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Using Prediction Markets to Evaluate Various Global Warming Hypotheses

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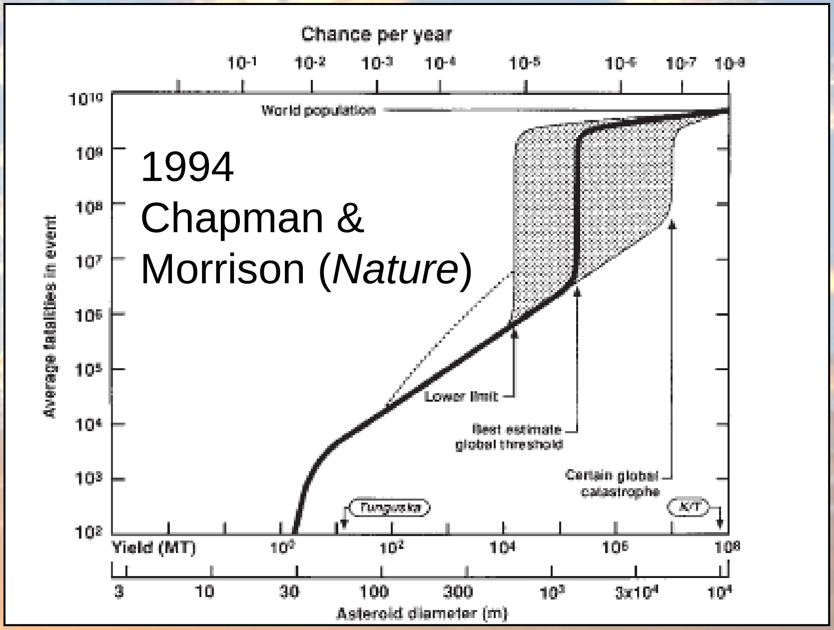
Avoidance of catastrophe

Three examples possible system “failure”

- Nuclear weapons failure
- Asteroid impact
- Extreme climate change



1994
Chapman &
Morrison (*Nature*)

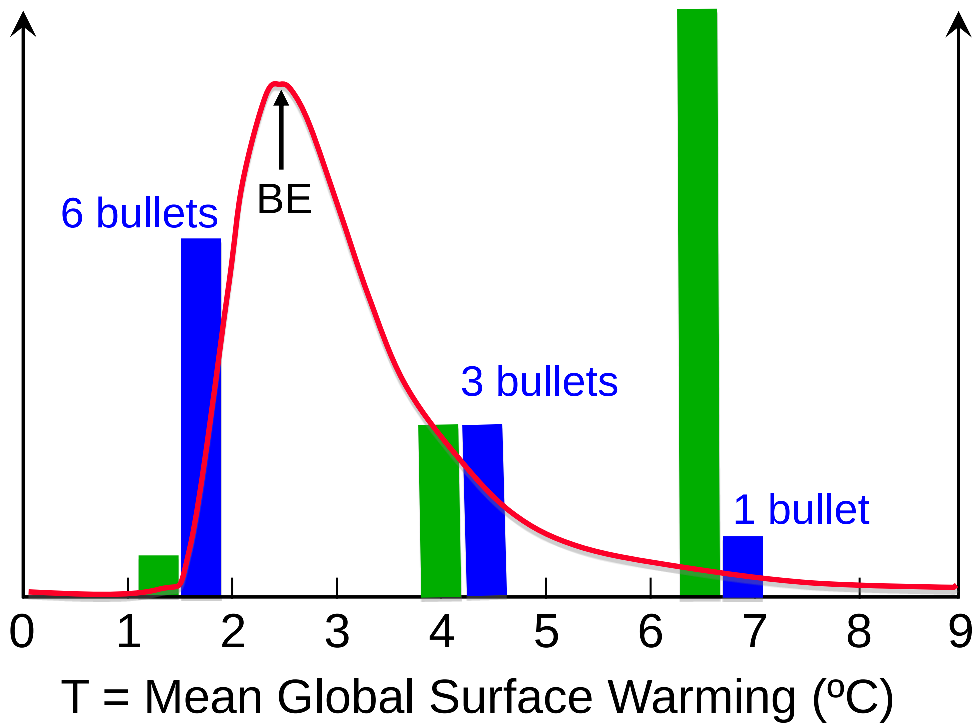
Low-probability/high-consequence events

Uncertainty quantification is required

Because decisions cannot wait for certainty

Severity of impact (consequences)

Large and irreducible epistemic uncertainty



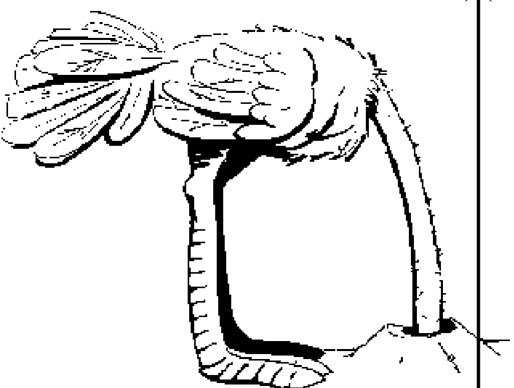
Probability of ΔT this century

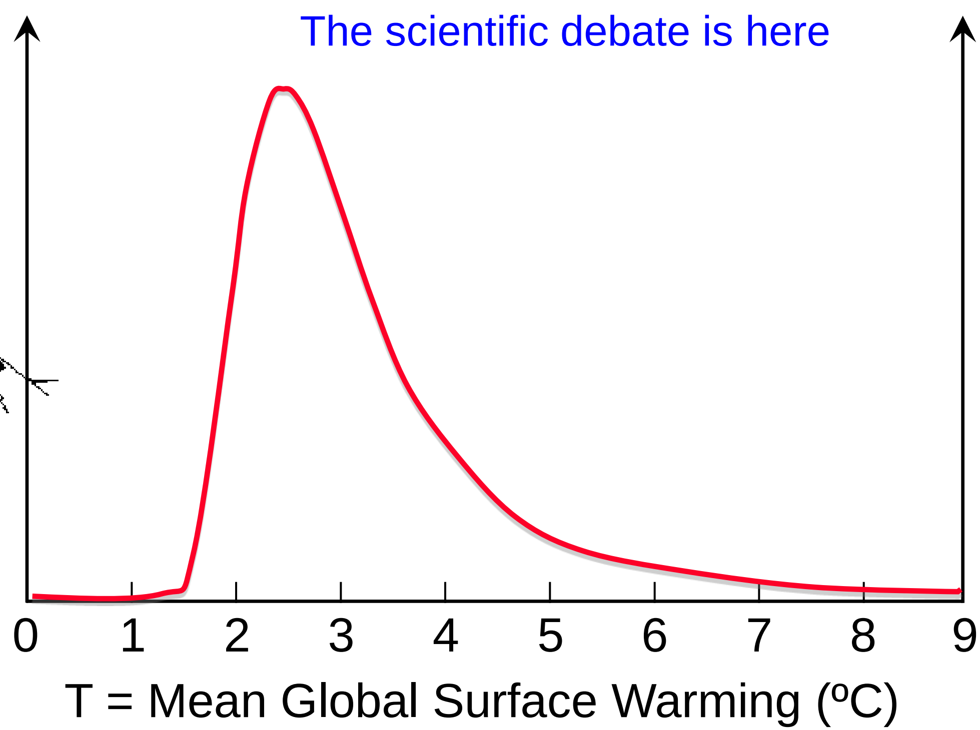
Cumulative probability is analogous to number of bullets in the gun.

- Big uncertainties in both consequences and probability of climate change.
- The risk of <u>deciding</u> to take no action can never be fully quantified.
- The “best estimate” (mean or mode) is not relevant by itself.

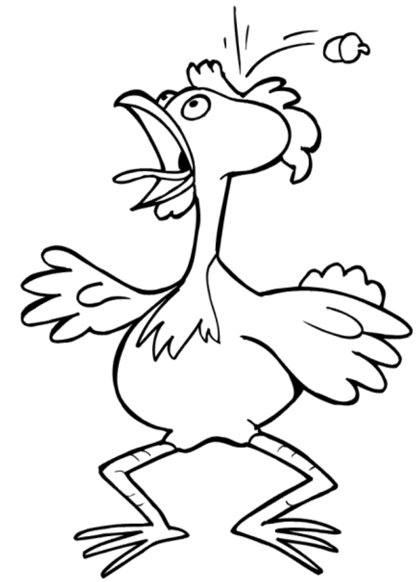
Statements that express absolute certainty about future climate change are unscientific

"Global warming is a hoax"





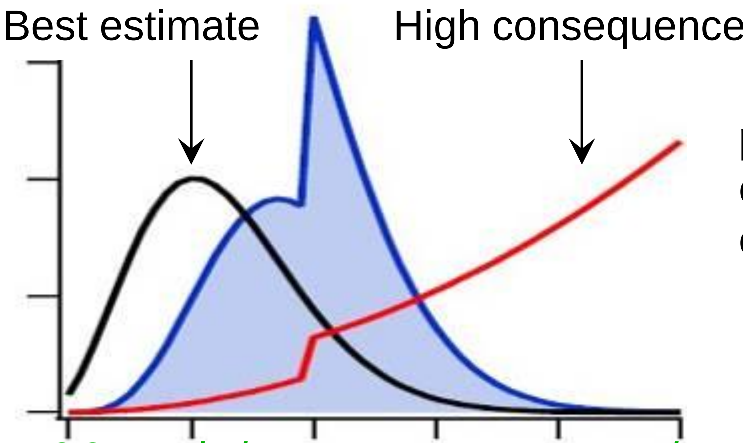
"Global catastrophe is certain"



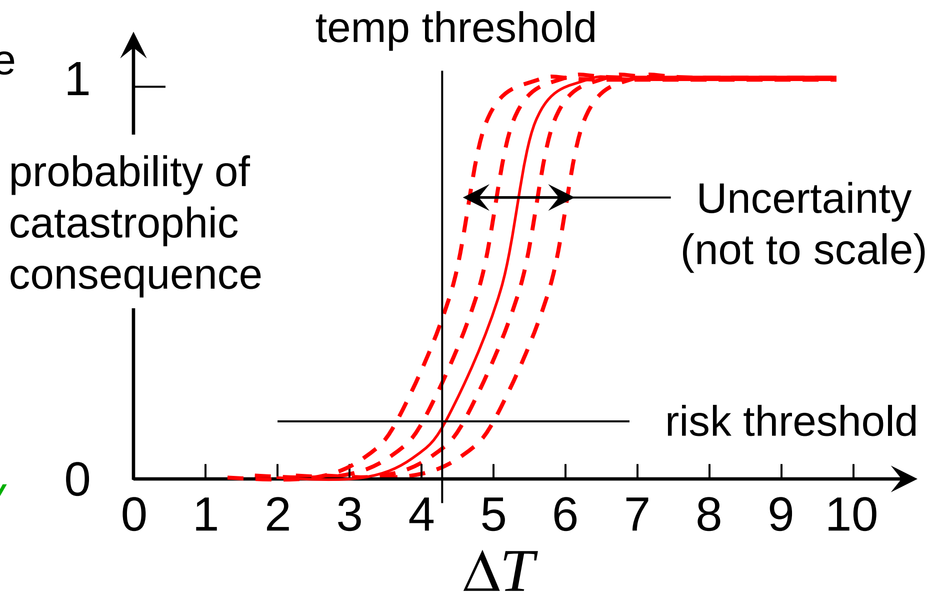
Neither of the extreme positions has any scientific basis

Risk is dominated by margin

*in contrast to the best estimate of IPCC**



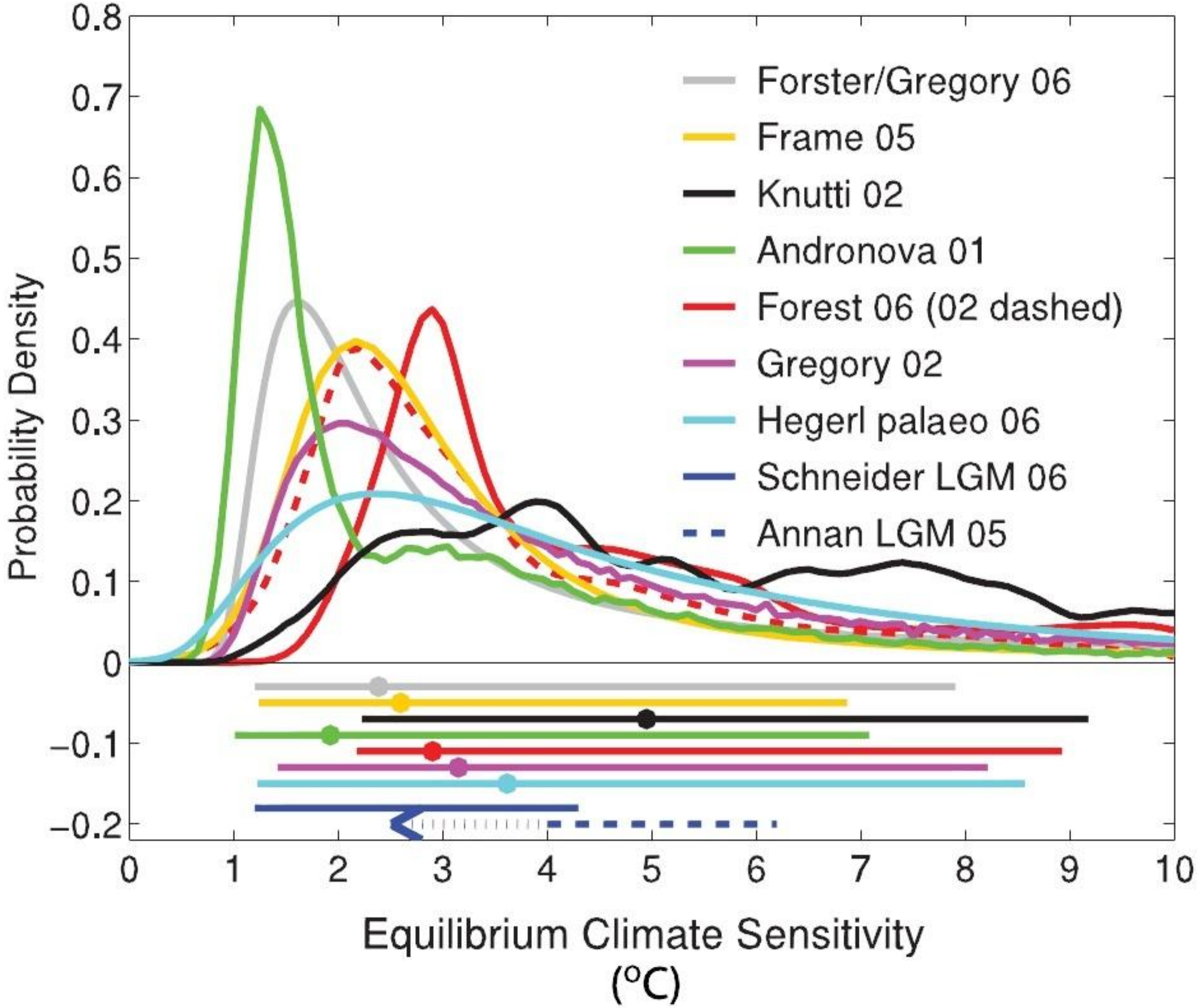
IPCC Workshop Report on Uncertainty and Risk (Manning, et al., 2004).



- Probability Density Function **(black)** for value of a climate change parameter such as global temperature.
- Consequences **(red)** are an increasing function of climate change.
- Estimated cost is the area under the product curve **(blue)**.
- Best estimate of climate change parameter is not the most important value for impact assessment
- High-consequence "fat tail" is more heavily weighted when a threshold is crossed so quantitative impact analysis should focus on the tail.

**Intergovernmental Panel on Climate Change*

Probability Density Functions



Market- Generated CCDF "Surrogate model" for Uncertainty quantification

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  - Immigration Reform
  - Pres. Job Approval
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  - 2010 US Senate Races
  - 2010 US House Races
  - 2010 US Gov. Races
  - 2010 US Primaries
  - 2012 US Elections
  - US Congress
  - US Legislation
  - New York Politics
  - Sarah Palin
  - Mark Sanford
  - Michael Steele
  - US Pres. Decisions
  - Impact of Next Pres.
  - UK Politics
  - Canadian Politics
  - Irish Politics
  - Australian Politics
  - Brazilian Politics
  - Austrian Politics
  - Czech Politics
  - Dutch Politics
  - Colombian Politics
- Scientific
  - Higgs Boson Particle
  - Focus Fusion
  - Supersym. Particle
- Social and Civil
- Technologies
- Test: Company Valuation
- Transportation

Show Expired

Suggest Contract

markets@intrade.com

Politics - 2010 US Midterms

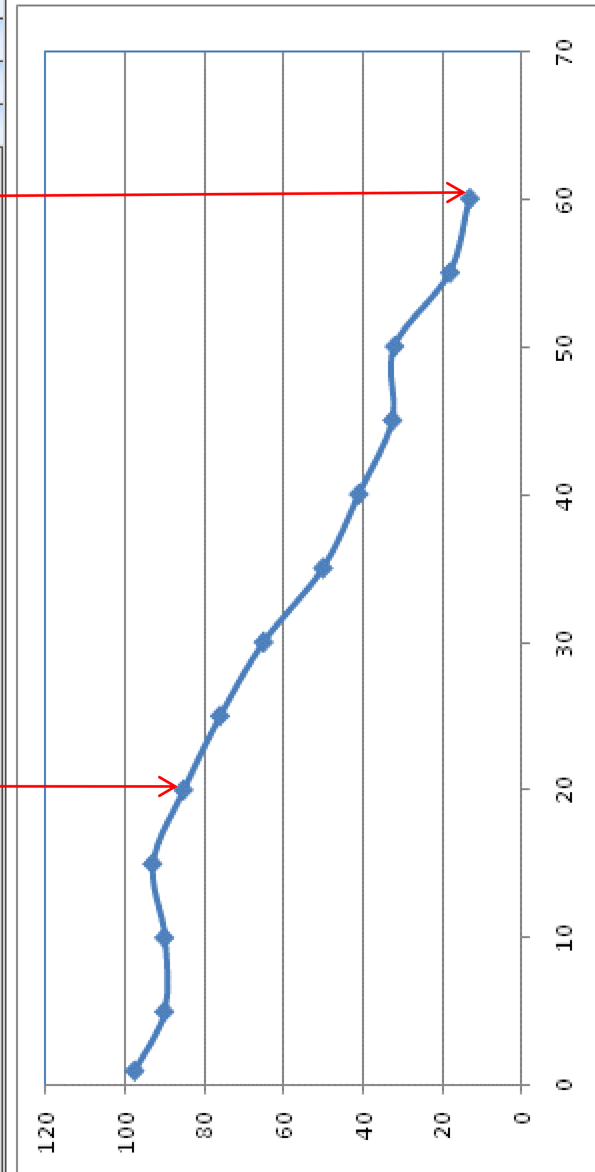
2010 US Senate Control +

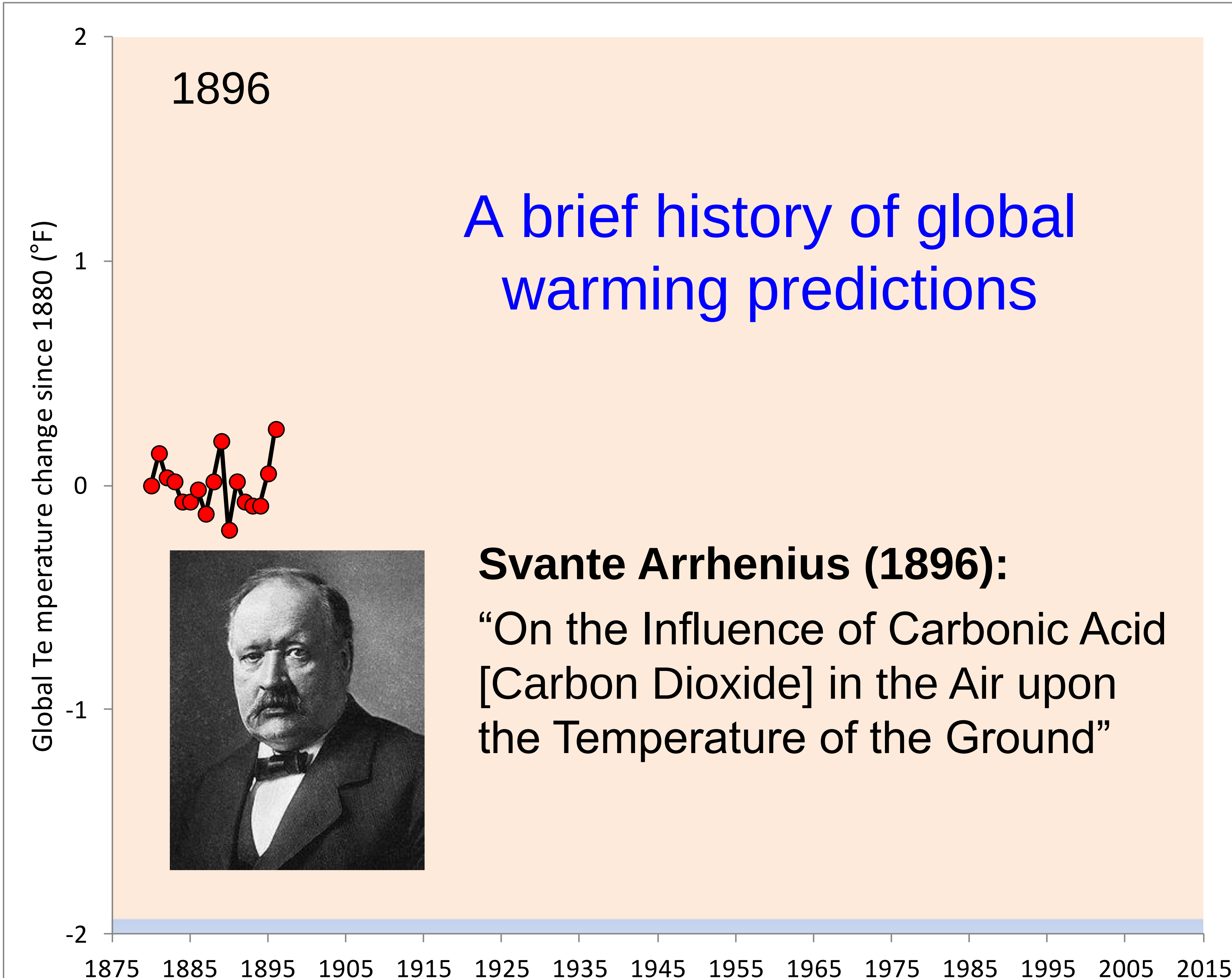
2010 US House of Representatives Control +

