2 of 4)

... This 65y lag reflects hitherto-neglected ocean-conveyor-belt circulation, i.e. downwelling Atlantic surface water, variably solar-warmed (depending on solar-governed cloudiness [**ref. 9**]), upwells decades later beside Antarctica, returning northward to affect continental air temperatures (PLATE 9). The conveyor slowed in the LIA (c.150y offset between 1280-1700CE cluster of solar Grand minima [**ref. 8**] and 1430-1850 cool phase **[ref. 6**]; PLATE 8). Lately the lag, obvious from visual cross-matching of 1850-2012 instrumental-temperature peaks and troughs (**ref. 10**) versus the 1700-2016 sunspot chart (Google images), is c.85y (1890 solar trough matches 1975 temperature trough; PLATE 10). Similarly, SL (**ref. 1**) clearly lags temperature (**ref. 10**) by 15y (1964 and 1976 temperature troughs match 1979 and 1991 SL troughs; PLATE 11). Thus the total SL-solar lag is 100y (85+15). Appreciating the 85y and 100y lags enables vital predictions: sunspots increased (sawtooth-style) from c.1890 until the 1958 GM (the only definite GM in >2ky [**ref. 8**]; PLATE 6), therefore ongoing warming will peak c.2043 (1958+85), and SL c.2058.

... continued *p.3 of 20*

ABSTRACT (p.3 of 4)

... How high will SL rise? The 1958 solar GM exceeded (95% confidence; **ref. 8**; PLATE 6) the c.525CE GM(?) that caused a c.5m rise, but SL has risen just 0.3m since c.1700 (**ref. 1**), so a further 4.7m+ is predictable by 2058. A viable cause is that whenever the sun exceeds the GM threshold (**ref. 8**; PLATE 12), "superwarmed" downwelling Atlantic water eventually upwells at Antarctica (PLATE 9), causing runaway retreat (ice-cliff collapse) of ice-sheet glaciers after melting the buttressing ice shelf (PLATE 13). Thus the ocean "remembers" the 1958 solar GM; the Antarctic "time-bomb" is set. The forecast 5m+ SL rise should largely span 2038-2058, as the GM threshold was crossed c.20y before the GM apex (**ref. 8**; PLATE 6). This implies catastrophic acceleration, in c. 20y time, to an average rate >25cm/y (100x current trivial 2.5mm/y; PLATE 14). The lookalike Dark Ages SL rise was perhaps c.50% slower (threshold possibly as much as c. 45y before apex [**ref. 8**; PLATE 6]). Lack of contemporary descriptions suggests that this SL rise of c.5m in c.45y (average 0.3mm/day) caused less concern than recurrent Justinian plague and frequent wars.

... continued *p.4 of 20*

ABSTRACT (p.4 of 4)

... The Dark-Ages event, preceding industrial CO2 emissions by >1ky, absolves mankind of causing climate and SL change, as does the >1.5ky solar/temperature correlation (PLATE 6; mismatches reflect "sliding lag", proxy imperfections and volcanic aerosol/ash eruptions).

References cited:

1 Jevrejeva et al. 2008 Geophys Res Lett 35 Fig1

2 Higgs 2016a abstract, 35th International Geological Congress, Cape Town, August 2016

3 Higgs 2016b abstract, Geol. Soc. America Annual Meeting, Denver, September 2016

4 Fairbridge 1961 Physics and Chemistry of the Earth 4 Fig.15

5 Siddall et al.2003 Nature 423 Fig1

6 Mann et al. 2009 Science 326 FigS5g “all proxy”

7 Ahmed et al.2013 Nature Geoscience 6 Fig4b

8 Usoskin et al.2014 Astronomy & Astrophysics 562 L10 Fig2

9 Svensmark 2007 Astronomy & Geophysics 48

10 IPCC Climate Change 2014 Synthesis Report Fig1.1a

1 An inconvenient truth about IPCC

IPCC's key "Climate Change 2013: The Physical Science Basis" report is doubly distorted, because :

(1) the 255 (sic) authors are all university/government scientists (none from private industry), most of whom have a fundamental vested interest (salaries, research grants) in promoting the idea that global warming and resulting sea-level rise (SL) are man-made;

(2) the 255 include no sedimentary geologists, i.e. the very scientists who know that global temperature & sea level have *always* changed. The 255 are Climate modellers, Geodesists, Geographers, Glaciologists, Meteorologists, Oceanographers, Physicists, Quaternary climatologists and Statisticians ... but no geologists, of any kind (except 7 glaciologists)

