Response by Gregory Wrightstone to Science Glacier preservation doubled by limiting warming to 1.5°C versus 2.7°C (submitted June 12, 2025)

Zekollari (2025), Science, 29 May 2025, Vol 388, Issue 6750, pp. 979-983, DOI: 10.1126/science.adu4675

Zekollari et al (2025) ignores historical records of 100-plus years of glacial retreat at low levels of atmospheric CO_2

This study arrives at the quite unremarkable conclusion that warmer temperatures cause glaciers to recede. The main assumption in the report is that human increases in greenhouse gases are directly linked to global glacial retreat and relies on unreliable modeling, rather than direct, observational data available for hundreds of glaciers over the last several centuries.

Any discussion of modern glacial retreat necessarily requires that any analysis of the recent glacial retreat of the last half-century be put into a much longer perspective. This longer perspective confirms that our Current Warming Period (CWP) began more than 300 years ago and long before humans began adding significant CO_2 to the atmosphere.

It is well-documented that the coldest period of the last 10,000 years (Holocene) occurred in the Little Ice Age (1250 to 1850 AD), and the coldest years occurred in in a period of extreme cold from 1670 to 1715, which is known as the Maunder Minimum. This period of horrific cold brought famine, poor harvests, disease and widespread loss of life.

This severe cold caused major advances of glaciers in the high latitudes and altitudes. Detailed records of glacial advances and retreats were kept because these events had profound effects on the local populace. The advance of glaciers was especially destructive, sometimes to entire villages.

Our current warming period began in the early 1700s, and the Earth has been warming in fits and starts since that time. Modern warming that began at the turn of the 18th century continues to this day, more than three centuries later. This gradual recovery from the death-dealing cold of the Little Ice Age began more than 200 years before any significant contribution of man-made CO_2 to the atmosphere.

Records allow us to determine the extent of glaciers with great accuracy going back several hundred years. Oerlemans (2005) catalogued glacial-length records from 169 sites around the world relative to their extent in 1950. This direct measurement (not modeled) of glacial retreat documented that global retreat began in the early 1800s and by 1850 was at approximately the

same retreat rate as in the late 20th century. That is about a century before atmospheric CO_2 increased significantly in the mid-20th century

Confirming that glacier retreat began more than 100 years before significant atmospheric CO_2 was added by human use of fossil fuels are very detailed records of Alaska's Glacier Bay. The glaciers that formed Glacier Bay reached their maximum extent in the late 1700s. Because it is easily accessible, the bay has been extensively studied and its glaciers well documented (Seramur 1997). By about 1794, the ice had already begun its retreat, shrinking significantly by the mid-20th century. It had retreated more than 50 miles before humans added significant amounts of CO_2 to the atmosphere. Only the last 10-or-so miles of melting occurred after CO_2 levels had exceeded 310 ppm around 1950.

Glacial history confirms that the bulk of glacial retreat since the end of the Little Ice Age occurred during a period of very low levels of carbon dioxide. The authors of this report assiduously avoid this important but unreported fact. Their claims of a direct linkage of increasing CO_2 to glacial retreat are exposed as highly suspect considering the 100 years of natural warming and retreat from about 1850 to 1950.

Oerlemans J (2005) Extracting a Climate Signal from 169 Glacier Records. *Science* 29 Apr 2005: Vol. 308, Issue 5722, pp. 675–677 DOI: 10.1126/science.1107046

Seramur KC, Powell RD, Carlson PR Evaluations of conditions along the grounding line of temperate marine glaciers: an example from Muir Inlet, Glacier Bay, Alaske, Mar Geol. 140 ((1997) 307-327

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