Will Larry Kudlow run for the US Senate in 2010? +

Number of House seats gained by Republicans in 2010 US midterms −

Contract	Bid	Ask	Last	Vol	Chge
2010.REP.HOUSE.+60 Republicans to gain 60 or more seats in 2010 mid-term elections Trade	4.0	40.0	13.0	171	0
2010.REP.HOUSE.+55 Republicans to gain 55 or more seats in 2010 mid-term elections Trade	15.0	19.9	18.0	150	0
2010.REP.HOUSE.+50 Republicans to gain 50 or more seats in 2010 mid-term elections Trade	20.0	29.9	32.0	40	0
2010.REP.HOUSE.+45 Republicans to gain 45 or more seats in 2010 mid-term elections Trade	25.1	37.5	32.5	31	0
2010.REP.HOUSE.+40 Republicans to gain 40 or more seats in 2010 mid-term elections Trade	41.0	45.0	41.0	69	0
2010.REP.HOUSE.+35 Republicans to gain 35 or more seats in 2010 mid-term elections Trade	45.0	60.0	50.0	77	0
2010.REP.HOUSE.+30 Republicans to gain 30 or more seats in 2010 mid-term elections Trade	65.0	69.9	65.0	179	0
2010.REP.HOUSE.+25 Republicans to gain 25 or more seats in 2010 mid-term elections Trade	75.0	81.0	76.0	111	0
2010.REP.HOUSE.+20 Republicans to gain 20 or more seats in 2010 mid-term elections Trade	85.2	87.0	85.2	124	0
2010.REP.HOUSE.+15 Republicans to gain 15 or more seats in 2010 mid-term elections Trade	89.0	94.0	93.0	25	+3.0
2010.REP.HOUSE.+10 Republicans to gain 10 or more seats in 2010 mid-term elections Trade	91.0	96.5	90.0	20	0
2010.REP.HOUSE.+5 Republicans to gain 5 or more seats in 2010 mid-term elections Trade	91.0	-	90.0	20	0
2010.REP.HOUSE.+1 Republicans to gain 1 or more seats in 2010 mid-term elections Trade	90.0	99.1	97.5	81	0
2010.REP.HOUSE.NOGAIN Republicans to gain no seats in 2010 mid-term elections Trade	1.2	98.5	-	0	0




1896
A brief history of global warming predictions
Svante Arrhenius (1896):
“On the Influence of Carbonic Acid [Carbon Dioxide] in the Air upon the Temperature of the Ground”
Global Te mperature change since 1880 (°F)
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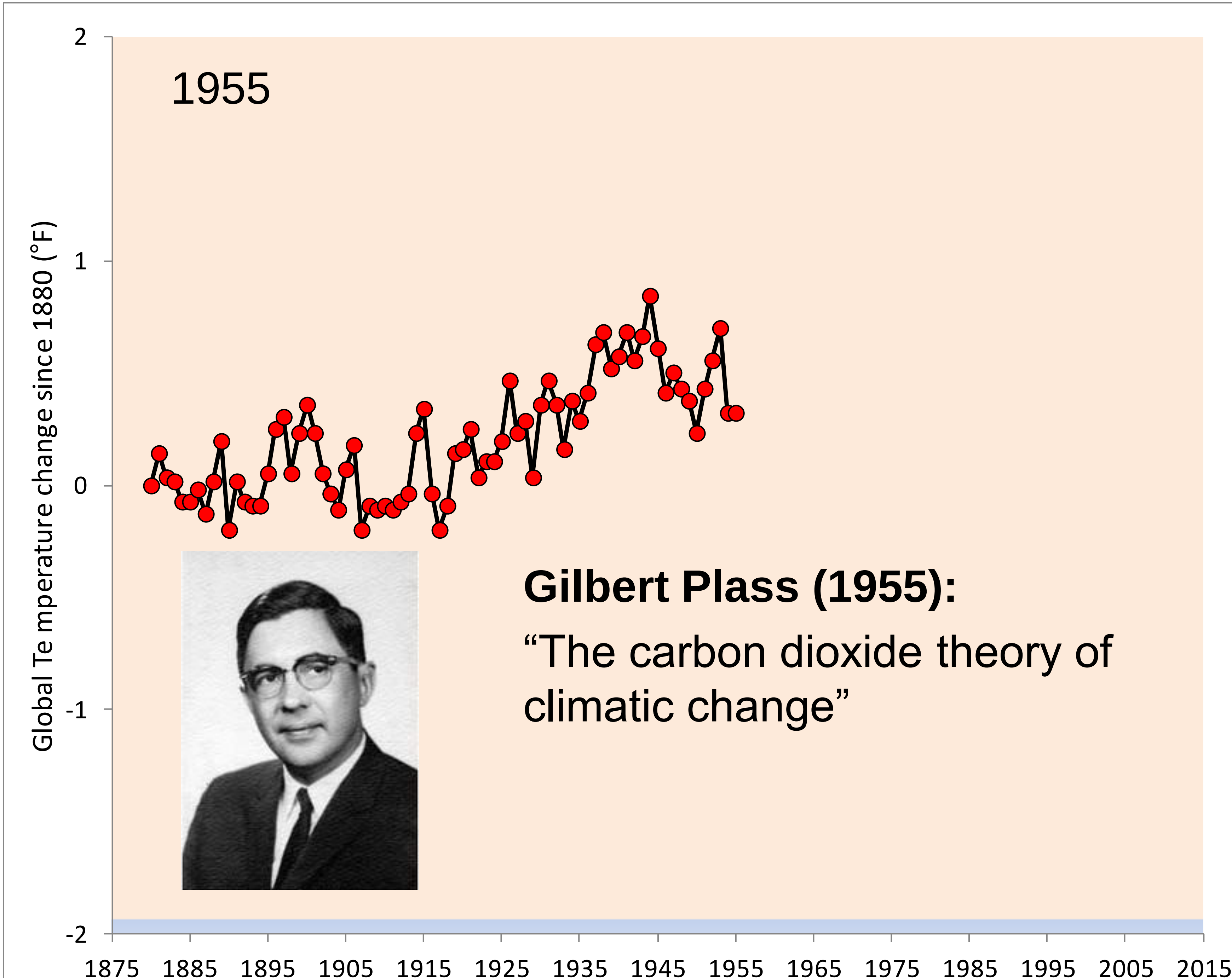

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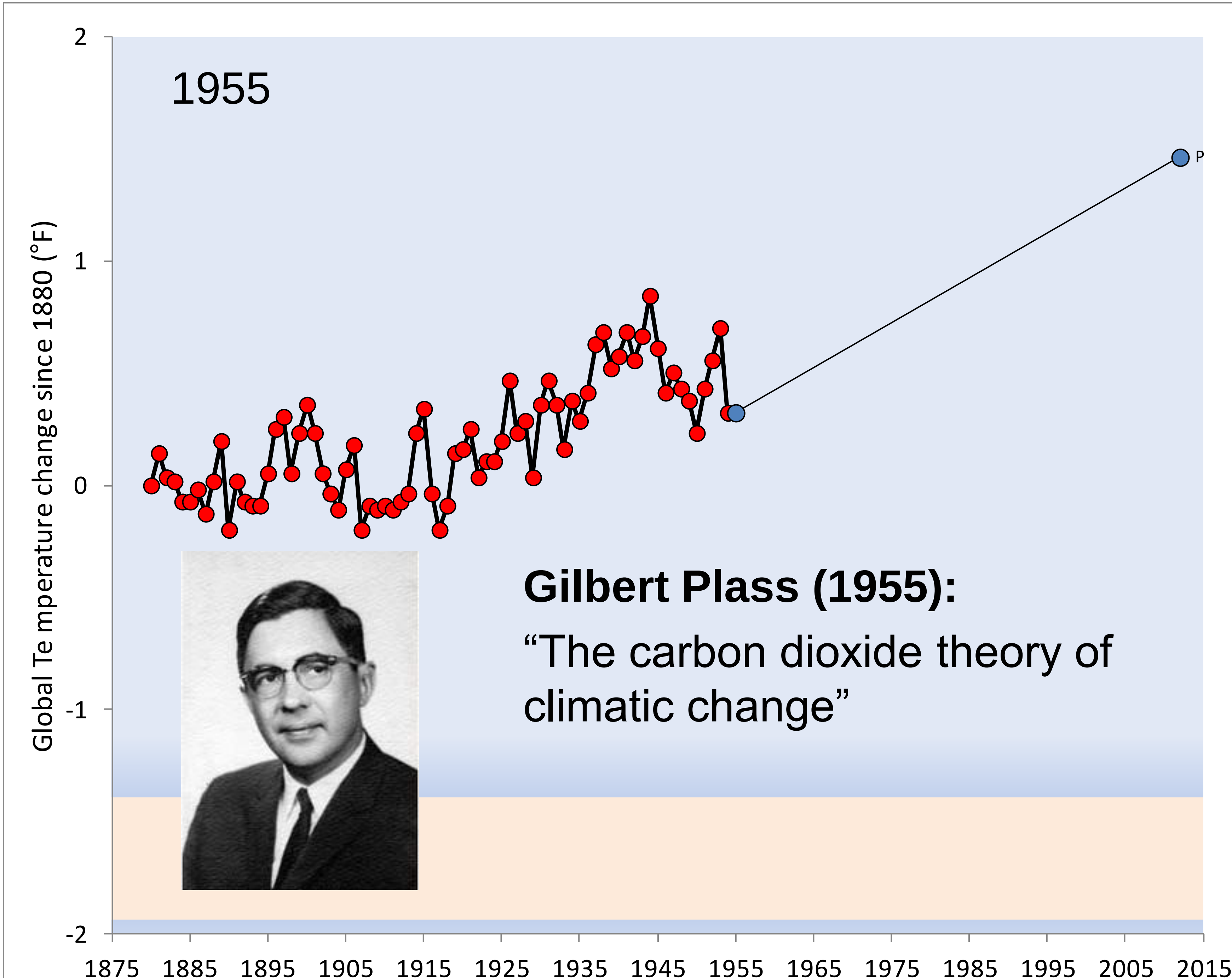
“The carbon dioxide theory of climatic change”



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Global Te mperature change since 1880 (°F)
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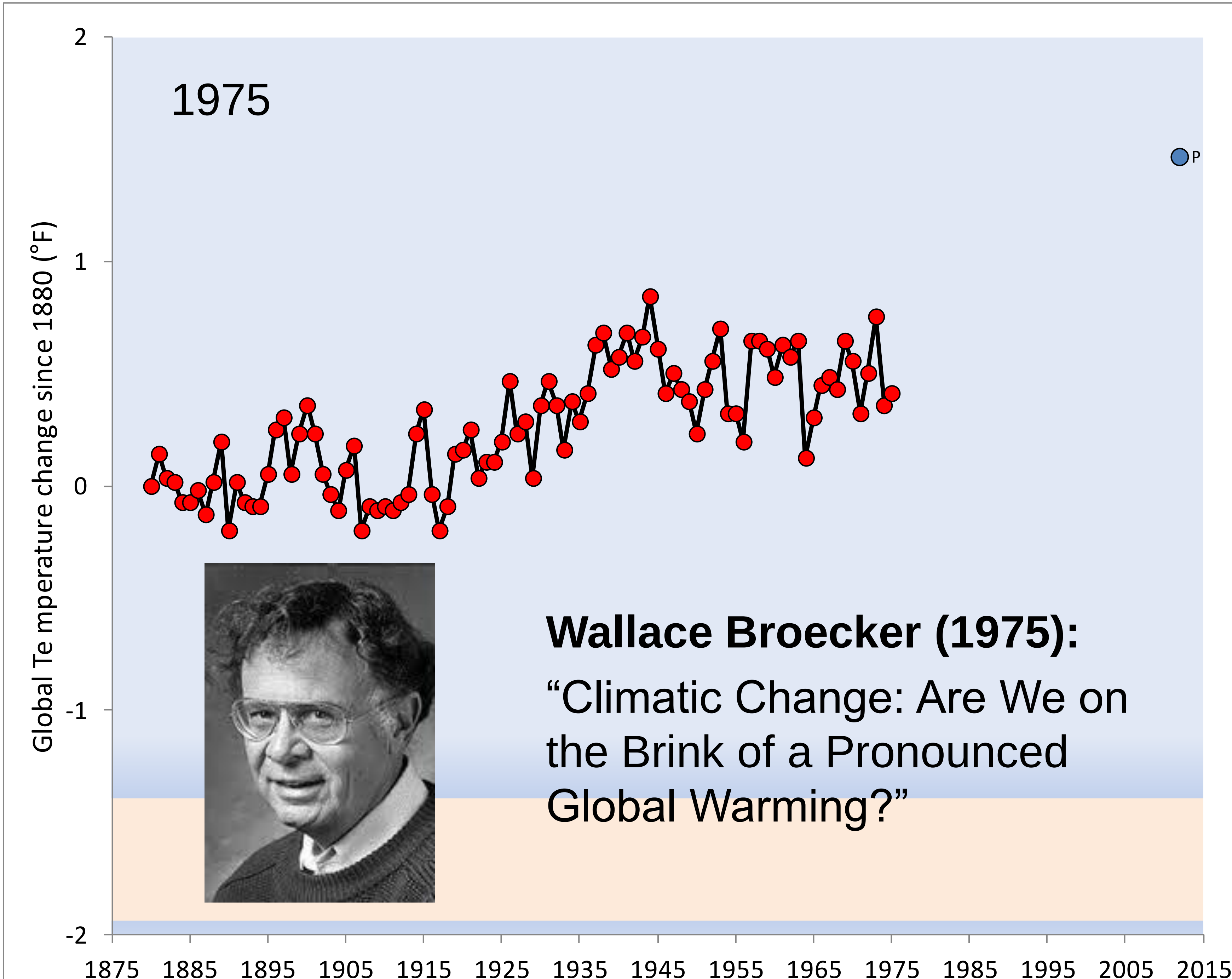
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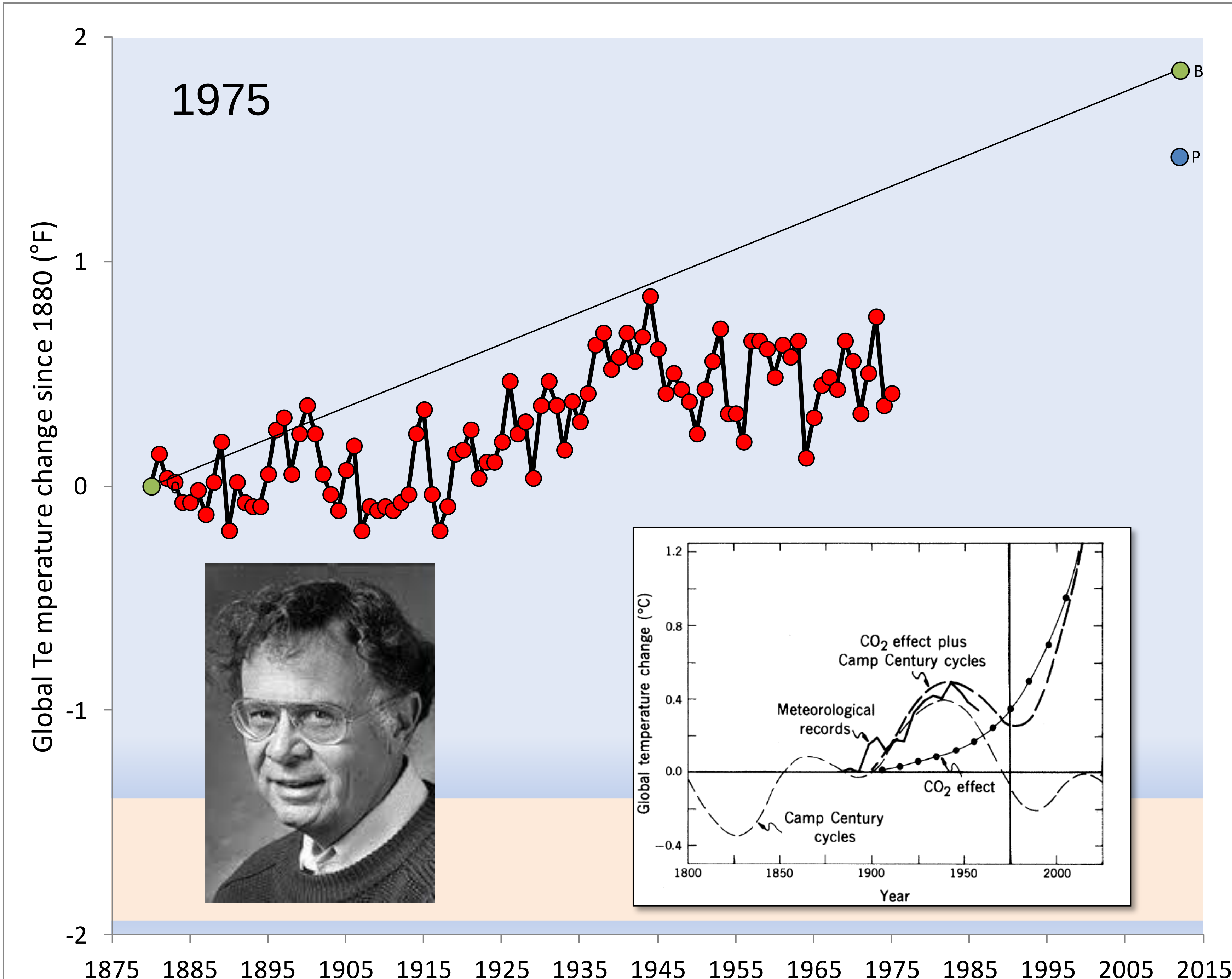
Wallace Broecker (1975):
“Climatic Change: Are We on the Brink of a Pronounced Global Warming?”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CO_2 effect plus
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Meteorological
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CO_2 effect
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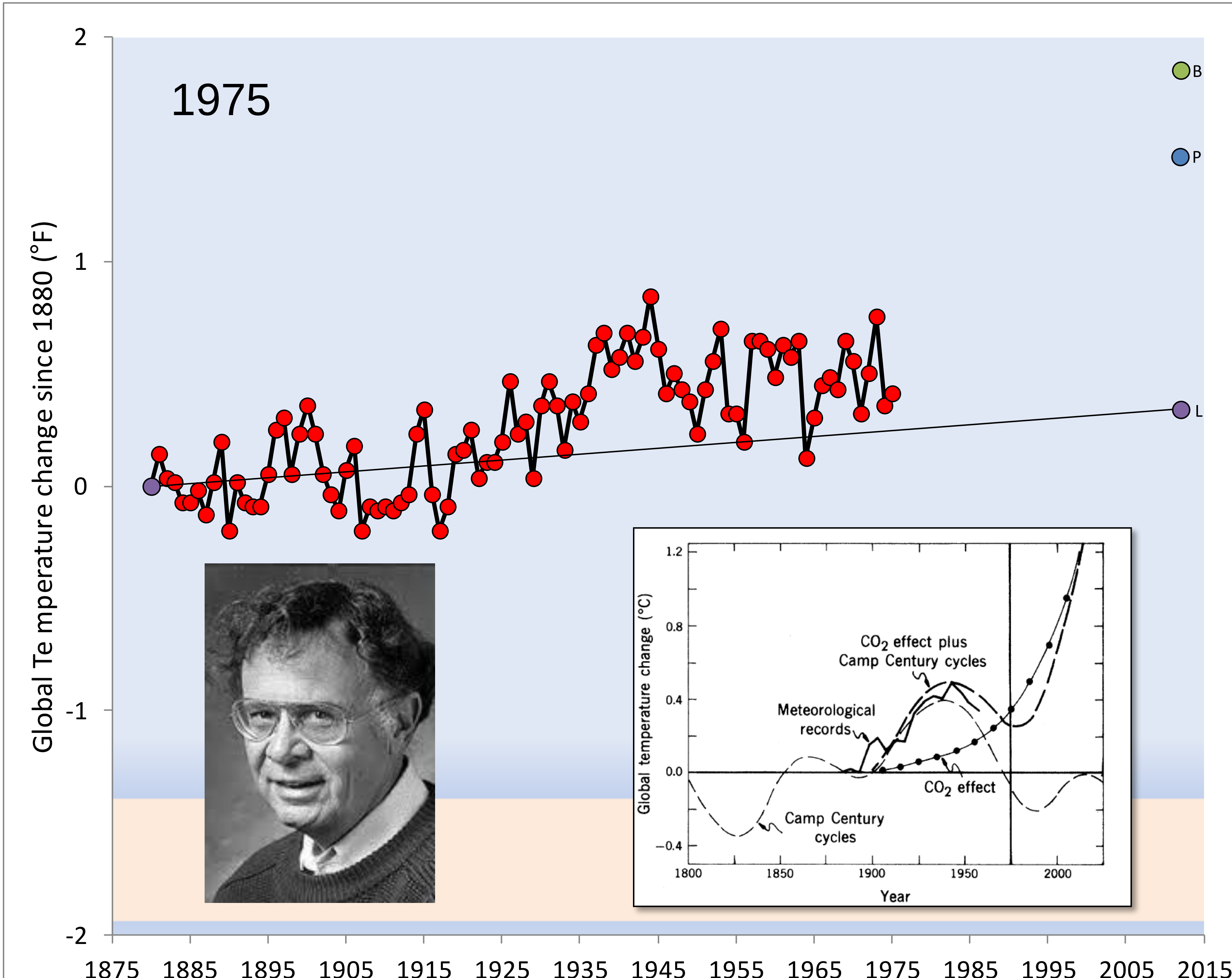
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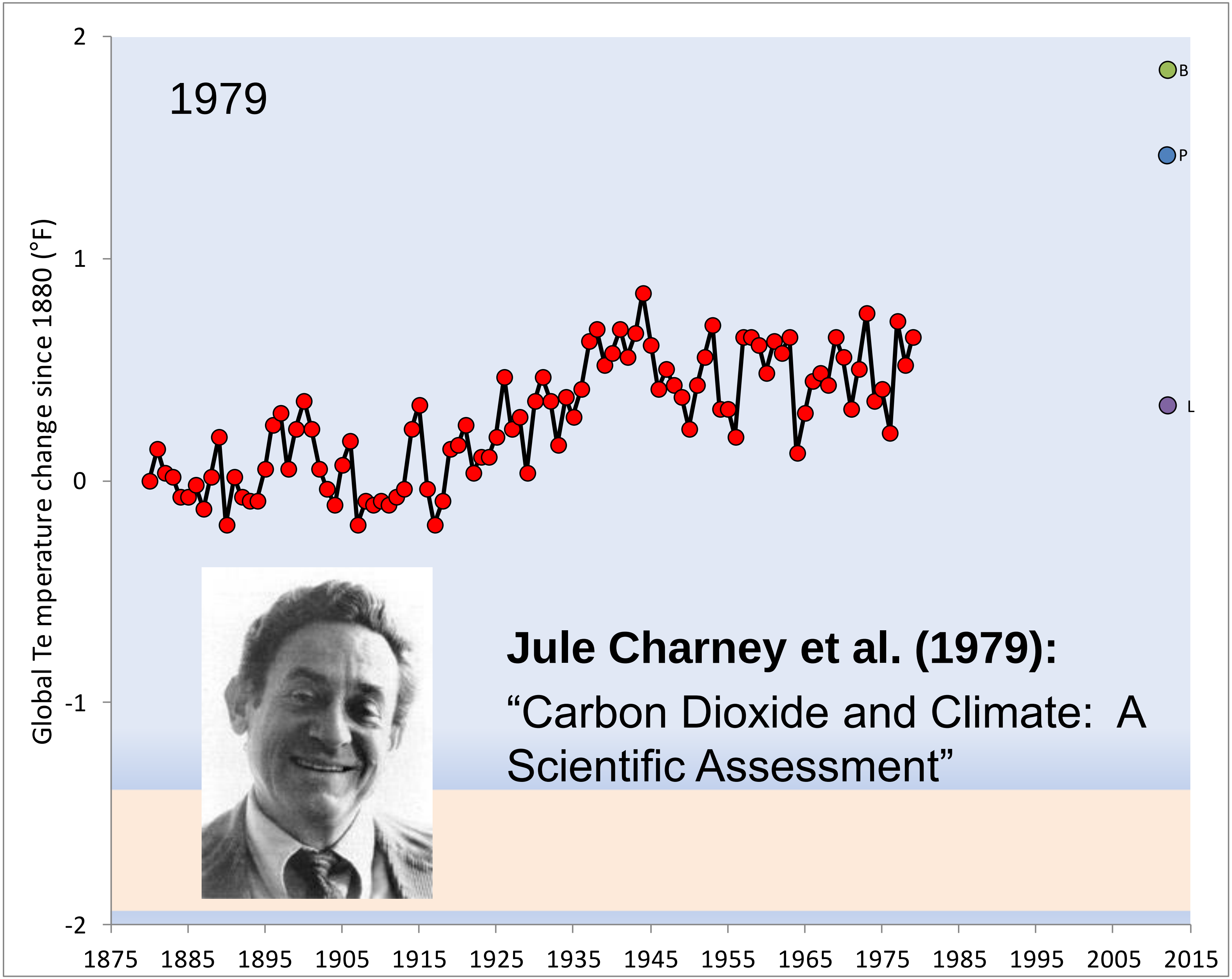