THIS IS OUTRAGEOUS

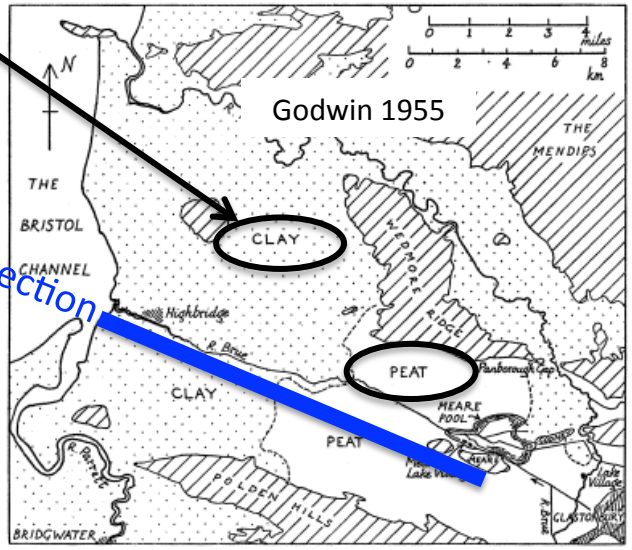
We geologists must speak out

2 English archaeological evidence for a Dark Ages c.5m SL rise & fall

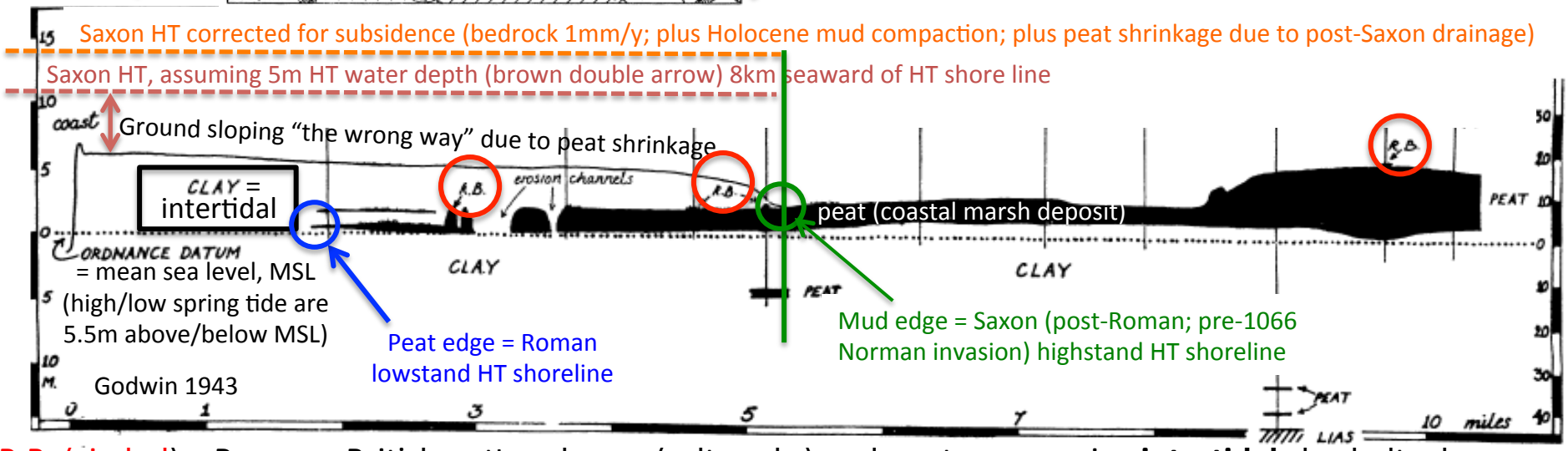
Example 1 (of dozens): Somerset Levels

"Roman Clay" = intertidal, based on forams, lamination, sinuous channels

Cross section (below)



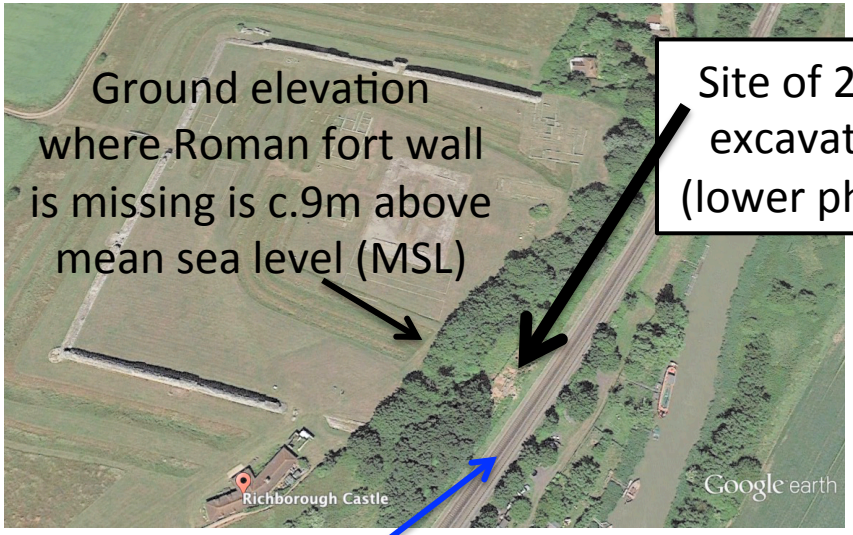
HT = high tide



R.B. (circled) = Romano-British pottery heaps (saltworks) under a transgressive **intertidal** clay belt whose surface elevation (corrected for subsidence & peat shrinkage) indicates sea level (SL) rose c.5m after 400CE, to c.8m above present SL. This was the basis of Godwin's 1943 "Romano-British Transgression". SL then fell several metres by 1086 (Domesday Book lists Norman villages on Somerset Levels).

3 English archaeological evidence for a Dark Ages c.5m SL rise & fall

Example 2 (of dozens): Richborough Roman fort, Kent



Railway elevation c.6m above MSL (= Ordnance Datum, OD)

14th-Century dock joins together two bus-sized pieces of fallen Roman fort wall. For marine erosion to have collapsed (by undercutting) the wall, high-tide level (HTL) must have reached the base of the wall at c.9m (top-left photo) some time after 400CE but before the 14th C, i.e. HTL reached c.9m above today's mean sea level (MSL), or c.11m after correcting for 1mm/y subsidence (measured by GPS), i.e. c.8m higher than today's HTL at nearby Ramsgate. Subsequently, by the 14th C, HTL must have fallen to c.1m below the top of the dock, i.e. to c.6m above MSL (same elevation as railway), or c.6.5m after correcting for subsidence, i.e. c.3.5m above today's HTL. Since then, HTL has fallen a further 3.5m, to today's HTL.

4

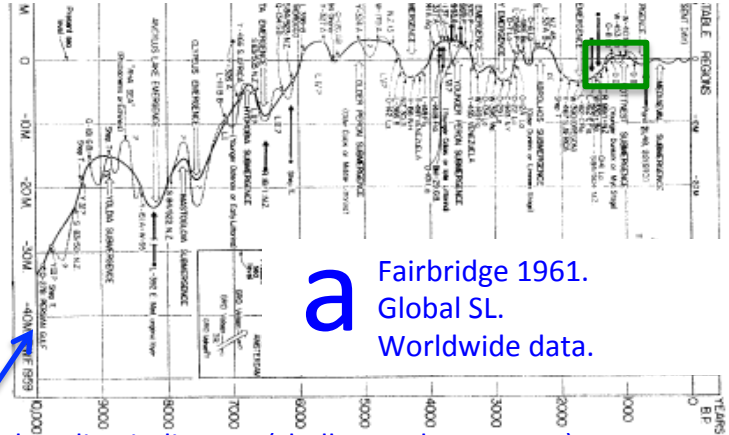
IPCC (2013) claims 0-1700CE sea level (SL) varied <25cm