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Jule Charney et al. (1979):
“Carbon Dioxide and Climate: A Scientific Assessment”
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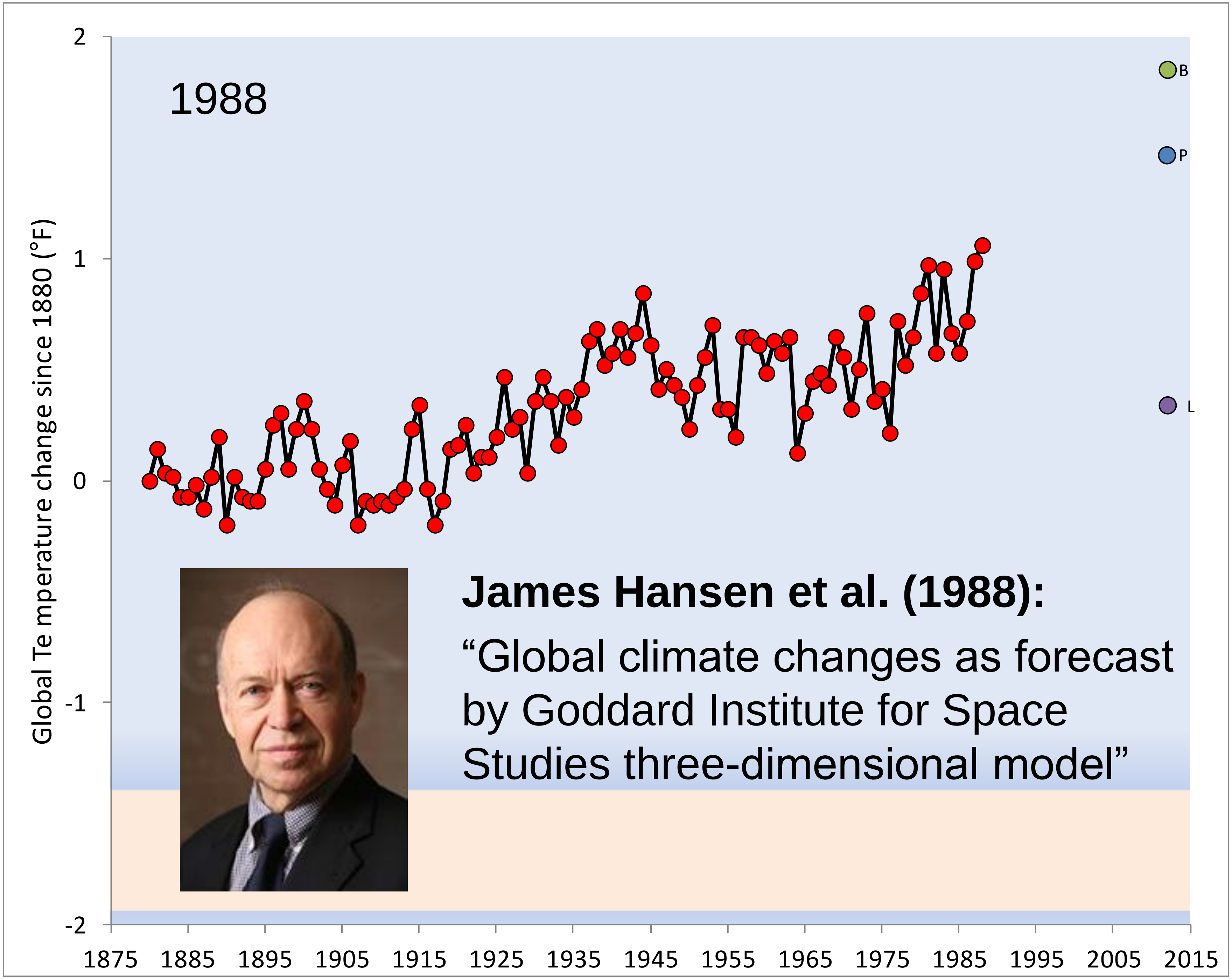
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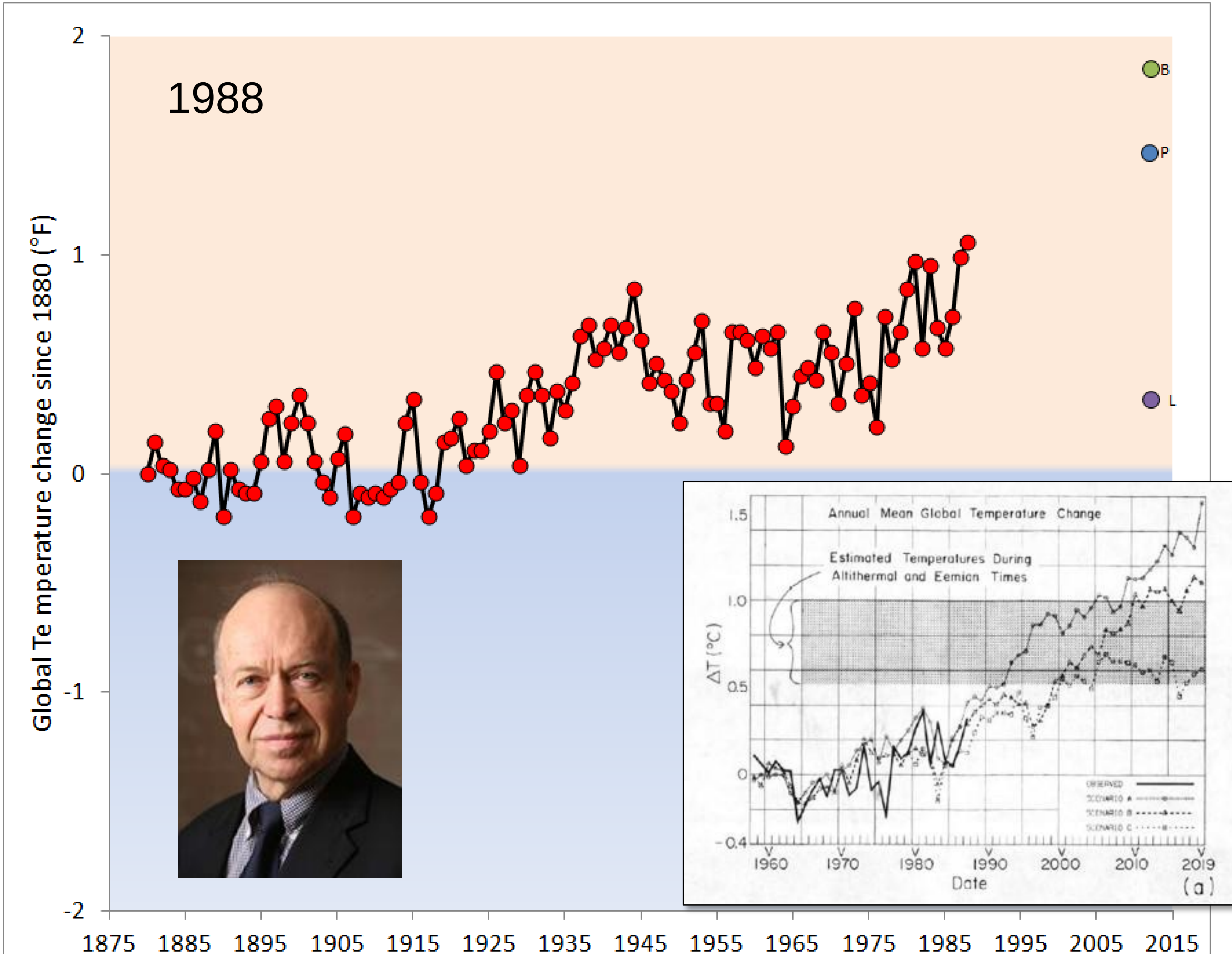
James Hansen et al. (1988):
"Global climate changes as forecast by Goddard Institute for Space Studies three-dimensional model"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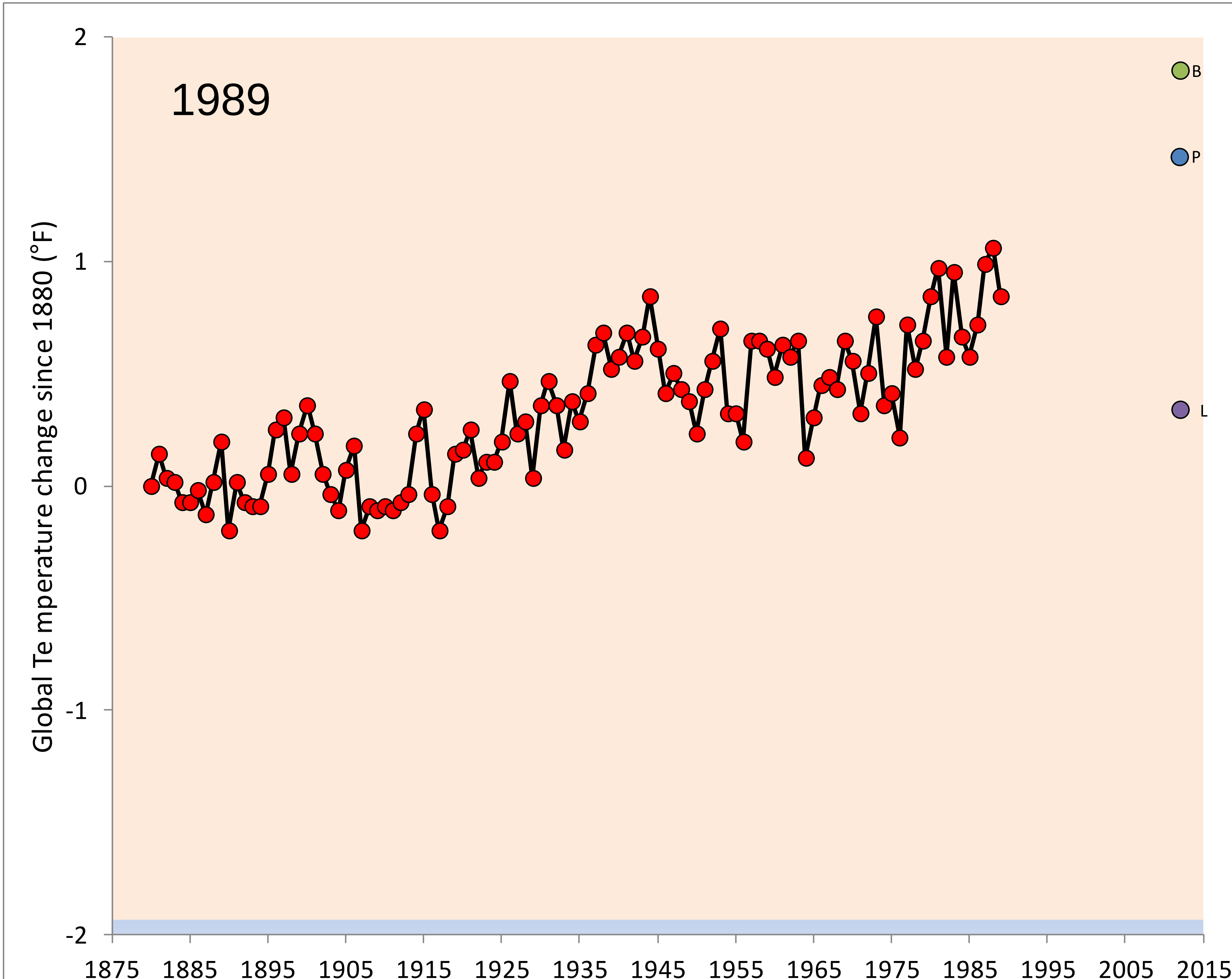
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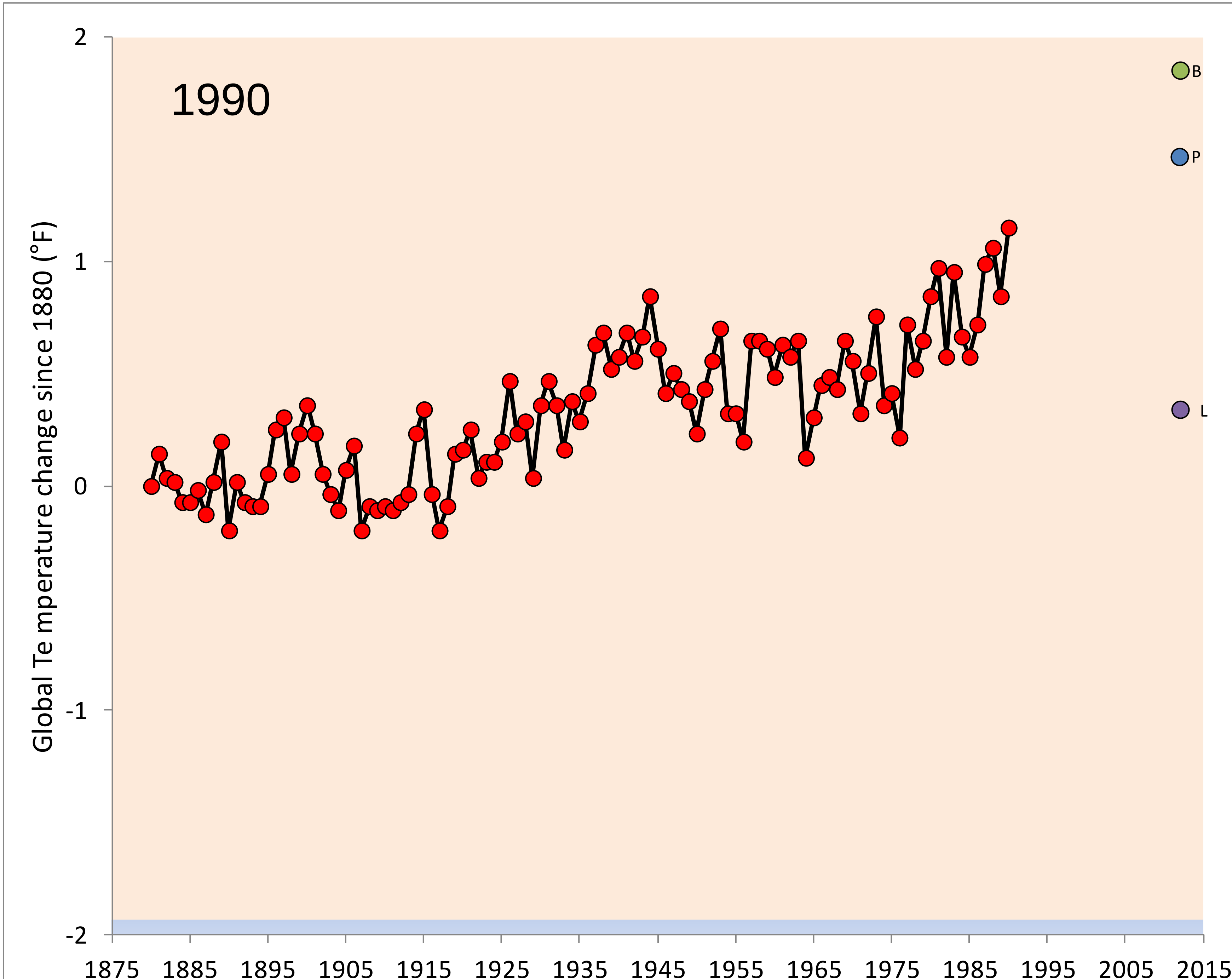

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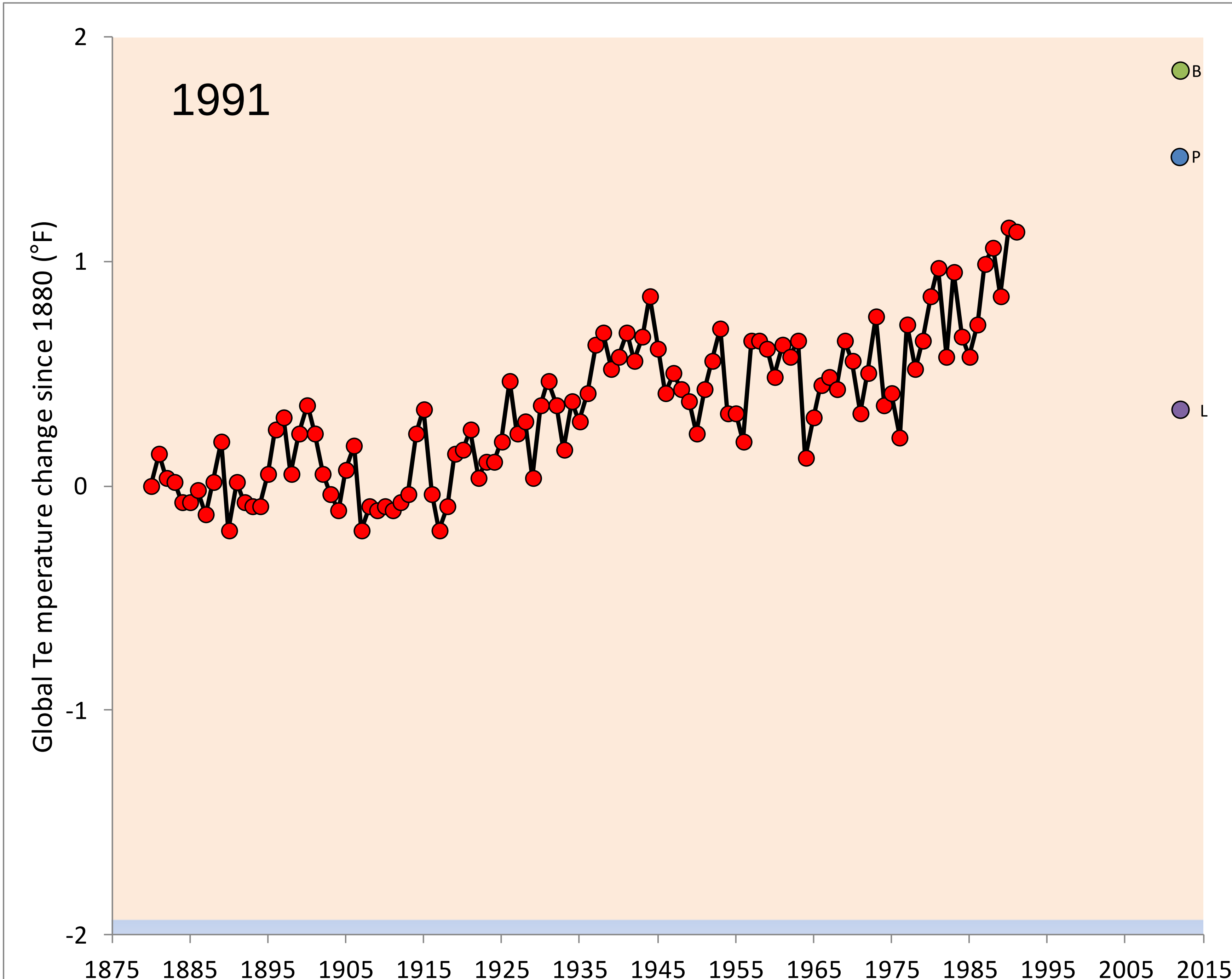
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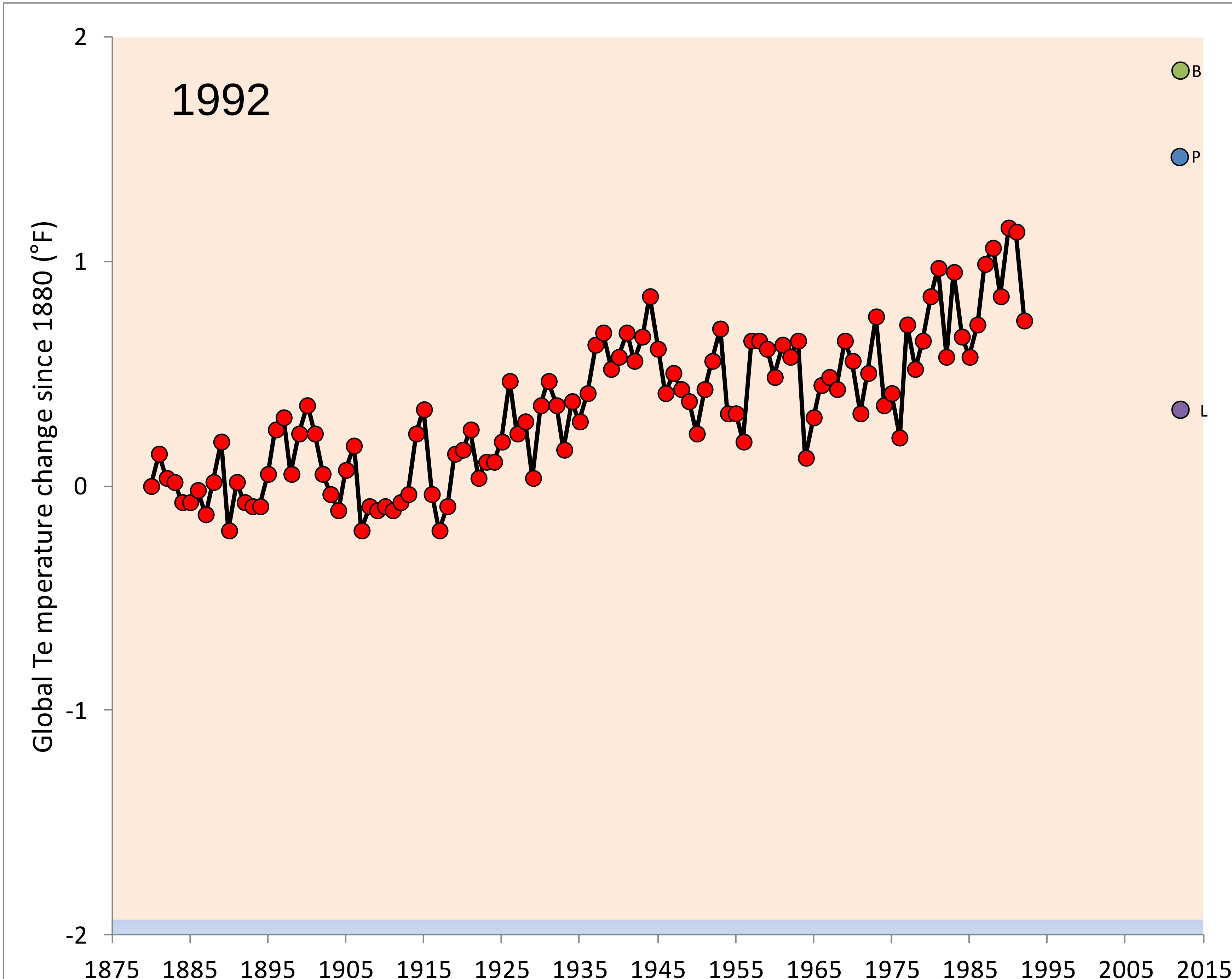
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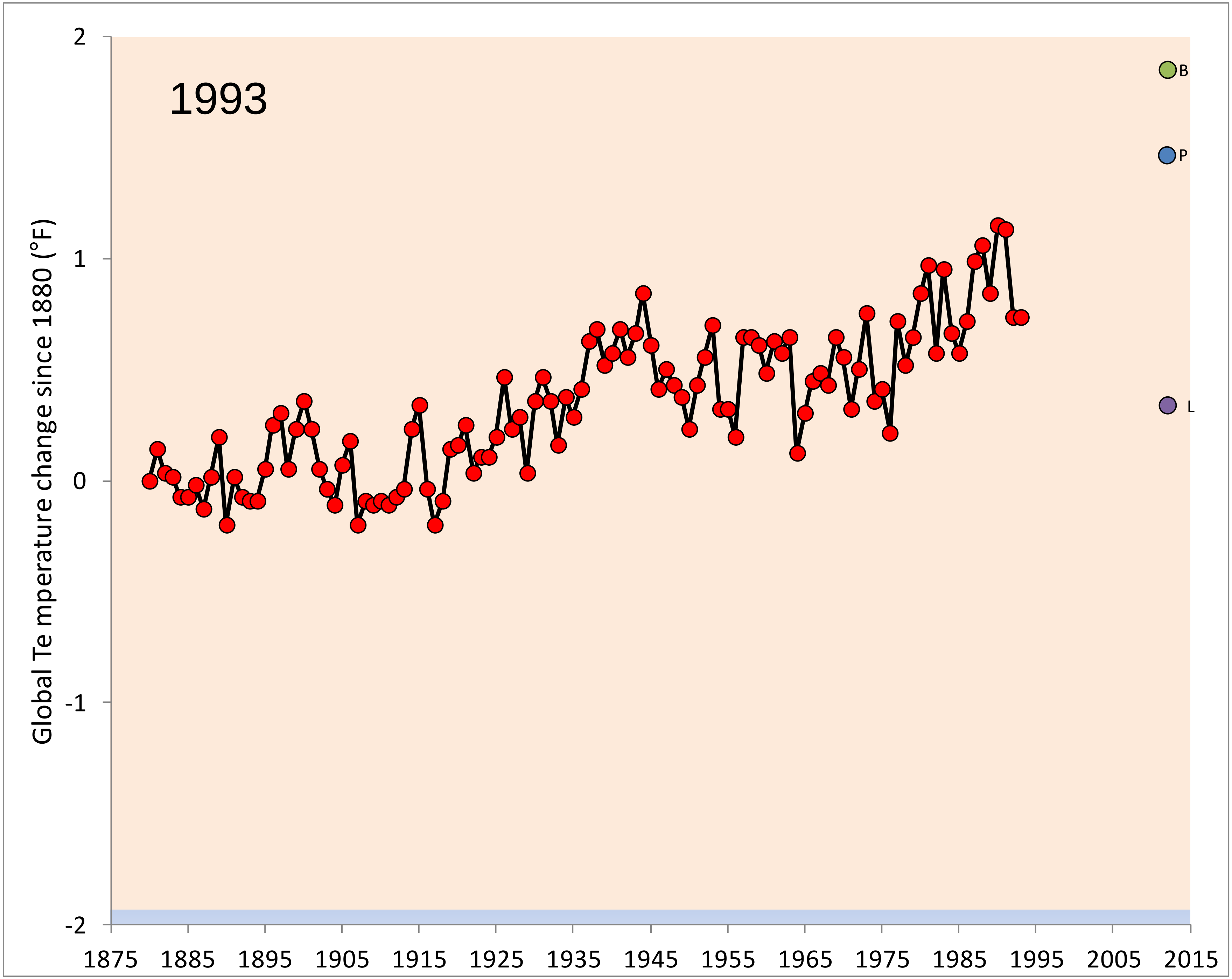
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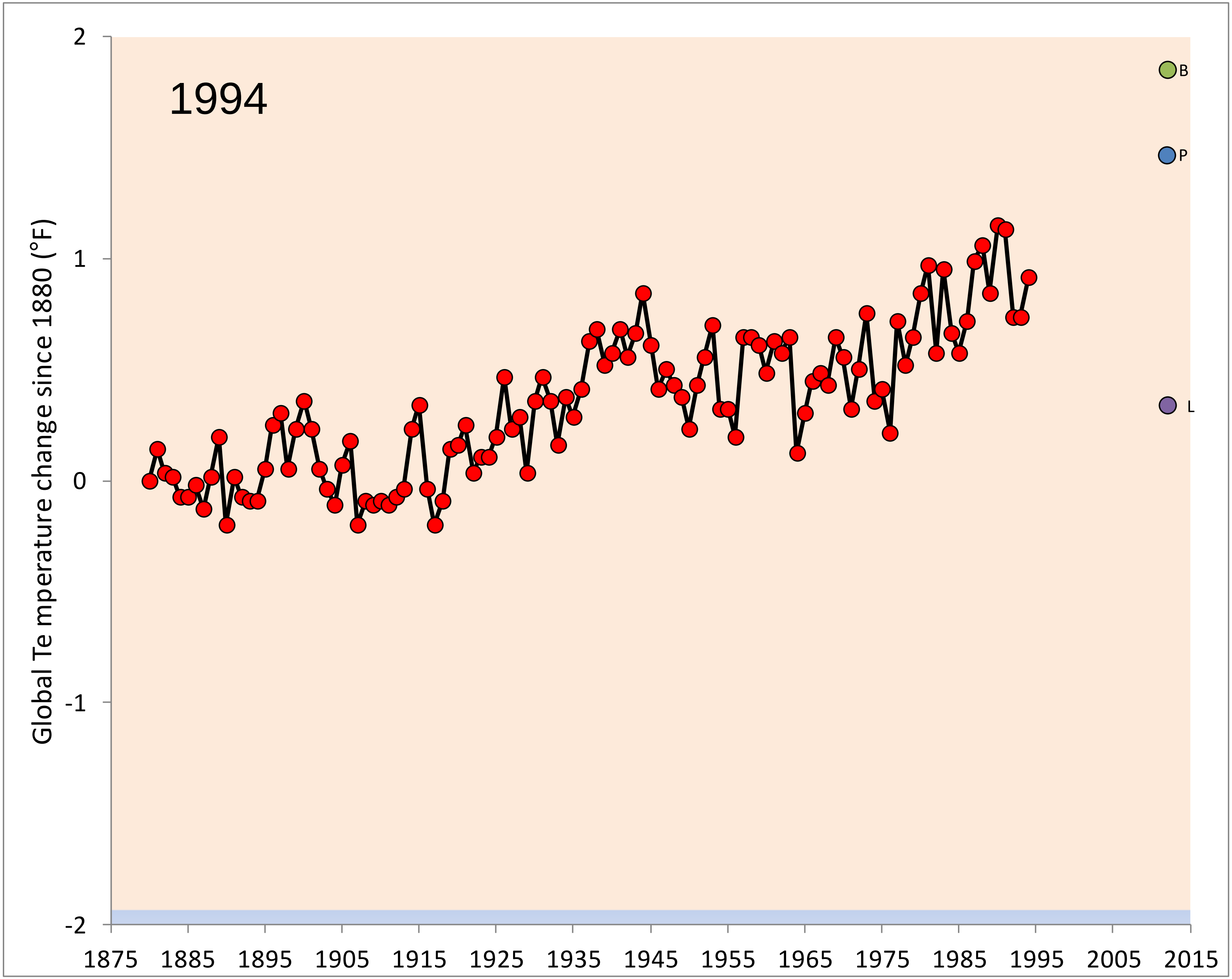
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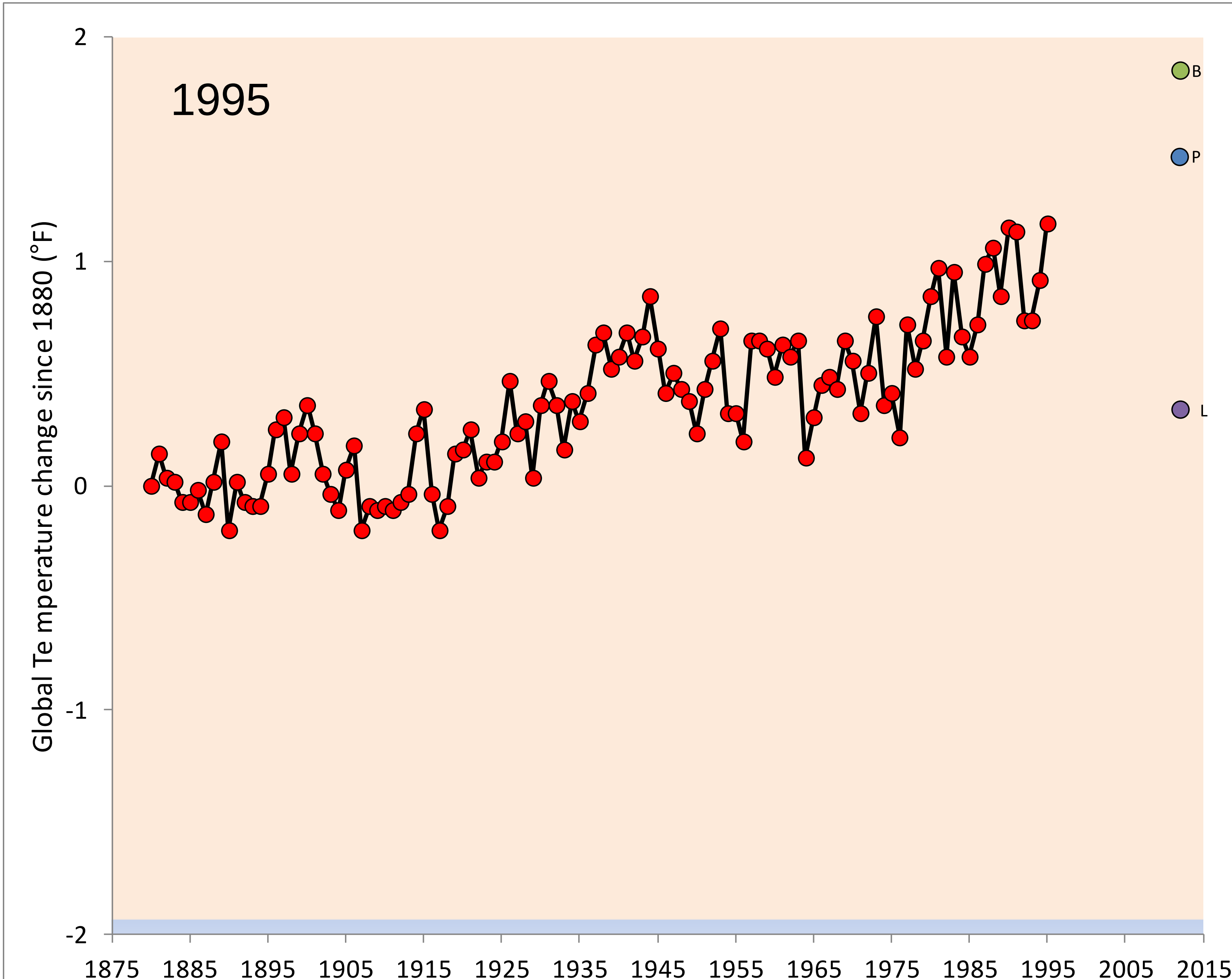
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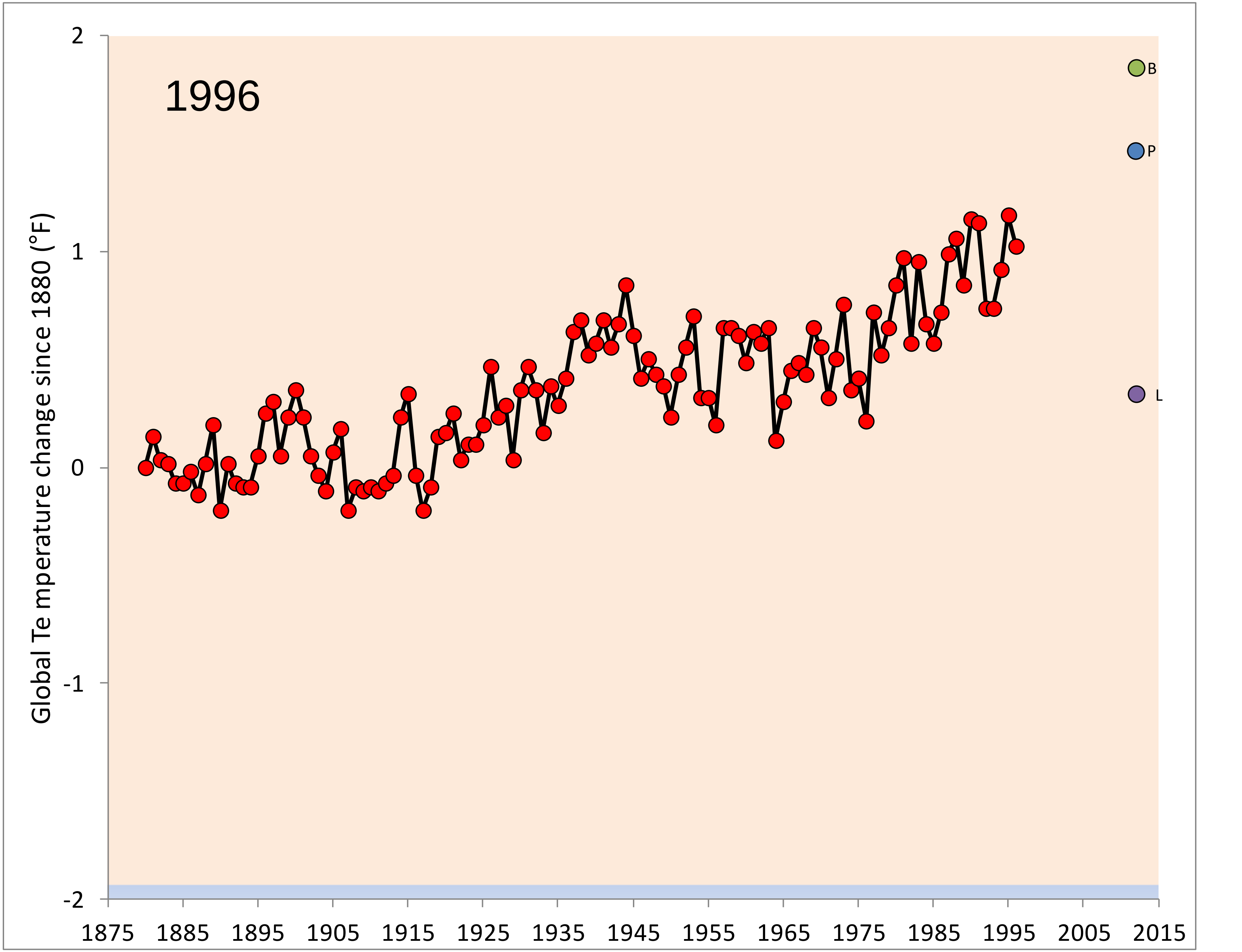
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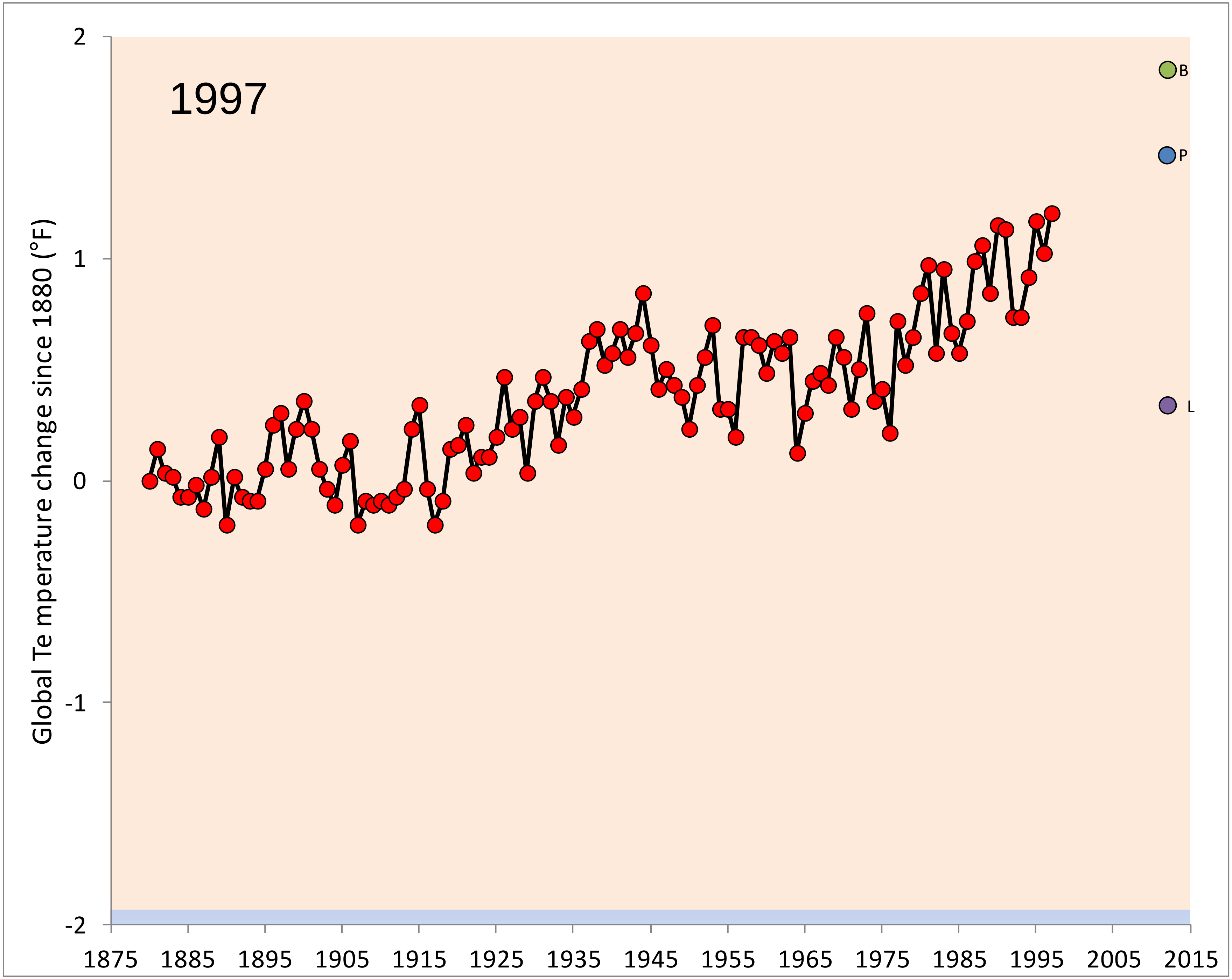