BUT 4 published SL curves show

3-10m SL rise between c.250 & 850CE

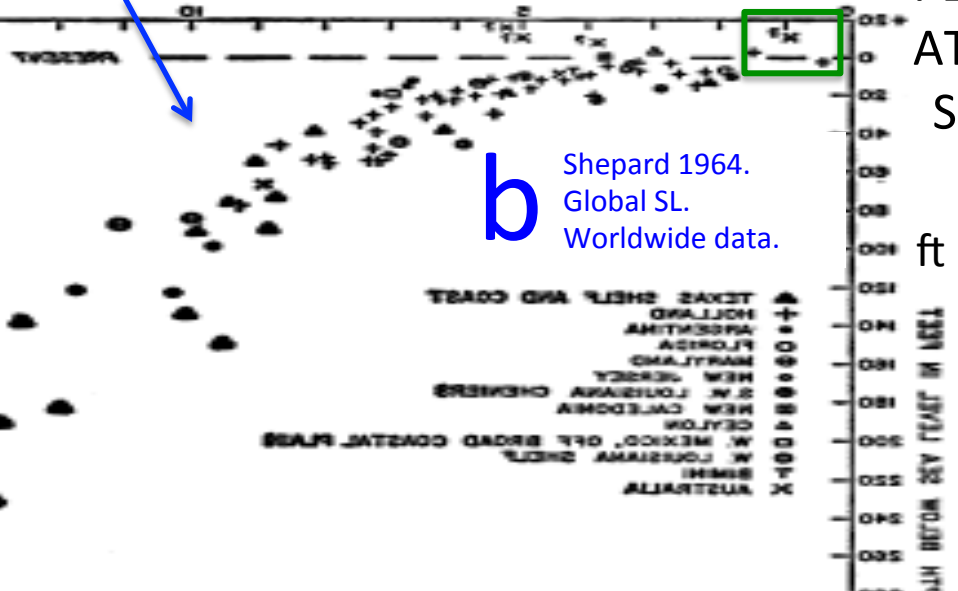
2-7m SL fall between c.850 & 1650CE

} see 4 green squares



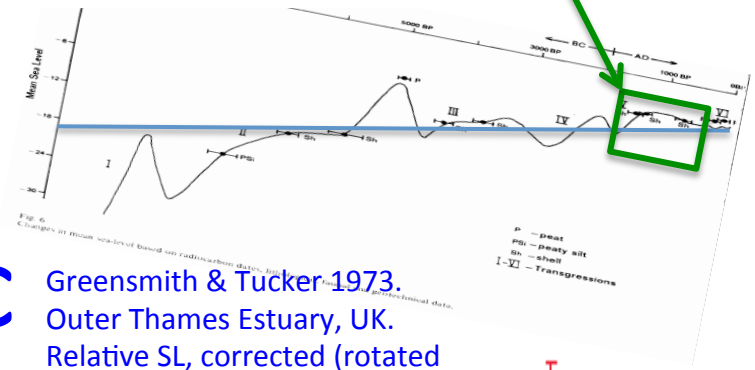
a Fairbridge 1961.
Global SL.
Worldwide data.

C14-dated shoreline indicators (shells, coral, peat, etc.)

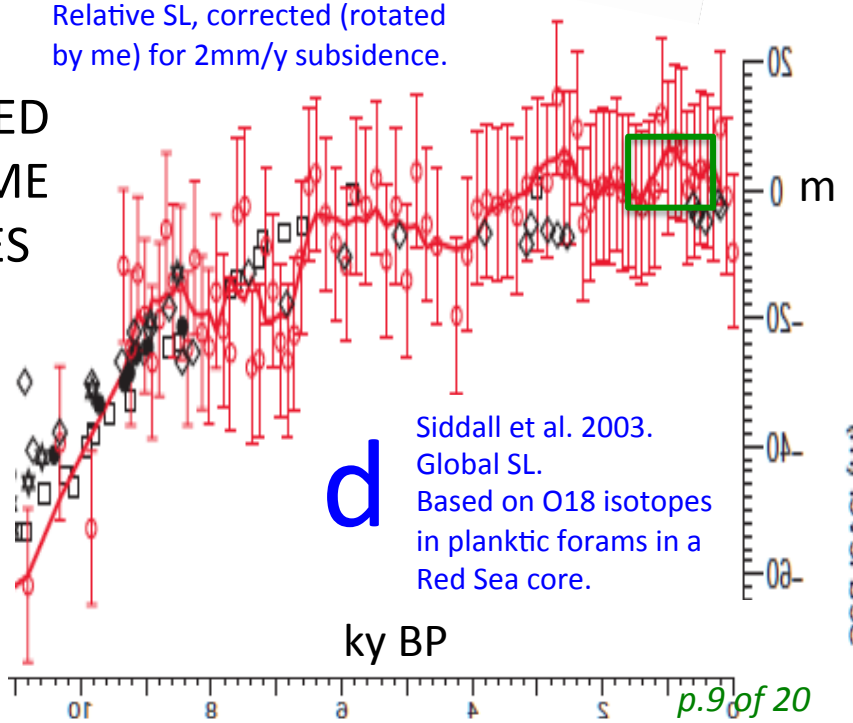


b Shepard 1964.
Global SL.
Worldwide data.

PLOTTED AT SAME SCALES



c Greenssmith & Tucker 1973.
Outer Thames Estuary, UK.
Relative SL, corrected (rotated by me) for 2mm/y subsidence.

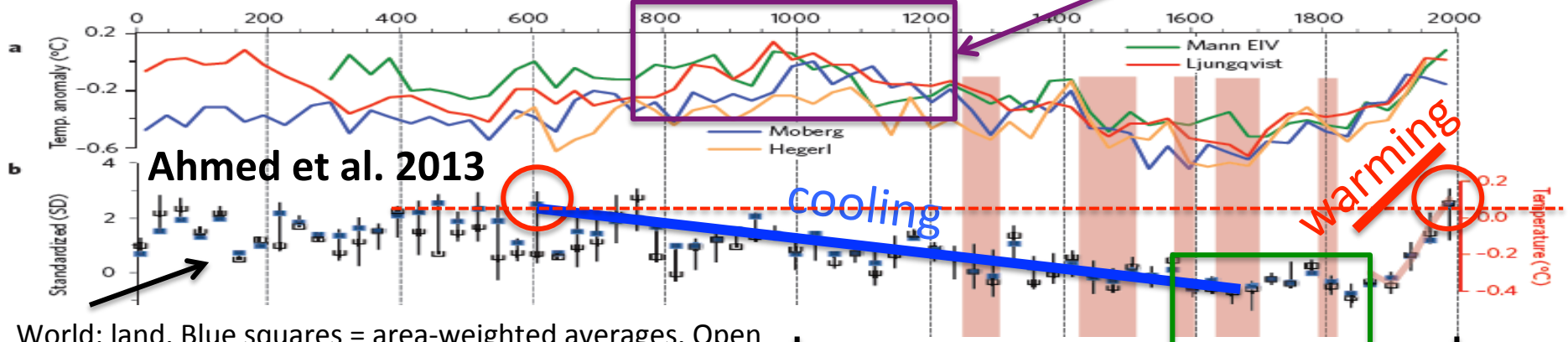


d Siddall et al. 2003.
Global SL.
Based on O18 isotopes in planktic forams in a Red Sea core.

5 *Two* recent global temp. curves, from proxies (tree rings, ice cores, etc.) show 1,000y cooling into Little Ice Age (contrast northern hemisphere's Medieval Warm Period)

Four Northern Hemisphere curves (coloured):
Moberg et al. 2005, land + ocean; Hegerl et al. 2007, land;
Mann et al. 2008, land + ocean; Ljungqvist 2010, land (except 1 of 30 sites)

Medieval Warm Period



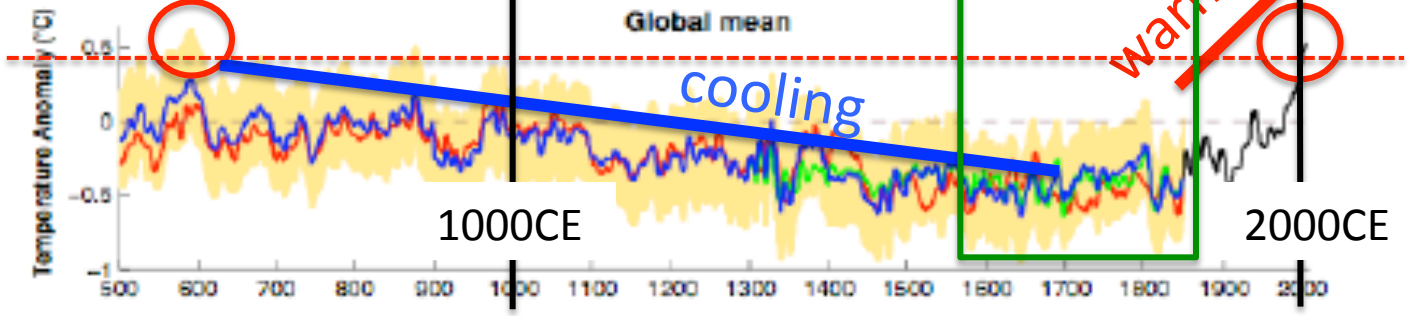
World; land. Blue squares = area-weighted averages. Open boxes = unweighted medians. Pink line = instrumental.