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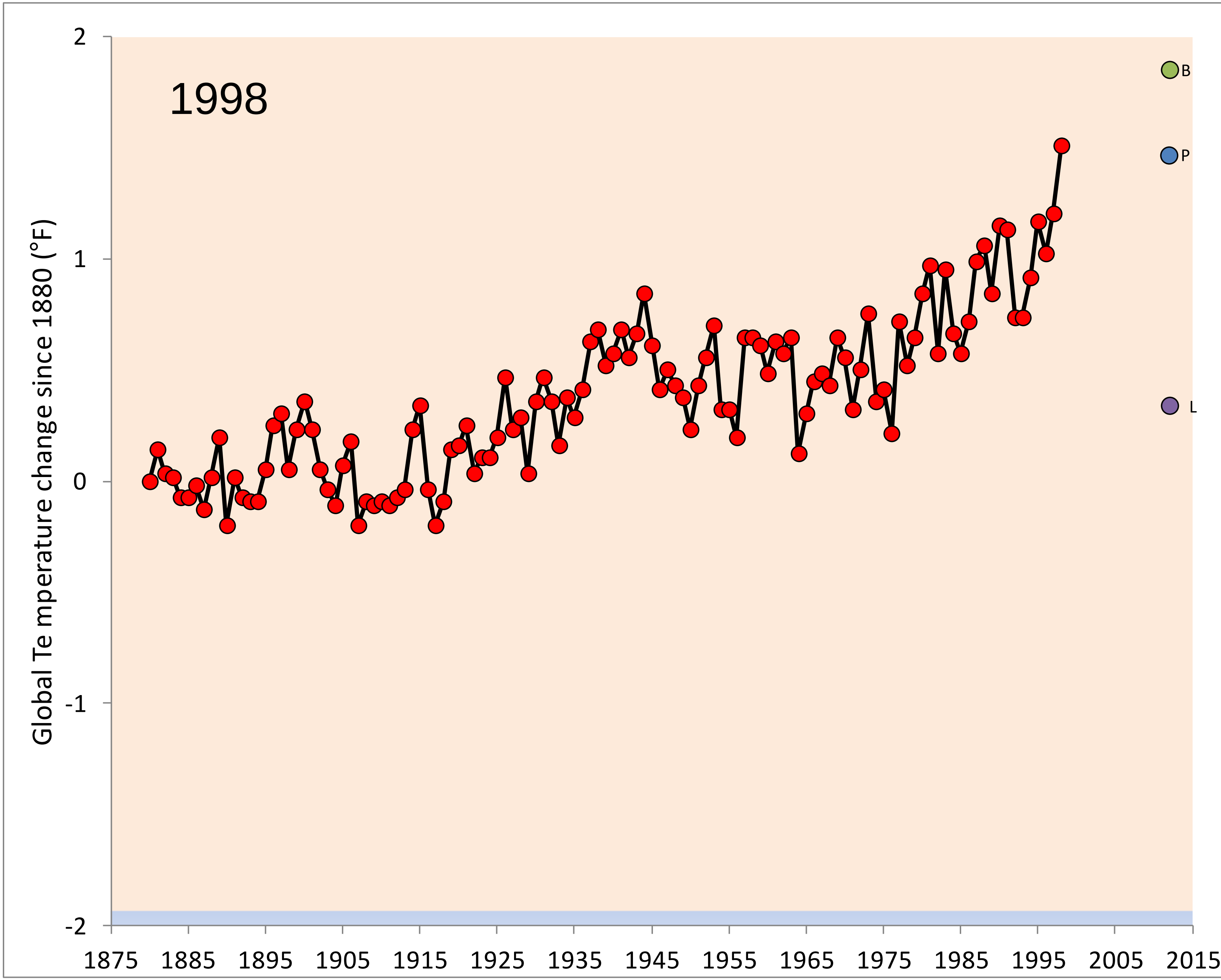
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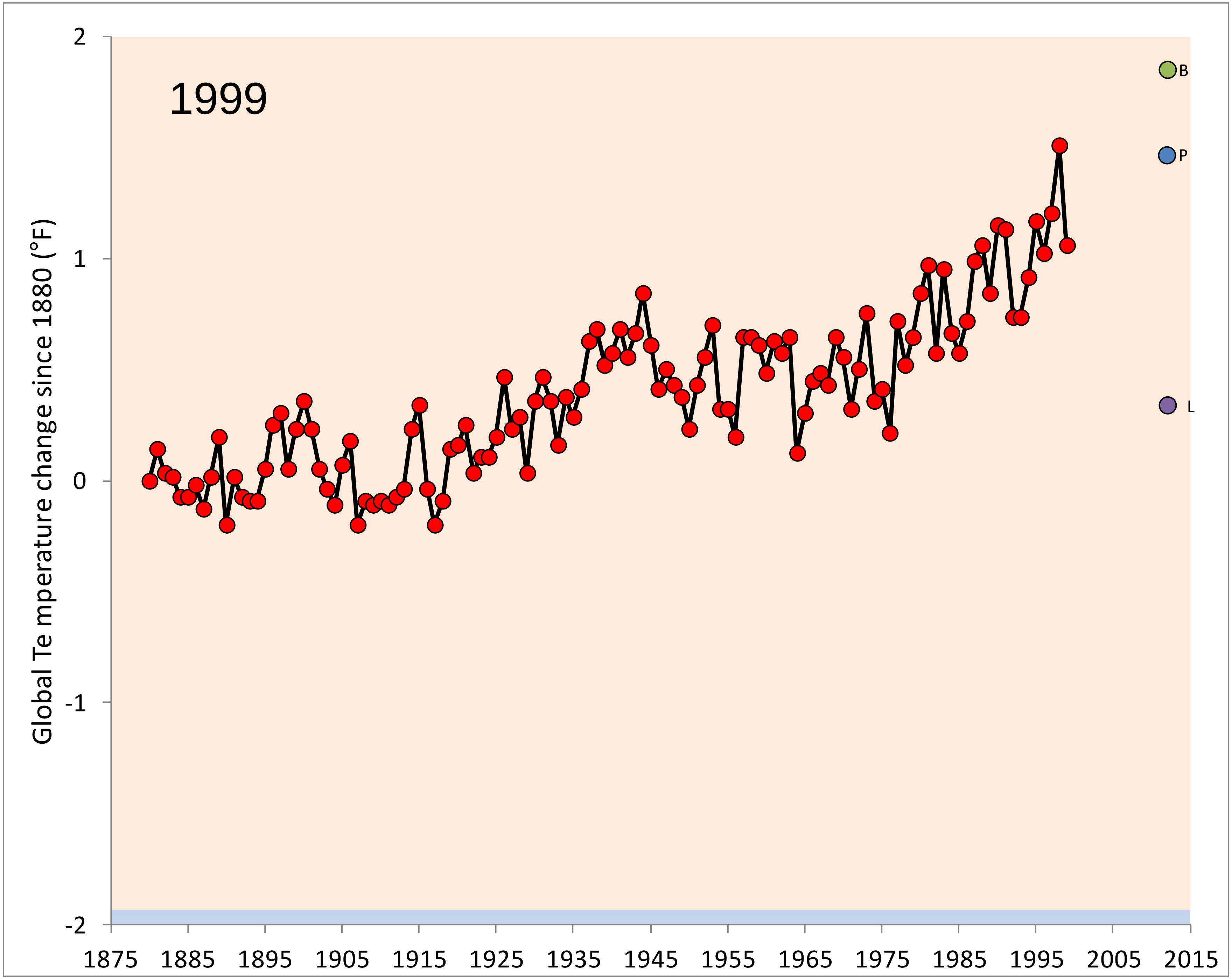
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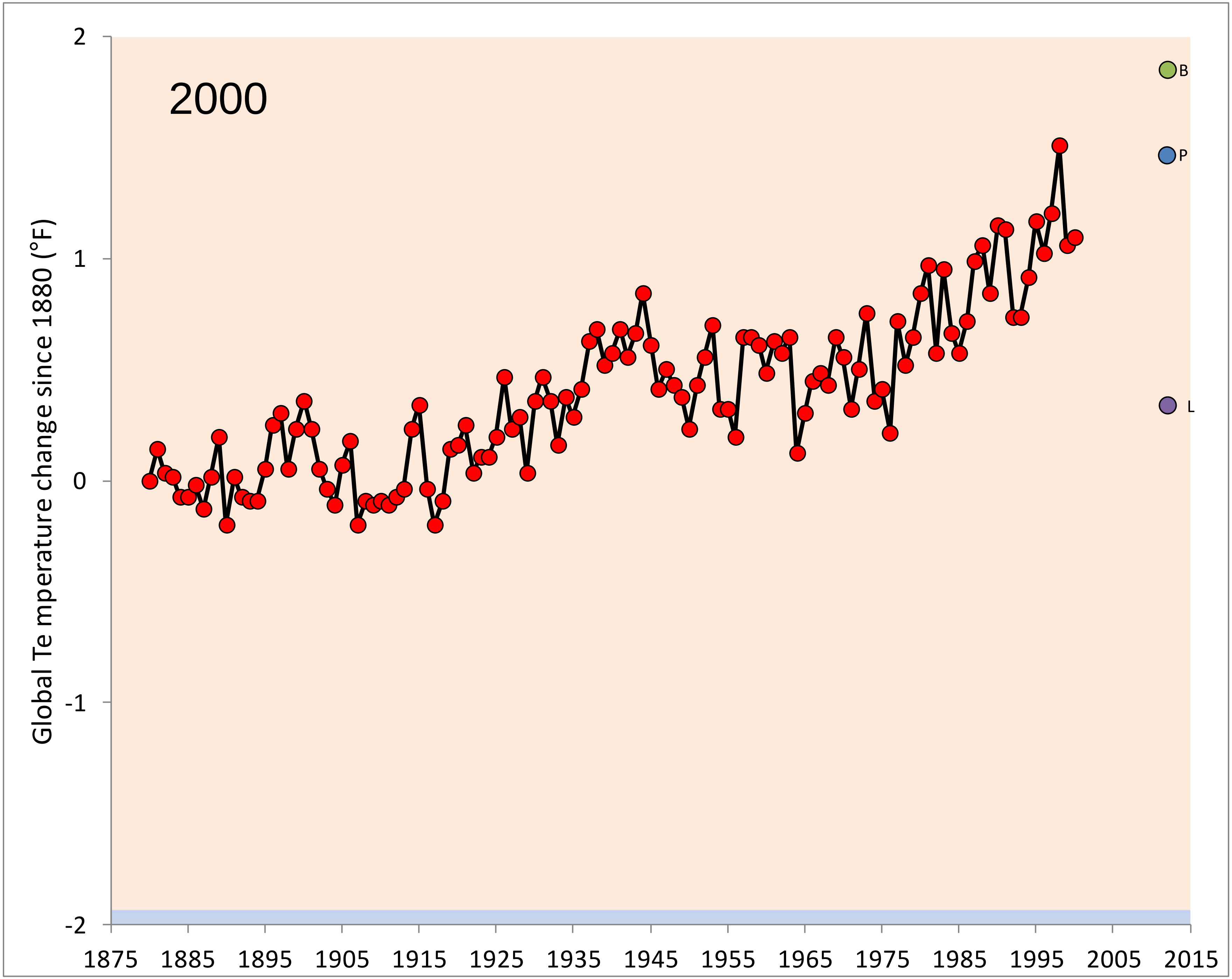
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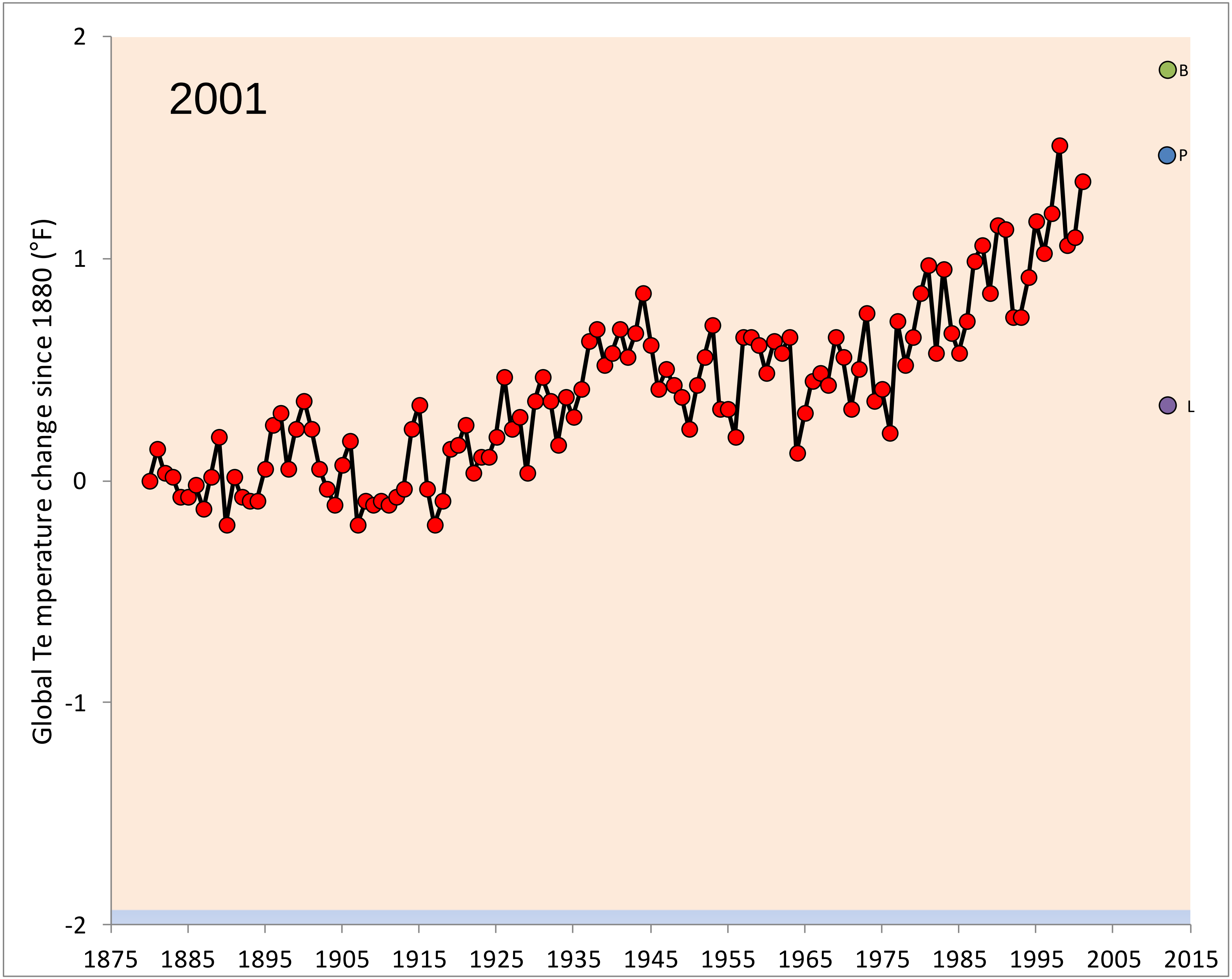

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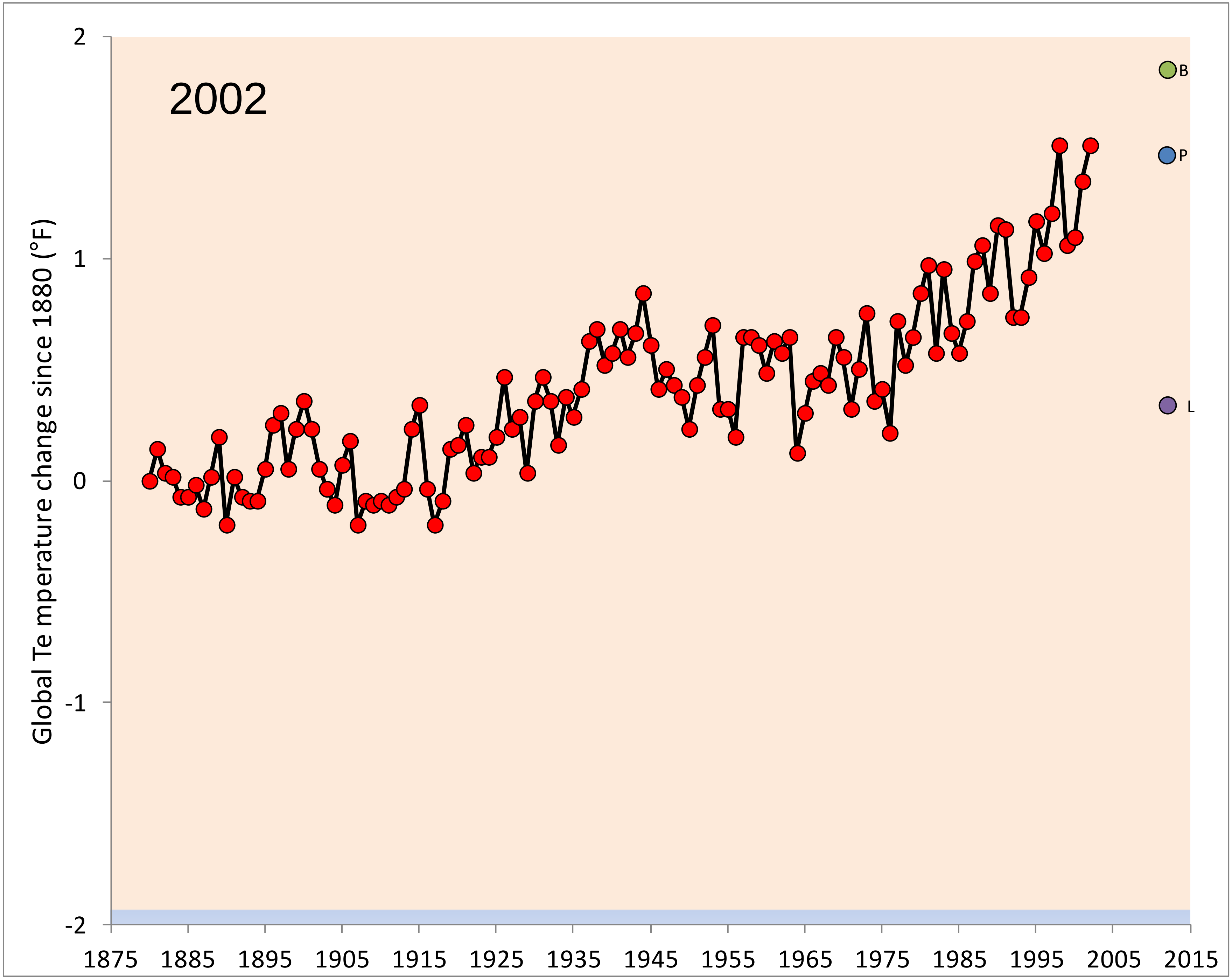