Little Ice Age

NB Two exceptional temp. peaks (circled)

Mann et al. 2009

World, land + ocean.
Blue = "all proxy". Yellow = 95% confidence interval (CI).
Black = instrumental.



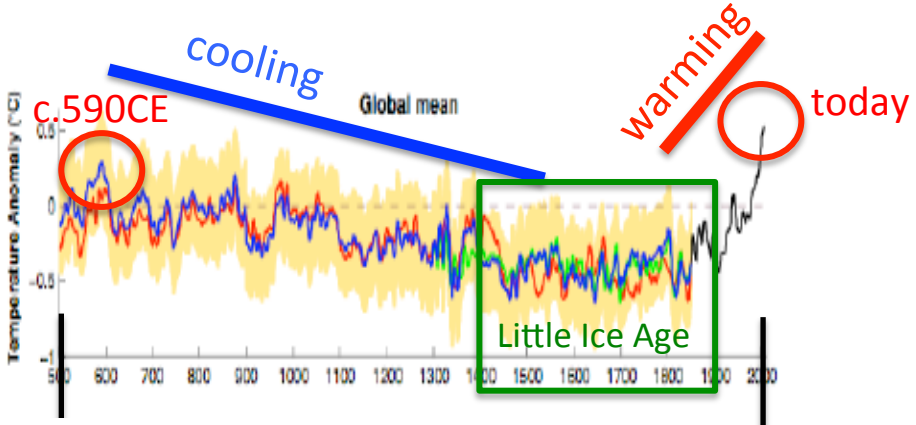
6 Solar output & global temp. curves match

i.e. warmings are due to solar upswings, amplified by **Svensmark** cosmic-ray/cloud mechanism

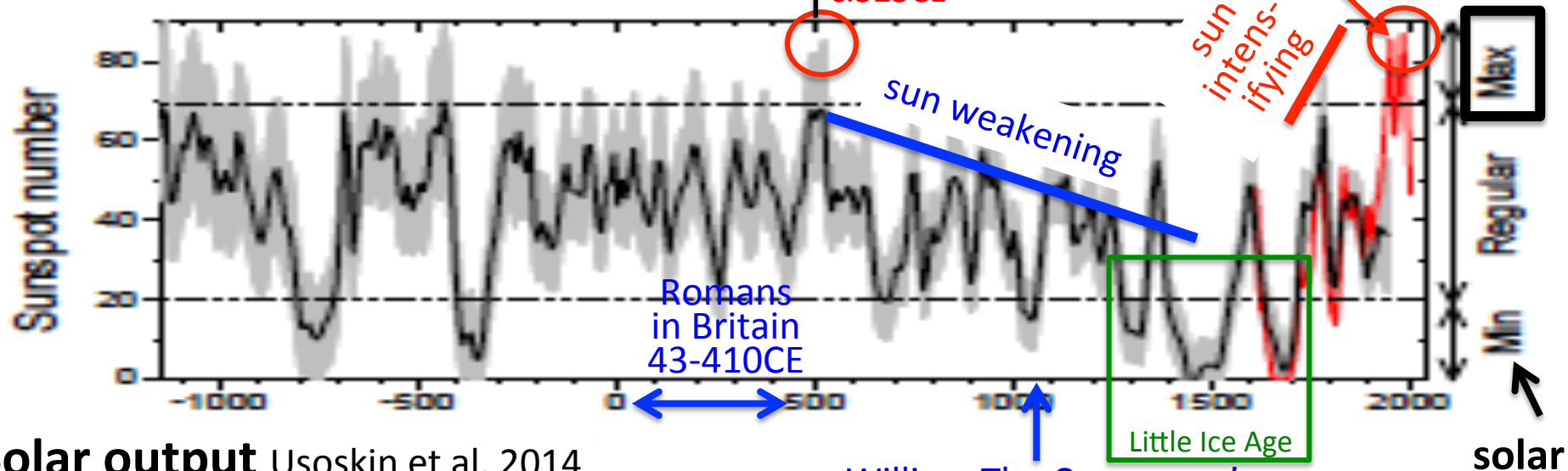
Mann et al. 2009

World av. temp.

from proxies, e.g. tree-ring widths. Yellow = 95% CI.



NB Two exceptional temp. & solar peaks (4 red circles)



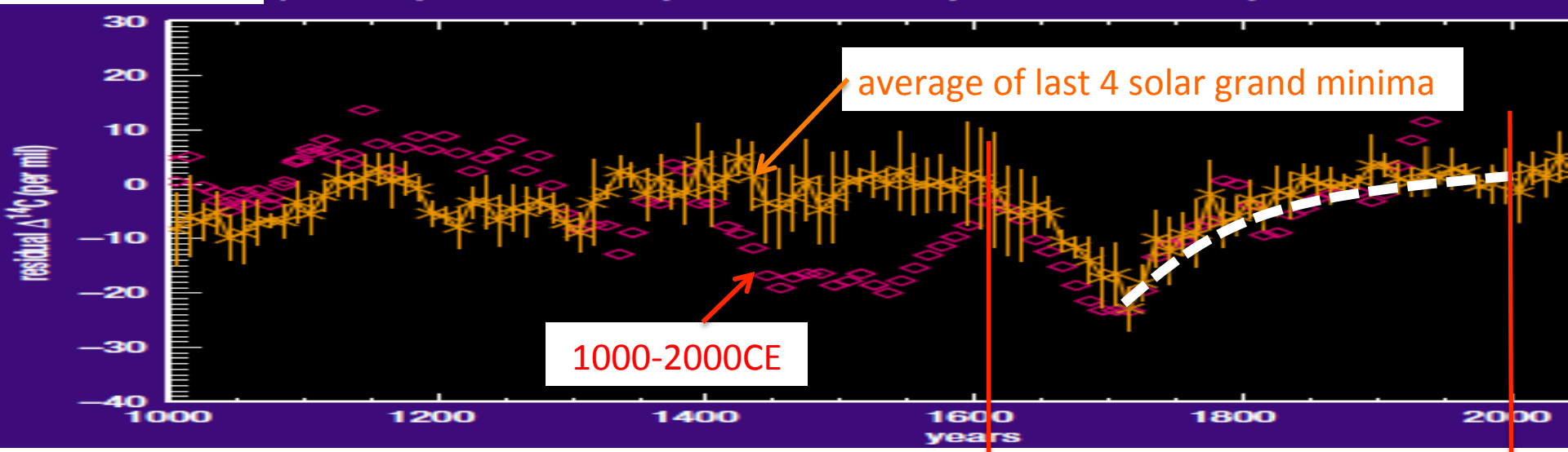
Solar output Usoskin et al. 2014

Tree-ring C14 proxy. Grey = 95% CI.

Red = group sunspot number (Hoyt & Schatten 1988).

7 Sunspot Group Number "correction" (lower-right fig.) is doubtful

Clilverd et al. 2003, fig. 2b: **The average behaviour (with variability) of the residue $\Delta^{14}C$ during minima of the last four Hallstatt cycles compared with the data from the present day. The impact of anthropogenic effects on present-day data can be clearly seen after 1900. The year 2100 is indicated by a vertical line.**



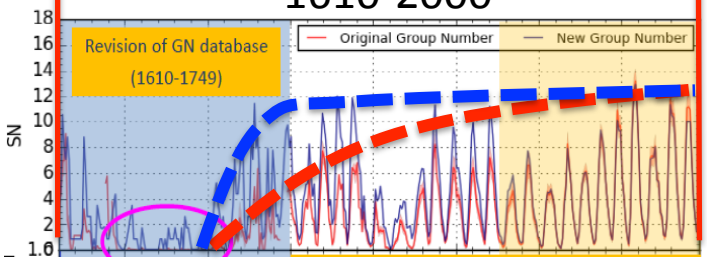
Two solar activity proxies:-
tree-ring C14 (upper fig.) & sunspots (lower fig.).

The gradual (rather than abrupt) solar recovery after each of the last four solar grand minima (upper fig., my white dashed line) is better matched by the Hoyt & Schatten (1998) "Original Group Number" (lower fig., red) than by the Clette et al. (2014) "New Group Number" (blue; my dashed lines).

Compiler:
Roger Higgs, April 2017

Group Number correction: overview

1610-2000

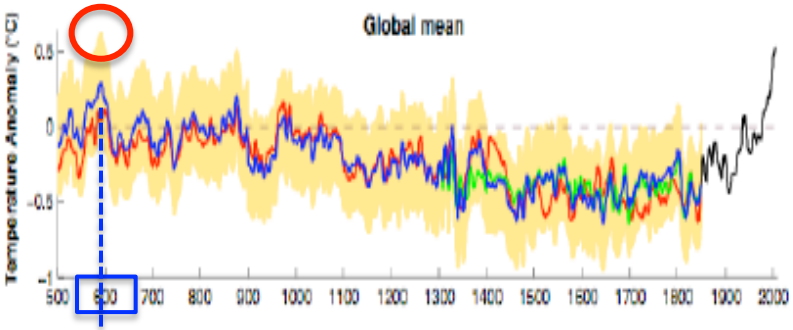


Clette & Lefèvre 2015

8

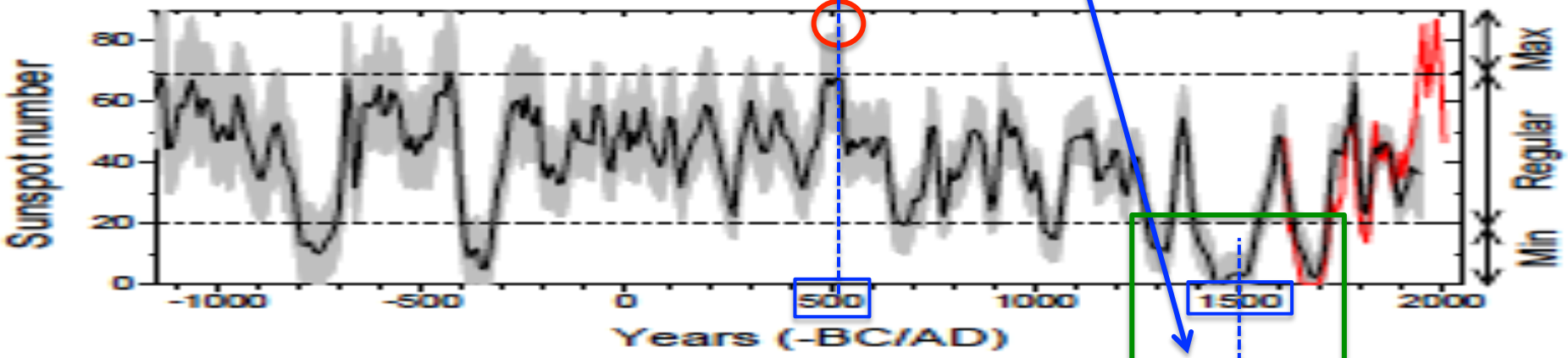
The temperature/solar match (PLATE 6) improves by introducing a variable time lag

World av. temp.;
65y lag applied



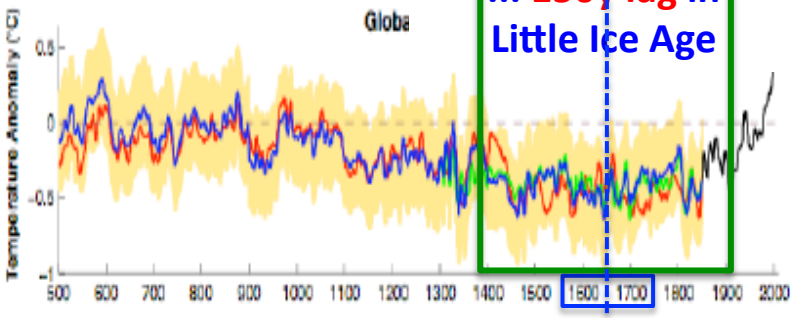
Solar output

65y lag at 500CE; grew to ...



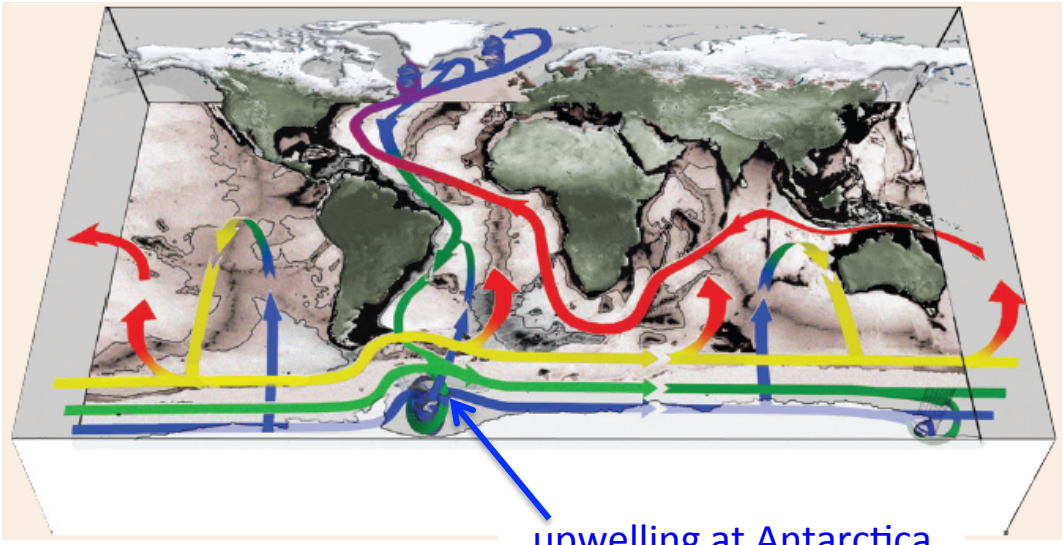
... 150y lag in Little Ice Age

World av. temp.;
150y lag applied



9 Why does global temp. lag behind solar output?

The "Global Conveyor Belt" ocean current system



upwelling at Antarctica (linking to Antarctic Circumpolar Current)