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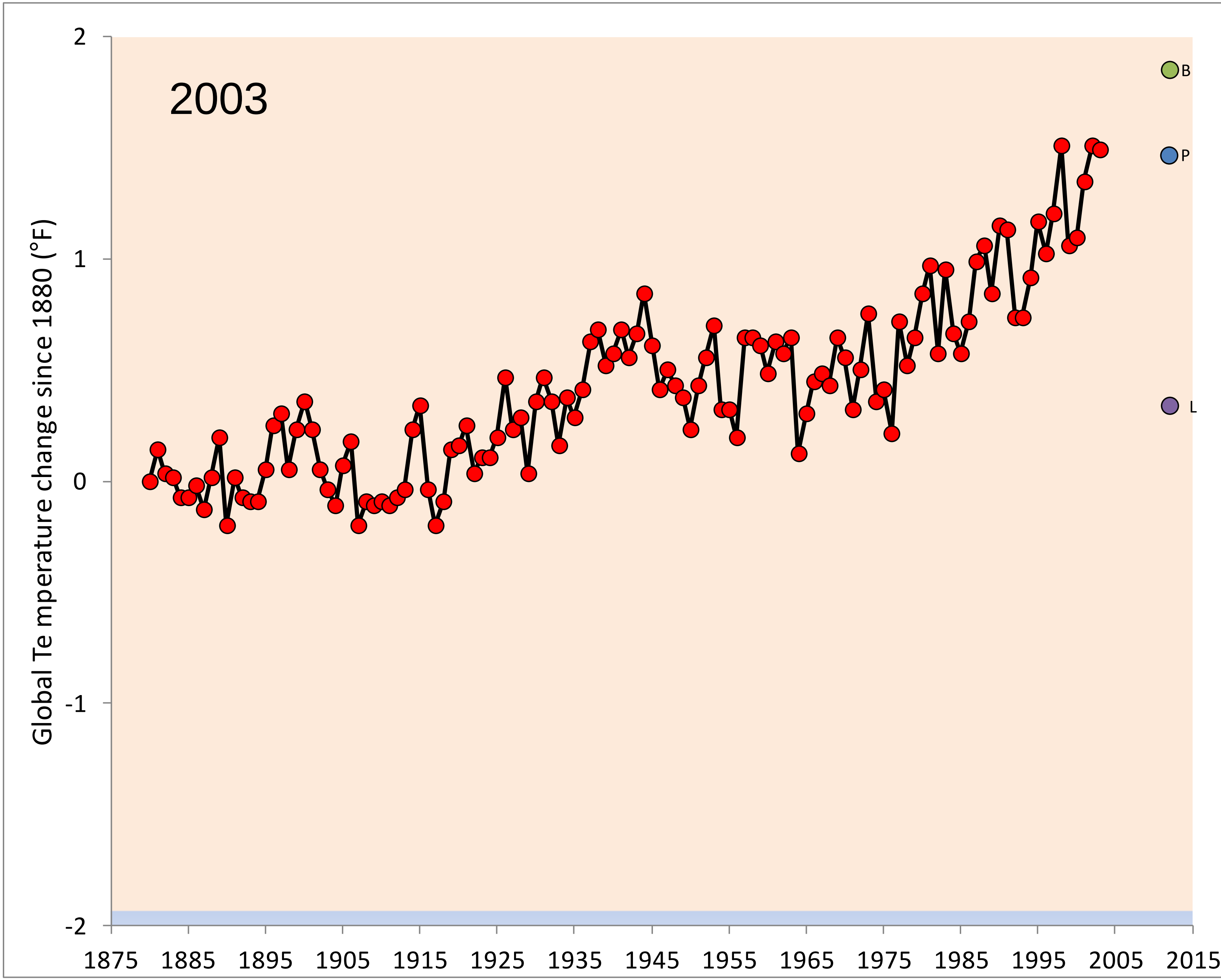

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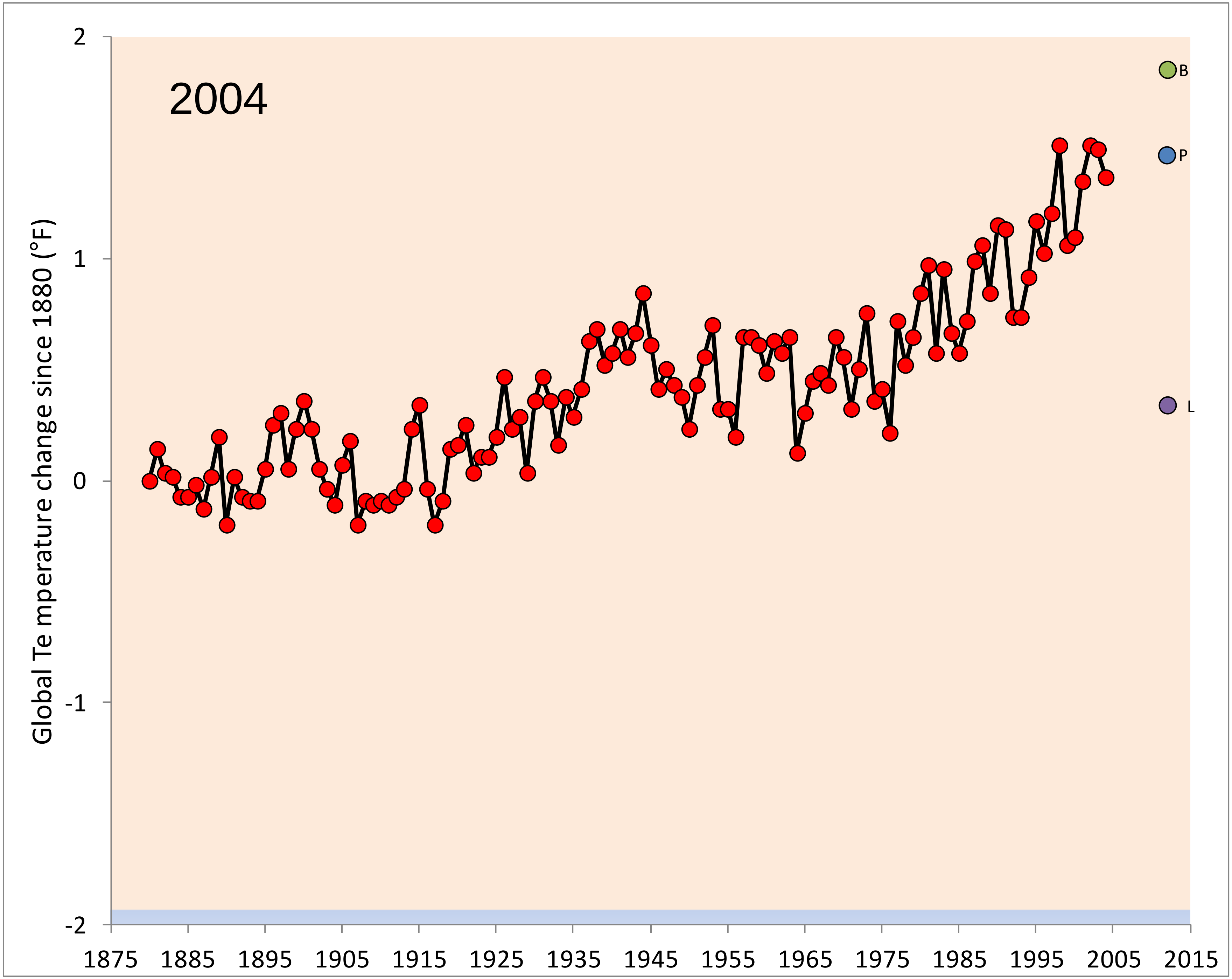
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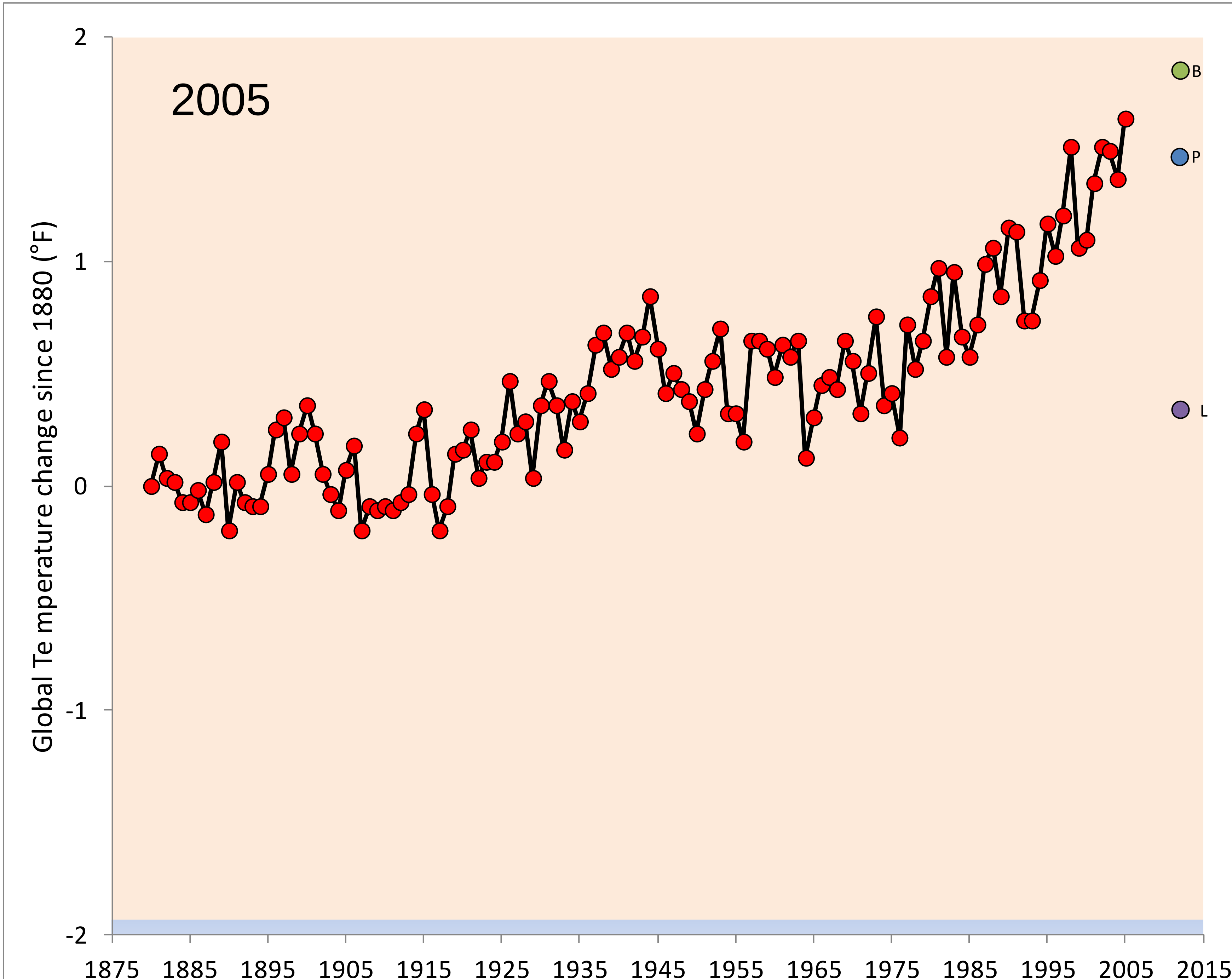
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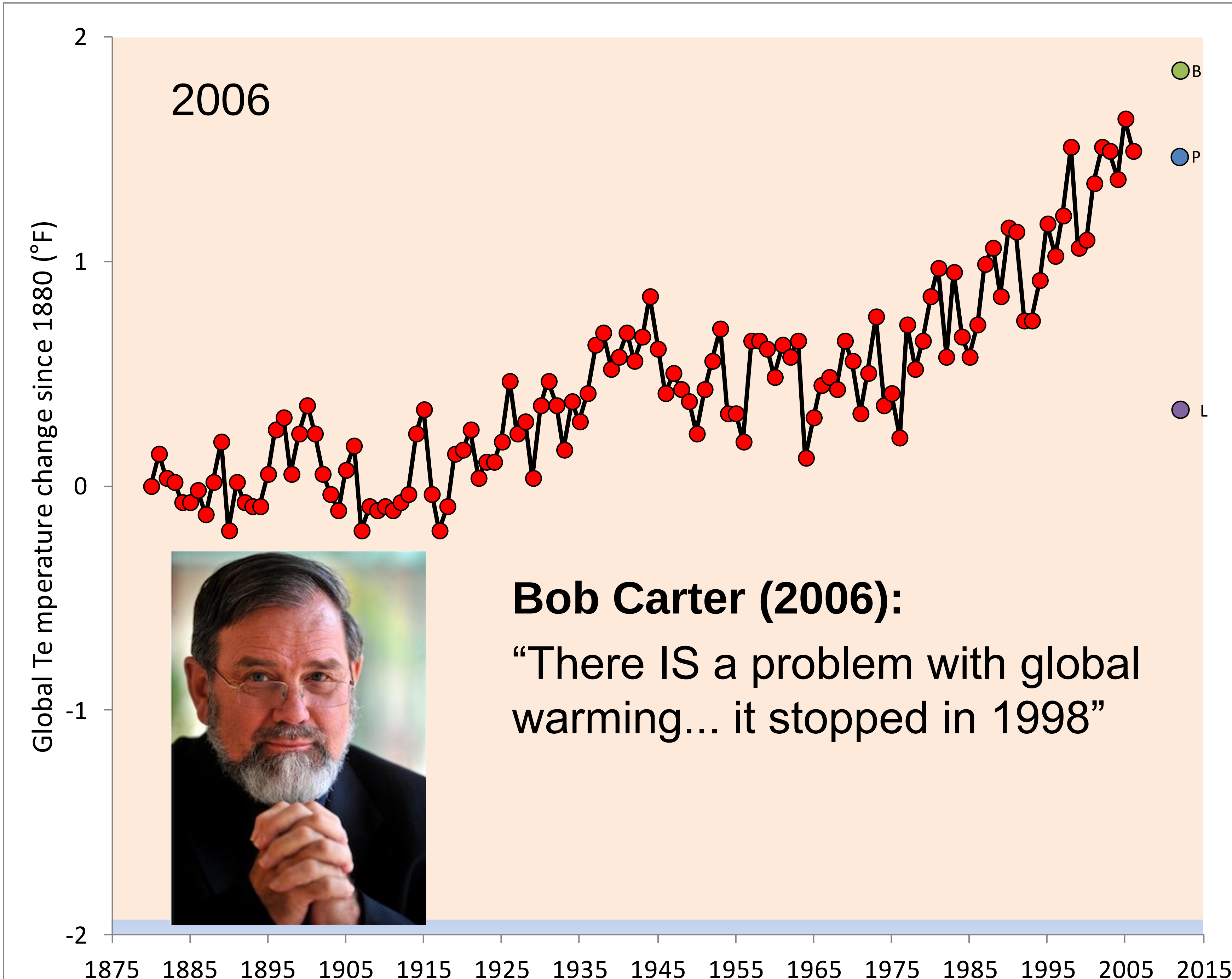
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Bob Carter (2006):
“There IS a problem with global warming... it stopped in 1998”
Global Te mperature change since 1880 (°F)
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1955
1965
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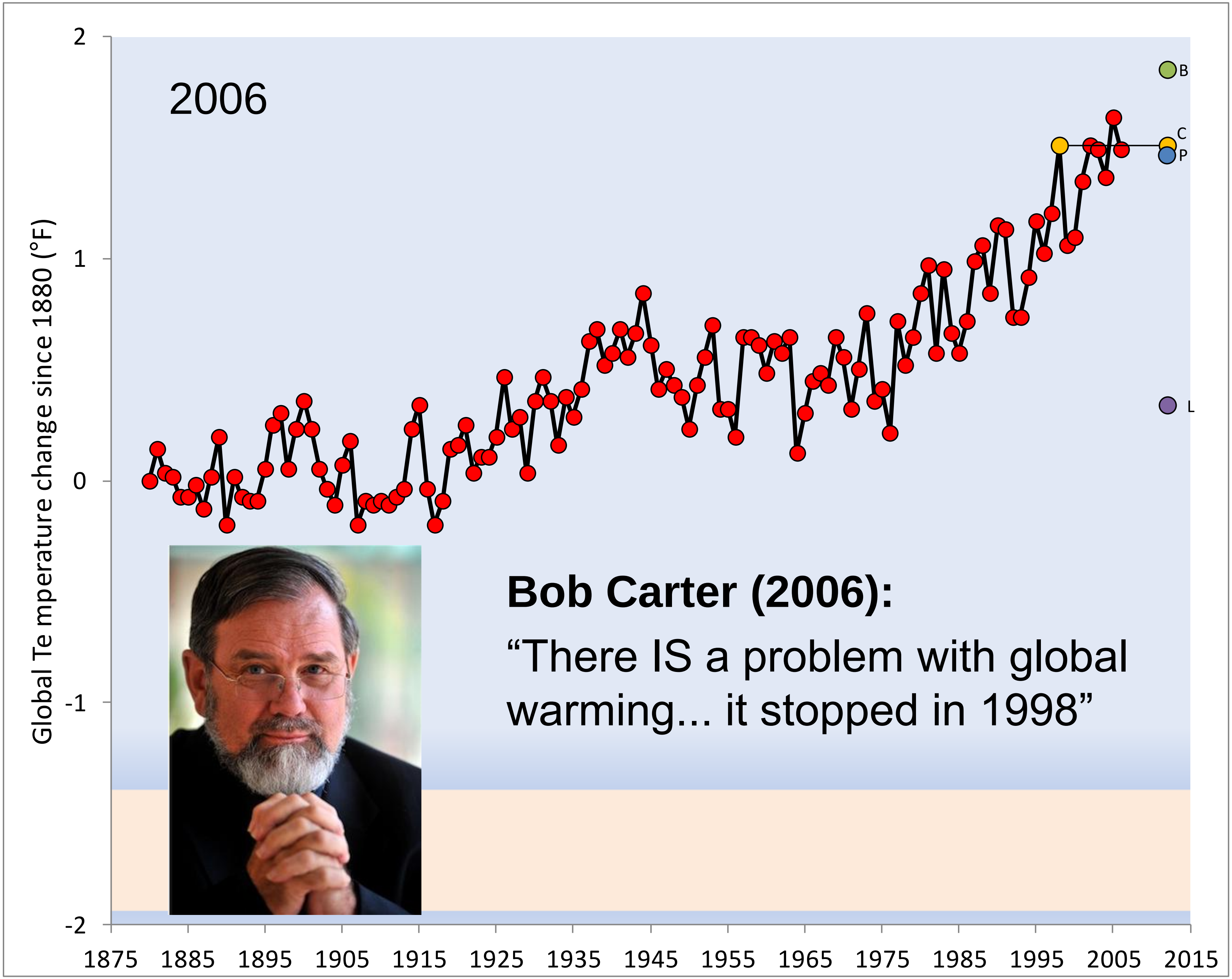
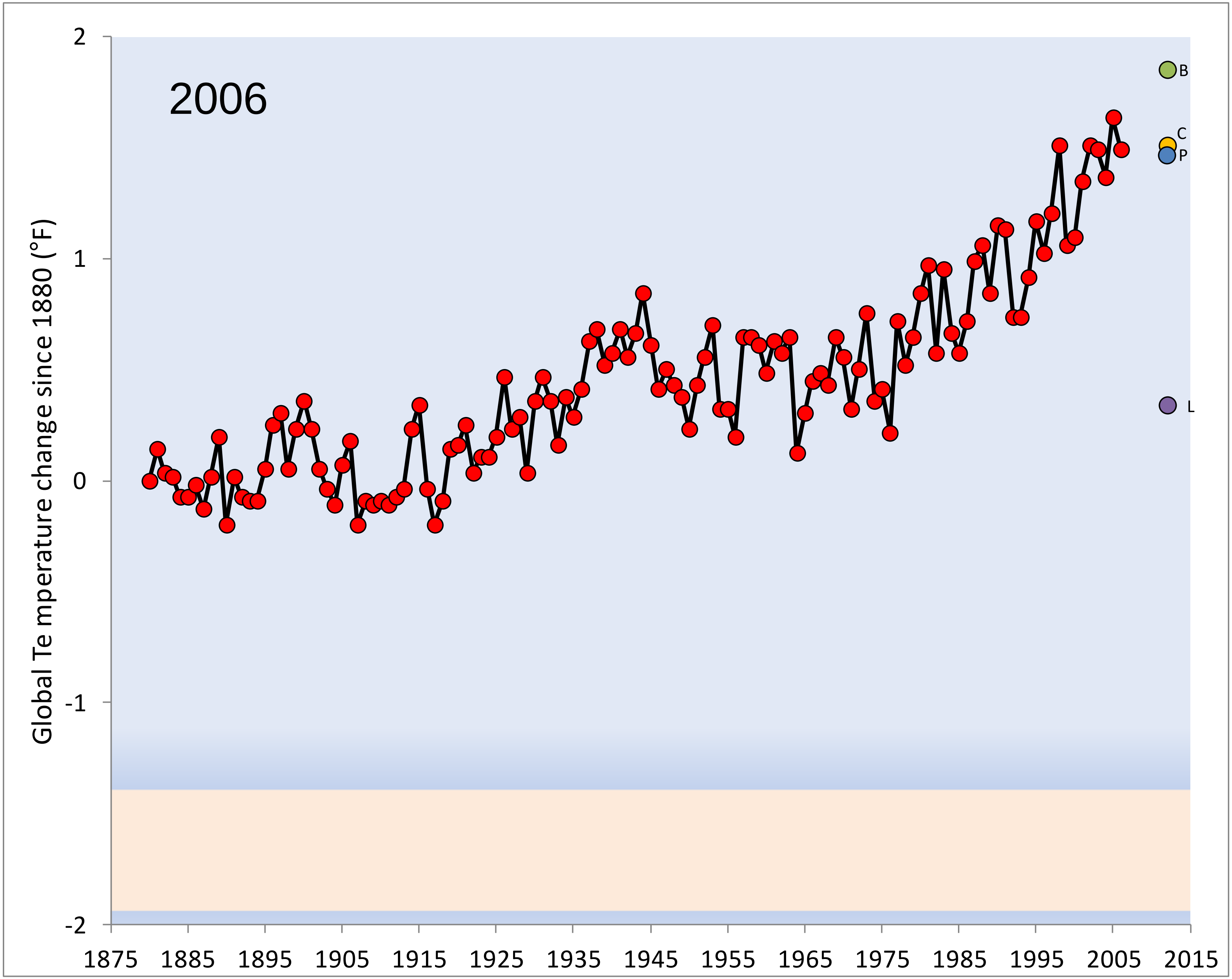
2005
2015
B
P
L