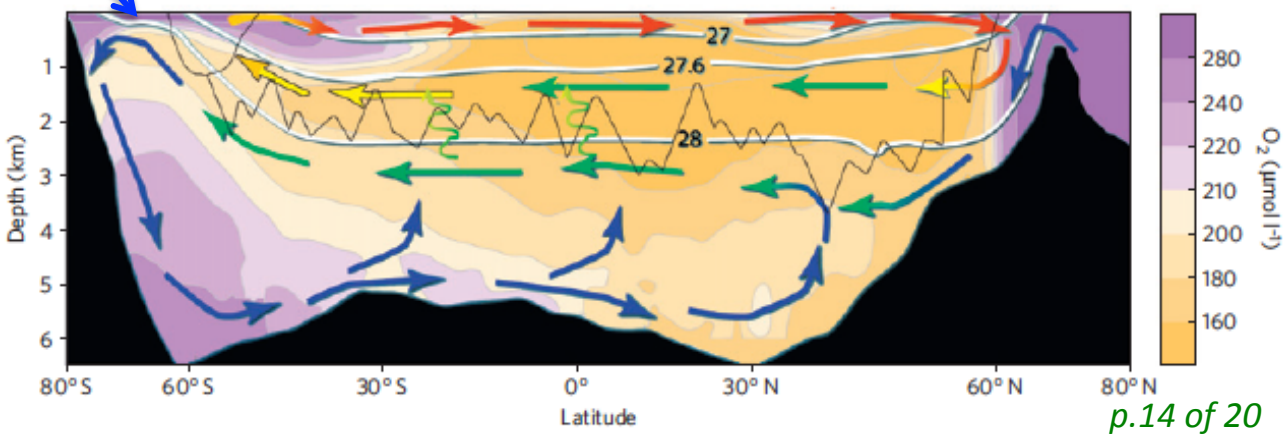
Marshall & Speer 2012

Neglected by IPCC

e.g. North Atlantic water, 'overwarmed' by the 1958 solar Grand Maximum (PLATE 6), upwells decades later at Antarctica, locally melting the entire buttressing ice-shelf (PLATE 13)

downwelling in N Atlantic

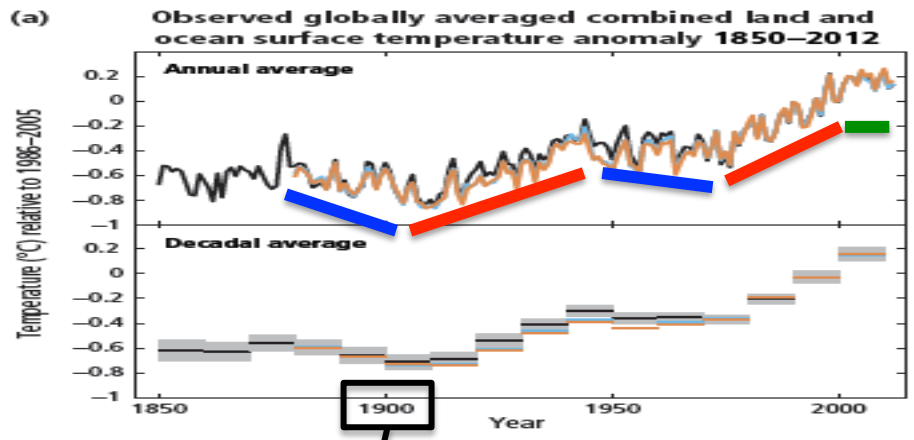
Atlantic S-to-N cross section:



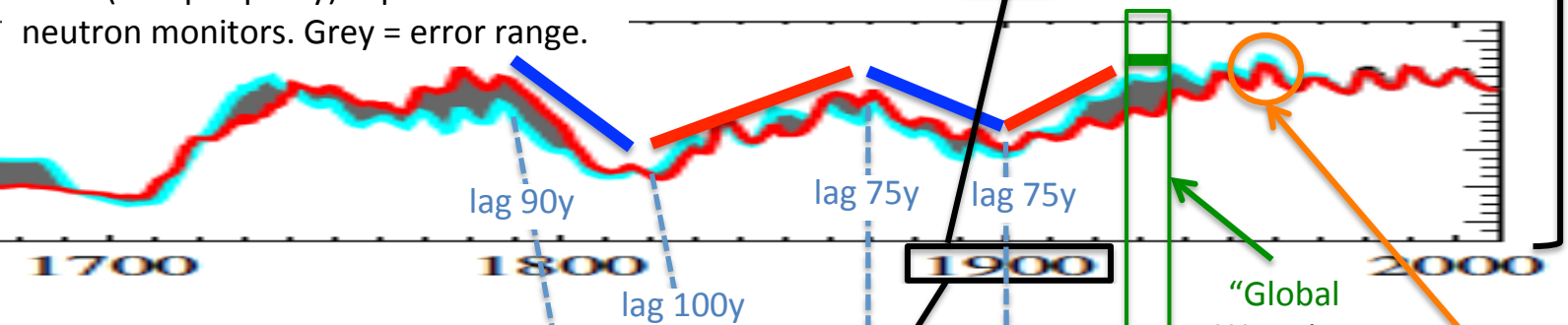
10 Measured (since 1850) global average temperature lags 75-100 years behind solar output

(variable lag reflects varying speed of global ocean circulation; PLATE 9)

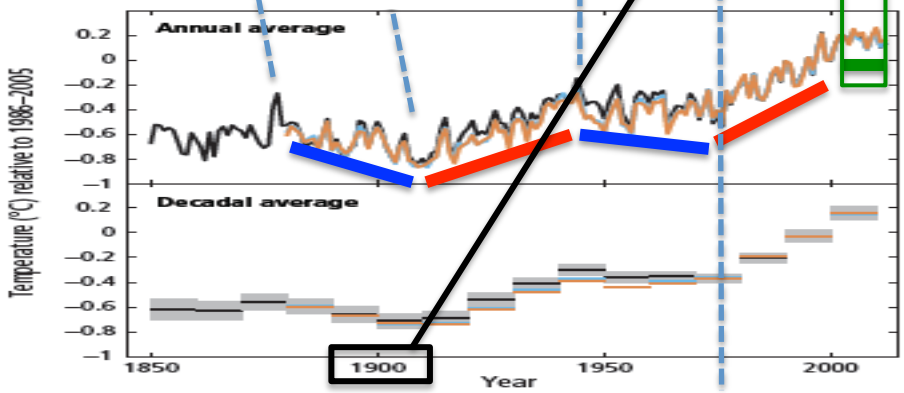
IPCC 2014, Fig. 1.1a
Global average temp.
Instrumental,
3 data sets