2006
Global Te mperature change since 1880 (°F)
2
1
0
-1
-2
1875
1885
1895
1905
1915
1925
1935
1945
1955
1965
1975
1985
1995
2005
2015
B
C
P
L
Bob Carter (2006):
“There IS a problem with global warming... it stopped in 1998”



2006
Global Te mperature change since 1880 (°F)
2
1
0
-1
-2
1875
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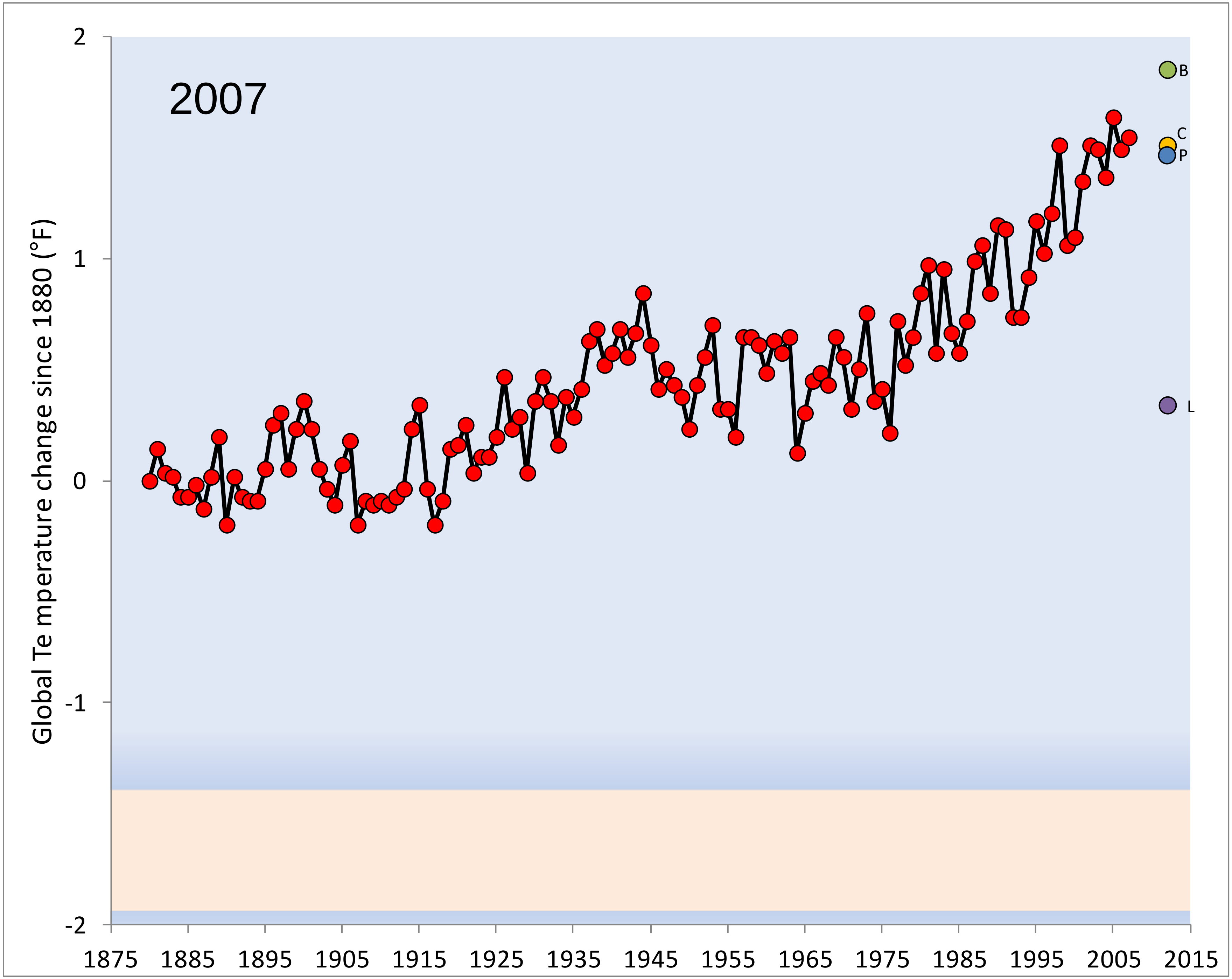

2007
Global Te mperature change since 1880 (°F)
2
1
0
-1
-2
1875
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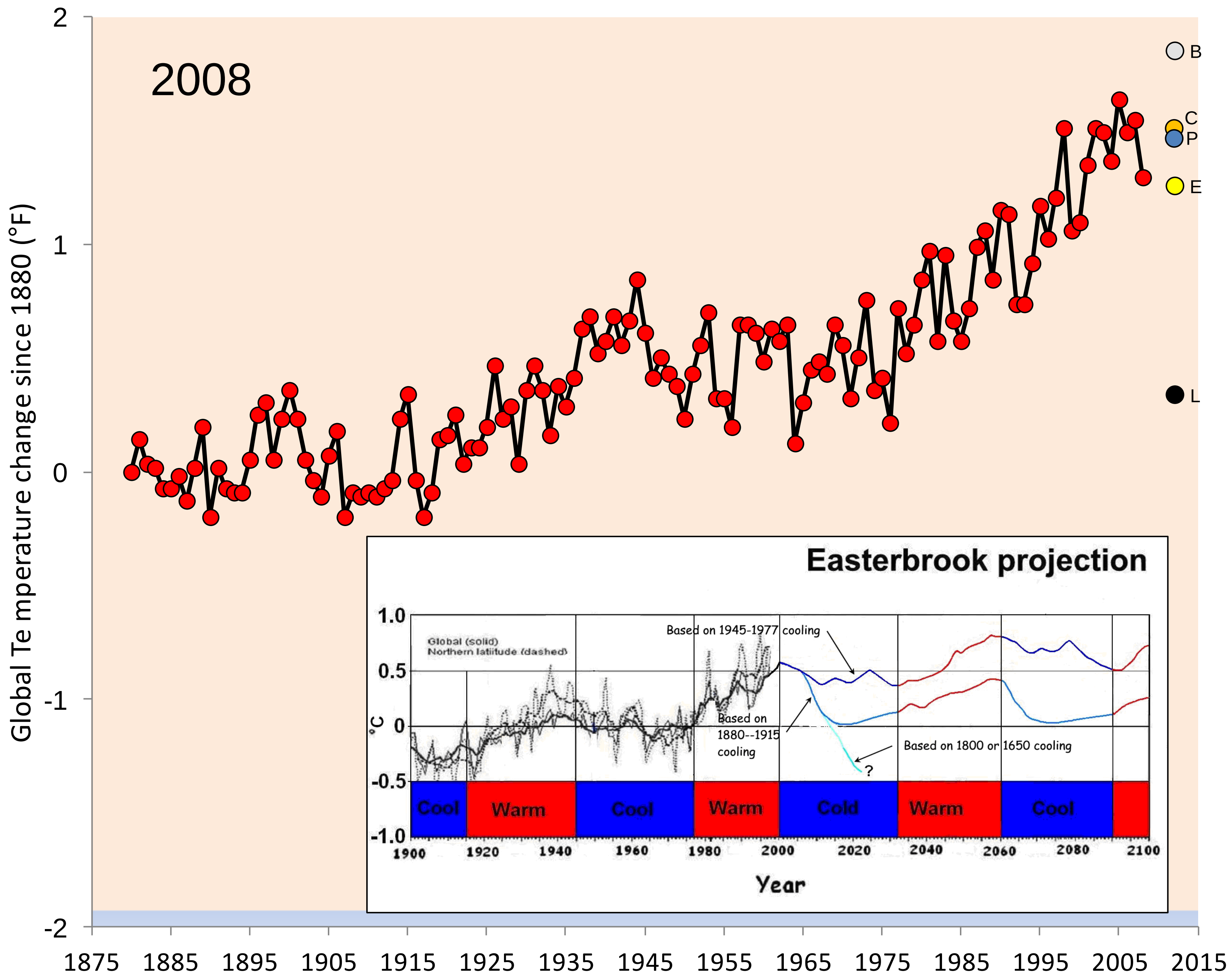
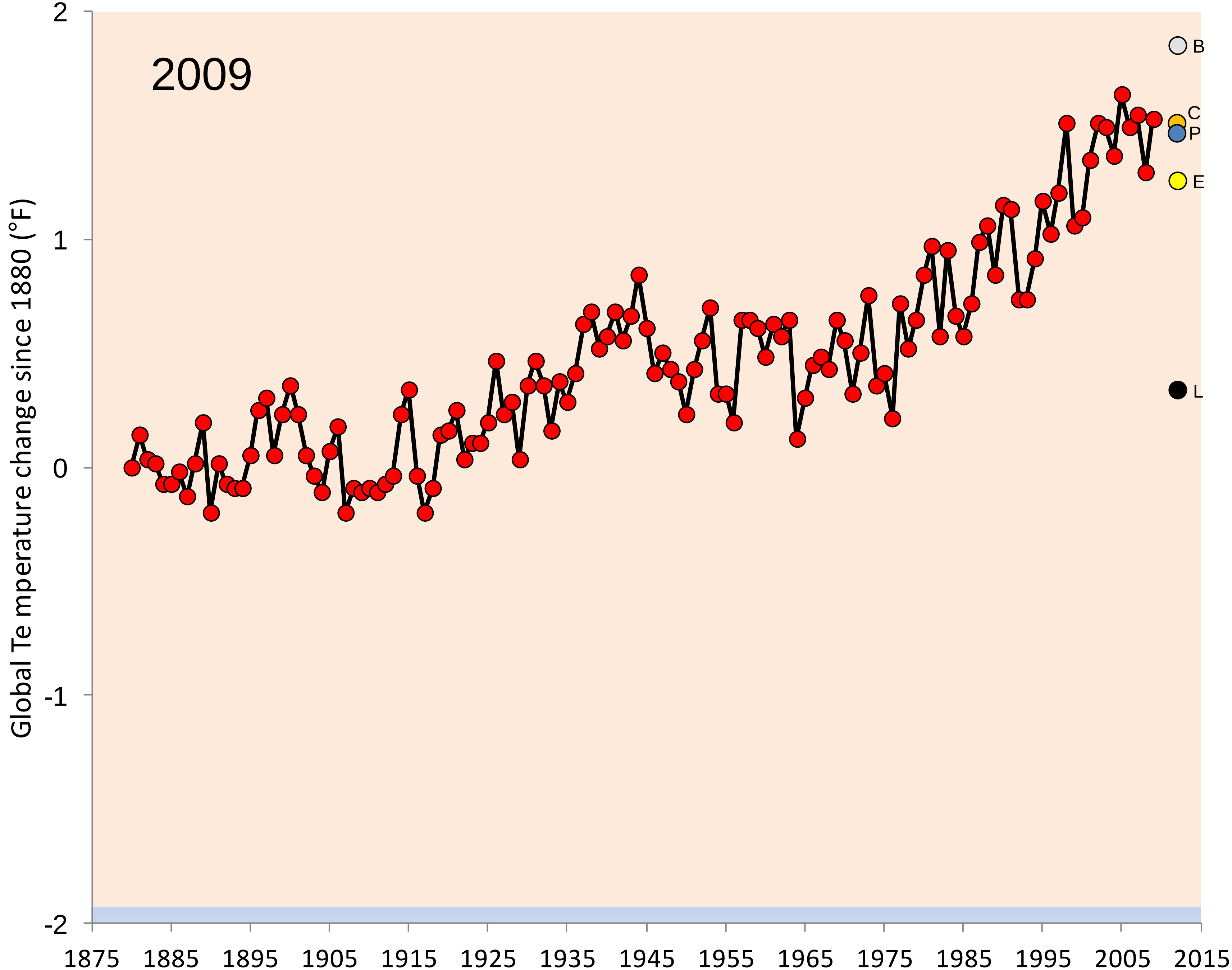

2008
Global Temperature change since 1880 (°F)
2
1
0
-1
-2
1875
1885
1895
1905
1915
1925
1935
1945
1955
1965
1975
1985
1995
2005
2015
B
C
P
E
L
Easterbrook projection
Global (solid)
Northern latitude (dashed)
Based on 1945-1977 cooling
Based on 1880--1915 cooling
Based on 1800 or 1650 cooling
?
°C
1.0
0.5
0
-0.5
-1.0
Cool
Warm
Cool
Warm
Cold
Warm
Cool
1900
1920
1940
1960
1980
2000
2020
2040
2060
2080
2100
Year



2009
Global Te mperature change since 1880 (°F)
2
1
0
-1
-2
1875
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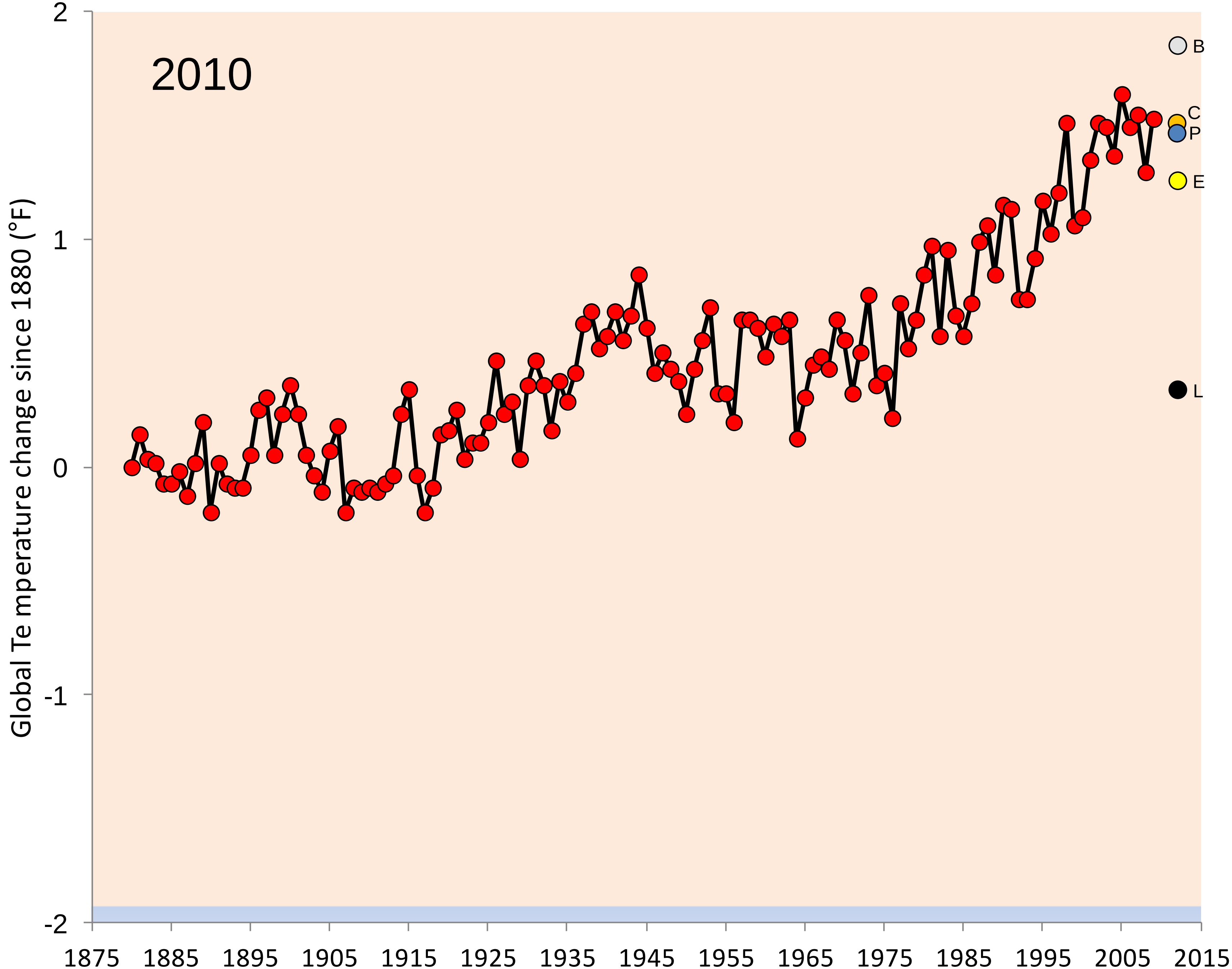
2010
Global Te mperature change since 1880 (°F)
2
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1875
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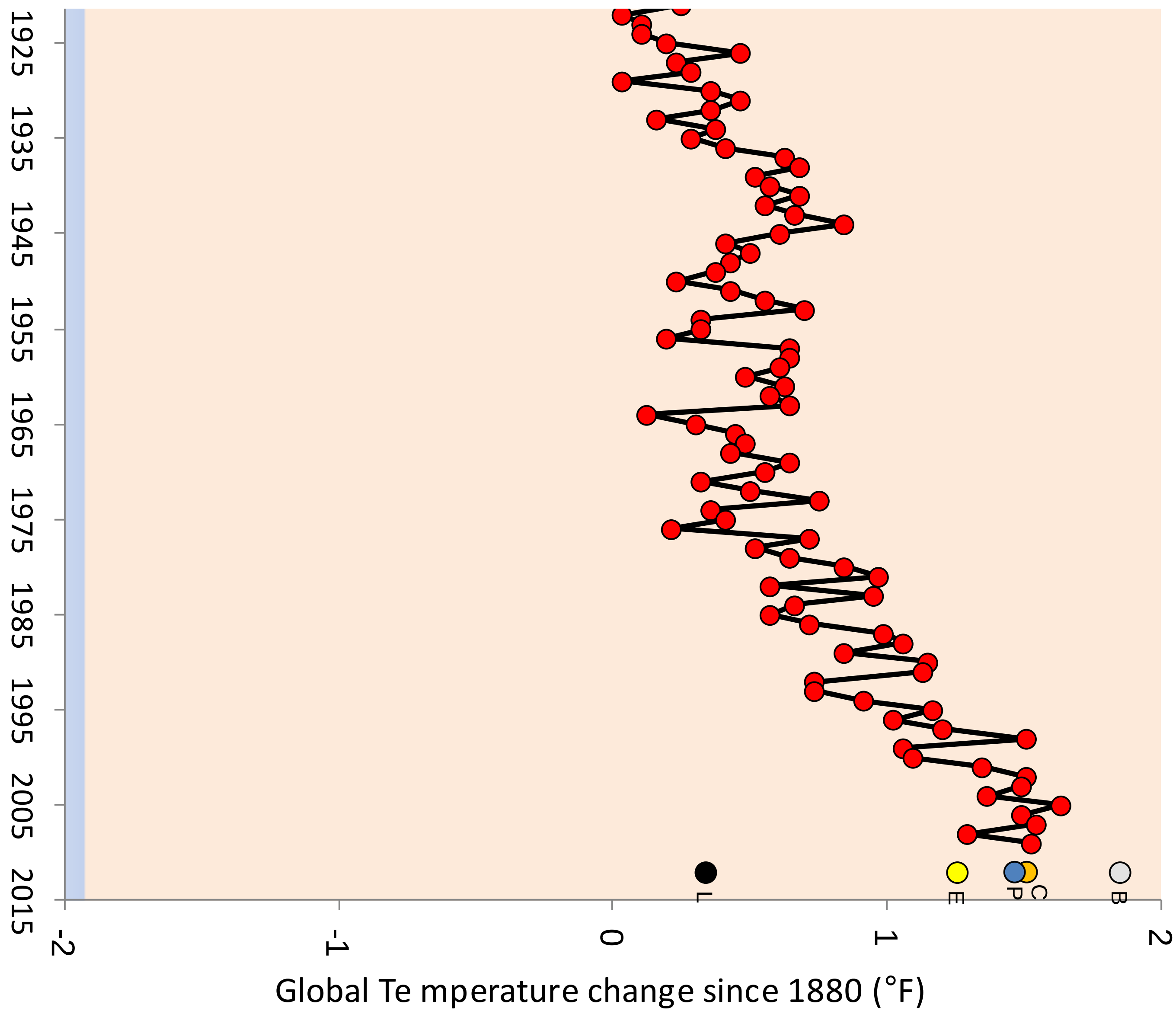
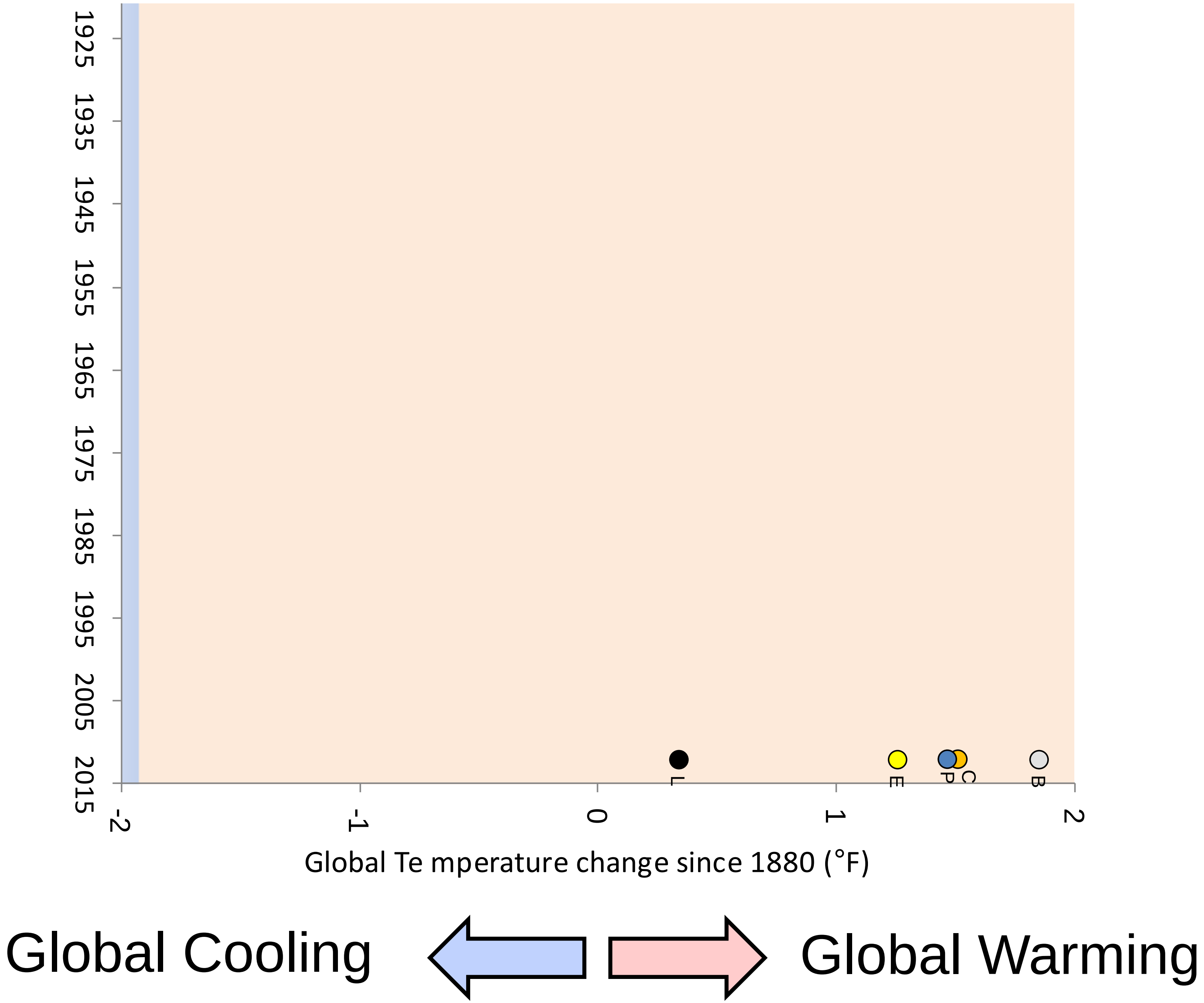
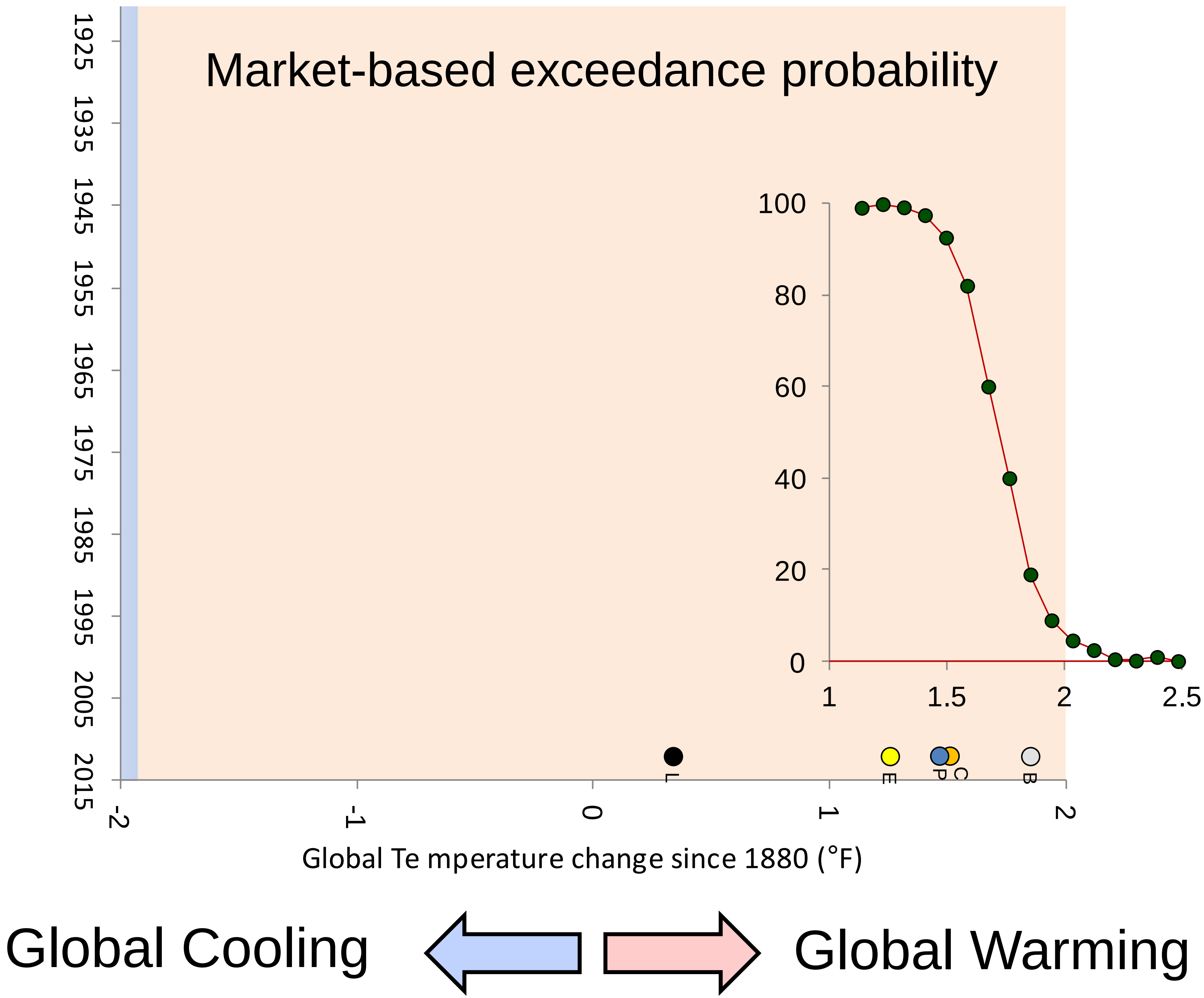


Global Cooling

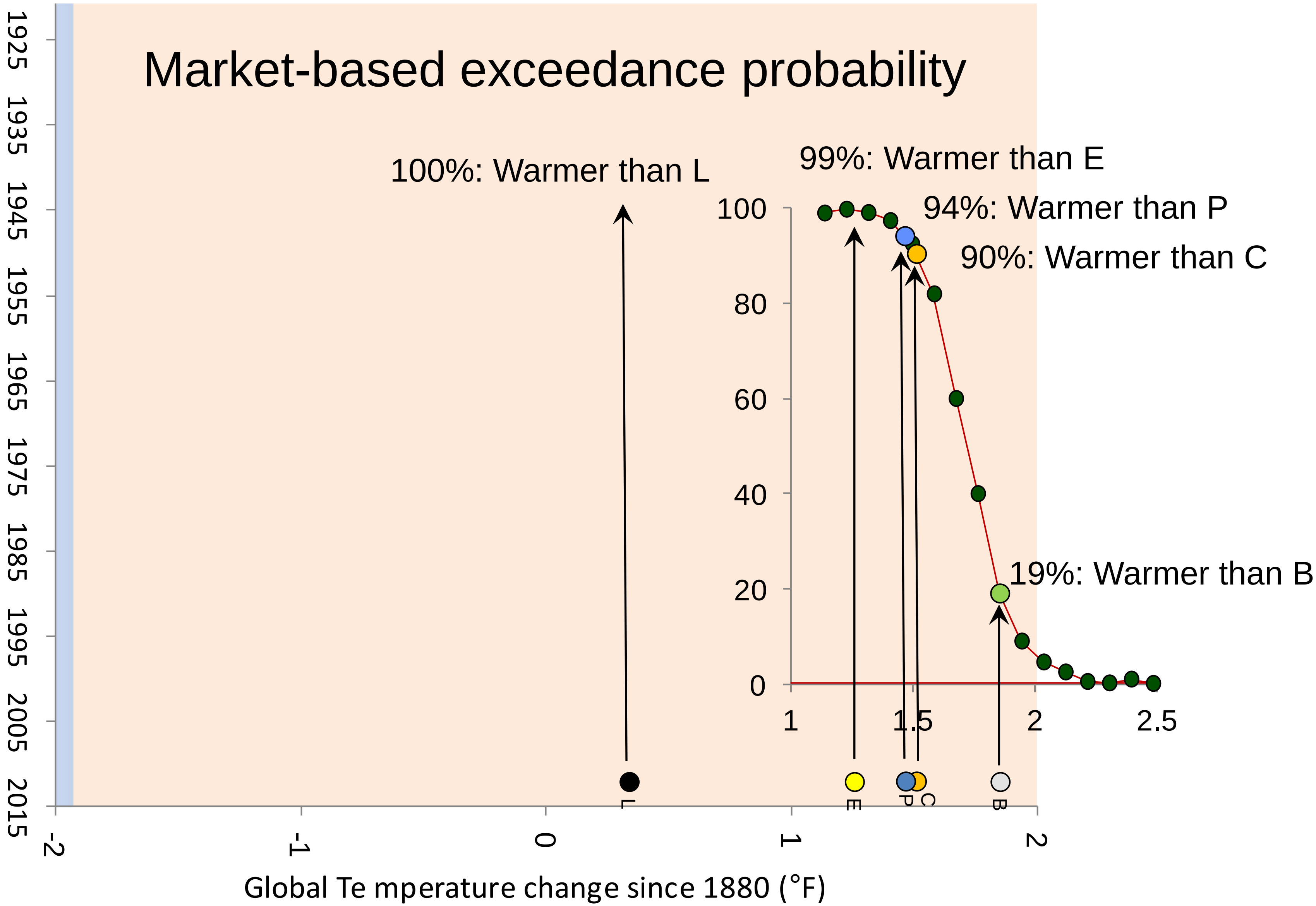
Global Warming



1925
1935
1945
1955
1965
1975
1985
1995
2005
2015
L
E
P
C
B
-2
-1
0
1
2
Global Te mperature change since 1880 (°F)
Global Cooling
Global Warming



Market-based exceedance probability
100
80
60
40
20
0
1
1.5
2
2.5
1925
1935
1945
1955
1965
1975
1985
1995
2005
2015
-2
-1
0
1
2
L
E
P
C
B
Global Te mperature change since 1880 (°F)
Global Cooling
Global Warming

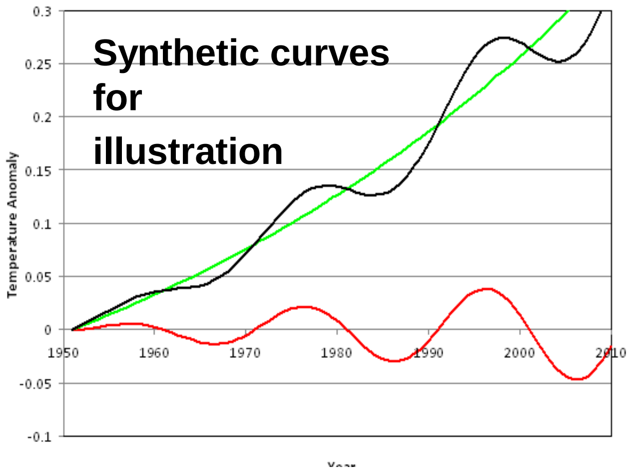


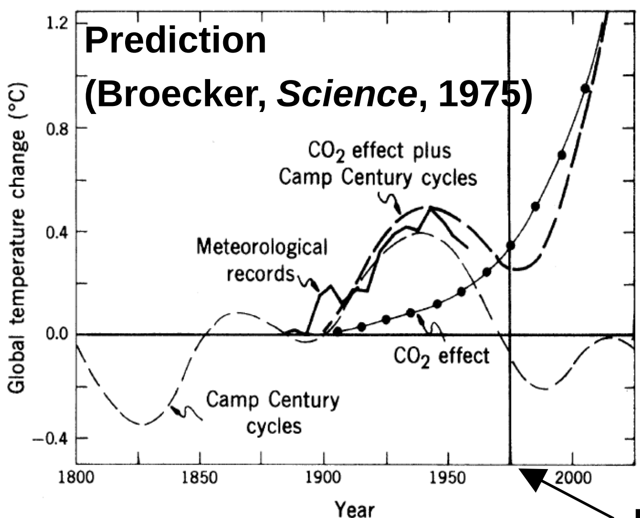
Global Cooling

Global Warming

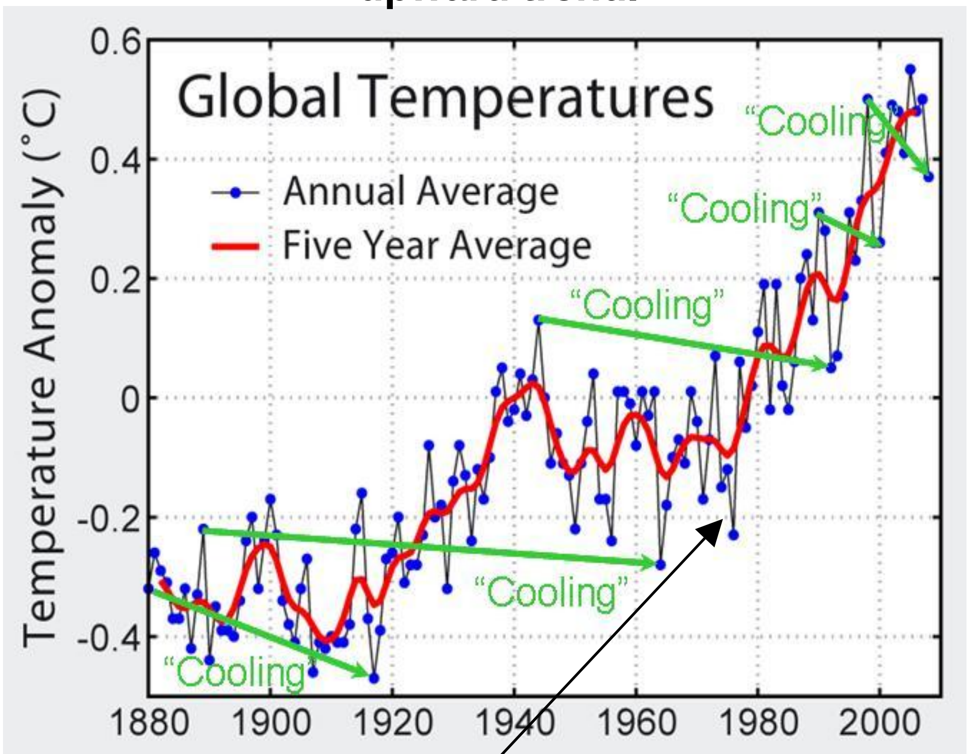
If you predict cooling, bet on cooling

Natural variability causes seemingly contradictory behavior





Each year can be associated with a projected "cooling" spell despite the upward trend.



Broecker's global warming prediction was published in 1975

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Order Book

2012.TEMP.ANOMOLY.0.35+

BID		ASK	
Qty	Price	Price	Qty
5	0.1	99.9	50

Order Ticket help

Quantity

Limit Price

Lifetime: Good Till Cancelled

Disclaimer

Advanced Order

Buy | Clear | Sell

	? Contract	B Qty	Bid	Ask	A Qty	Last	Vol	Chge
Trade	2012.TEMP.ANOMOLY.0.30+	2	61.0	99.0	47	99.0	1	0
Trade	2012.TEMP.ANOMOLY.0.35+	5	0.1	99.9	50	99.8	1	0
Trade	2012.TEMP.ANOMOLY.0.40+	1	95.0	-	0	99.1	1	0
Trade	2012.TEMP.ANOMOLY.0.45+	0	-	99.0	17	97.4	1	0
Trade	2012.TEMP.ANOMOLY.0.50+	0	-	95.0	1	92.5	1	0
Trade	2012.TEMP.ANOMOLY.0.55+	10	60.0	-	0	82.0	1	0
Trade	2012.TEMP.ANOMOLY.0.60+	3	36.0	-	0	60.0	3	0
Trade	2012.TEMP.ANOMOLY.0.65+	0	-	-	0	40.0	1	0
Trade	2012.TEMP.ANOMOLY.0.70+	0	-	50.0	10	19.0	2	0
Trade	2012.TEMP.ANOMOLY.0.75+	0	-	34.0	10	9.0	1	0
Trade	2012.TEMP.ANOMOLY.0.80+	1	4.5	4.7	1	-	0	0
Trade	2012.TEMP.ANOMOLY.0.85+	0	-	-	0	2.5	1	0
Trade	2012.TEMP.ANOMOLY.0.90+	30	0.3	-	0	0.5	1	0
Trade	2012.TEMP.ANOMOLY.0.95+	0	-	-	0	0.2	1	0
Trade	2012.TEMP.ANOMOLY.1.00+	25	0.2	99.0	33	1.0	1	0
Trade	2012.TEMP.ANOMOLY.1.05+	10	0.1	-	0	0.1	1	0
Trade	2012.TEMP.ANOMOLY.1.10+	87	0.1	25.0	1	0.1	1	0

How to generate market liquidity

- Require greenhouse gas polluters to issue bonds
- Bonds pay for dumping fee that is scaled to market-based global warming predictions
- Zero global warming means zero dumping fees
- Dumping fees paid out in cash dividends to those whose "right to radiate" has been infringed

Mountain pine beetle infestation, Colorado

Family tree farm, Boulder County, Colorado

"It were not best that we should all think alike; it is difference of opinion that makes horse races."

MARK TWAIN, *The Tragedy of Pudd'nhead Wilson*

"A prediction market gives people an incentive, a clear personal incentive to be right and not wrong….what we want is the few people who know the best to speak up and everybody else to shut up."

ROBIN HANSON, *The Folly of Prediction (Freakonomics)*

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