Shapiro et al. 2011.
Total solar irradiance, from ice-core 10Be (sunspot proxy) & post-1950 neutron monitors. Grey = error range.



lag 90y
lag 100y
lag 75y
lag 75y



No time shift: curves match poorly after 1975

"Global Warming Pause" is consistent with 75y lag

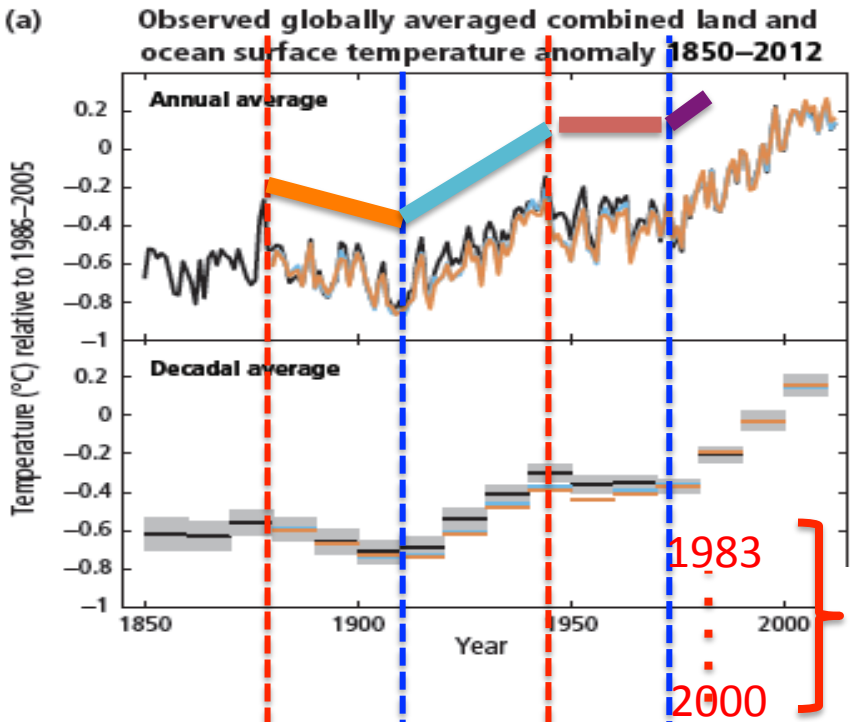
1958 solar Grand Maximum: 75y lag predicts corresponding peak temp. in 2033

75-100y shift: curves match well throughout

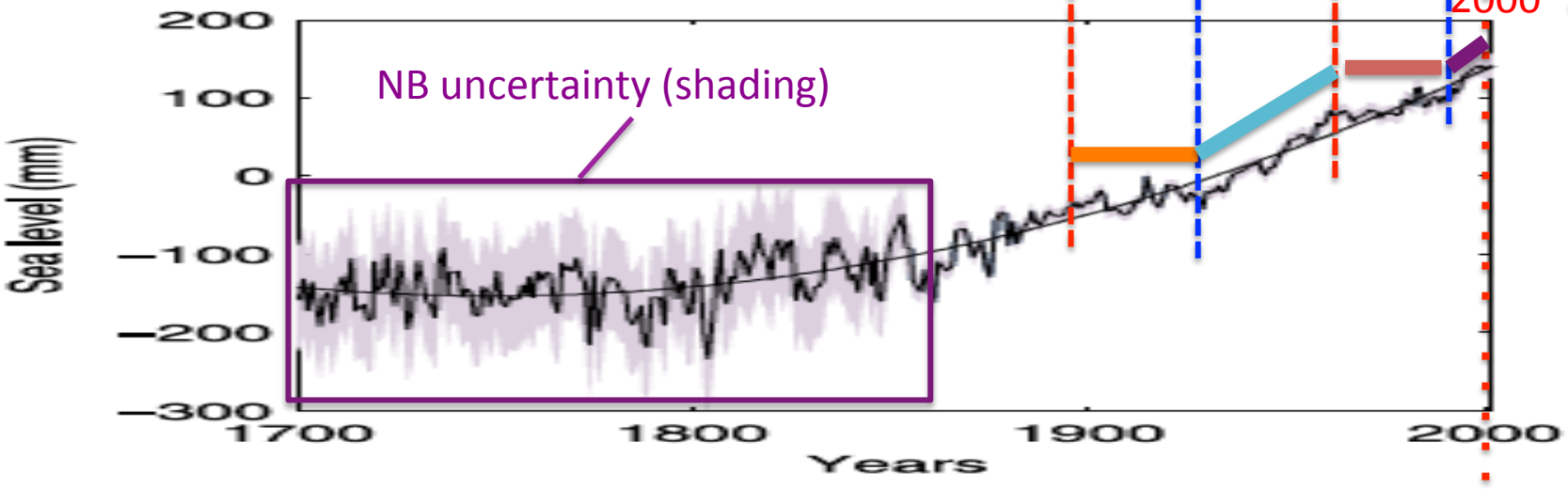
11 World sea level lags world temp. by 17y

("about 20 years" according to Robinson et al. 2007)

Global average temp.
IPCC 2014, Figure 1.1a
Instrumental, 3 data sets



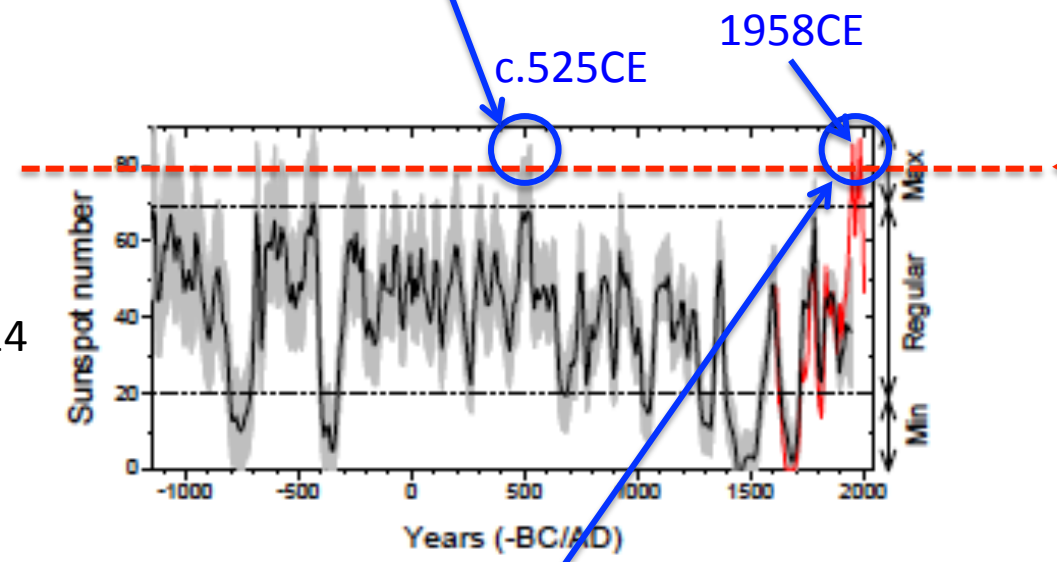
World sea level
from tide gauges
Jevrejeva et al. 2008



12 Another c.5m sea-level (SL) rise is imminent

The c.525CE solar peak drove a c.5m SL rise
(peaked c.80y later, due to c.65+c.15y lags)

Solar output
Usoskin et al. 2014



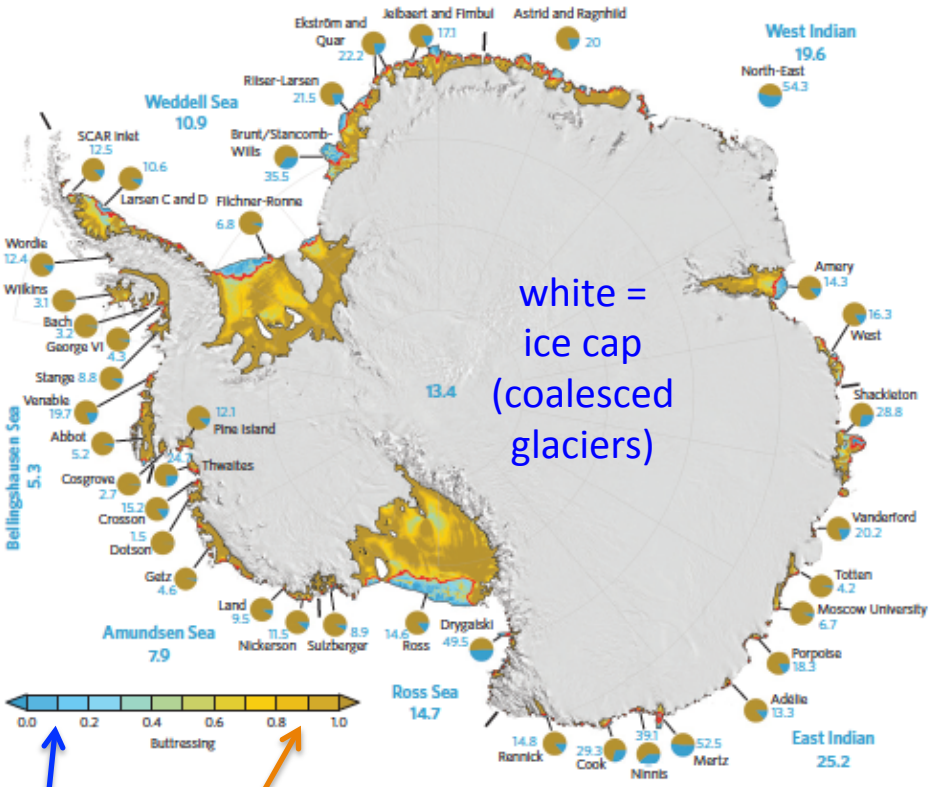
Solar threshold for metre-scale SL rise?

The 1958 solar peak was even higher
(a "Grand Maximum"), so I predict a SL rise of *at least* 5m,
peaking 100y later (i.e. present-day lags are 85+15y),
in 2058, just 40 years away

13 Likely mechanism for the c.5m Dark Ages & imminent SL rises:

local collapse of Antarctic ice sheet (unstable due to largely subsea base & reverse bed gradient; Schoof 2007) after the buttressing ice shelf is removed, primarily by melting by increasingly warm upwelling water (PLATE 9)

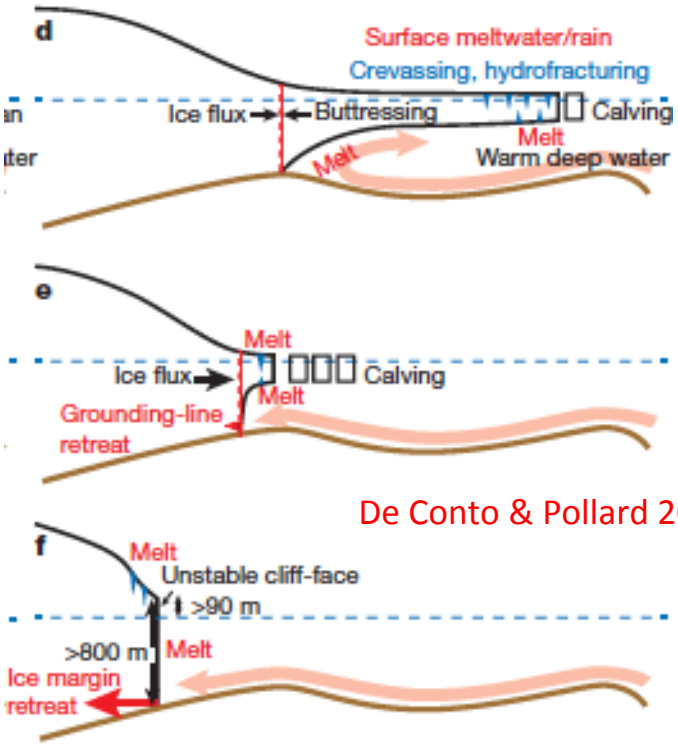
Fürst et al. 2016
"The safety band of Antarctic ice shelves"



Ice shelf (floating):

Brown = buttressing the ice cap

Blue = non-buttressing (nearly all gone in many places)



De Conto & Pollard 2016

Schematic cross-sections of an ice sheet approaching hypothetical cliff failure. In f, the buttressing ice shelf has been completely removed by basal melting, surface melting, and calving, exposing a vertical cliff >800m high rising >90m above sea level (SL), whereupon the cliff undergoes structural collapse, causing runaway rapid grounding-line retreat, resulting in metre-scale SL rise.

14 CONCLUSIONS/PREDICTIONS

An imminent world sea-level (SL) rise of at least 5m, like the one that occurred in the Dark Ages, will *end* by 2058 (1958 solar peak + 100y total lag), just 40 years away

The coming rise, like the Dark Ages one, is solar-driven & has nothing to do with mankind's industrial CO2 emissions

The SL rise will largely span c.2038-2058 (as the sun passed the "Grand Maximum" threshold only c.20y before the 1958 apex), implying an average rate of 25cm/y (*100x present-day 2.5mm/y*)

When SL starts to surge, the rate of rise will leap from <1cm/y to >10cm/y in weeks or months

If this hypothesis is correct:
We have <20y to begin evacuating half-a-*billion* coastal people & moving coastal nuclear plants, refineries, seaports, businesses, etc.

Expect socio-economic chaos unrivalled since .....

the Dark Ages "Migration Period"

15 PLEASE NOTE ...

To arrange a lecture, private or public, at your premises, summarising my research up to the moment, with many more examples of British (& other) archaeological evidence indicating Dark Ages world sea level was several metres higher than today's, please email rogerhiggs@hotmail.com

For my trilogy of presentations (IGC Cape Town August 2016; GSA Denver September 2016; EGU Vienna April 2017) summarizing IPCC bias & presenting full arguments for an imminent solar-driven c.5m sea-level rise like that of the Dark Ages, please visit https://www.researchgate.net/profile/Roger_Higgs

CV at http://www.geoclastica.com/RogerHiggsCV.htm