

ral plaque assay on a plant host. In contrast to viral infection of higher plants, PBCV-1 infection of *Chlorella* can be synchronized. This should expedite studies of viral replication and gene expression.

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8. The algae were grown on Bold's basal medium [H. W. Nicols and M. C. Bold, *J. Phycol.* **1**, 34 (1965)] modified by the addition of 0.5 percent sucrose and 0.1 percent proteose peptone (MBBM). Fifty-milliliter cultures were inoculated with algae (1×10^6 per milliliter) and grown at 25°C on a rotary shaker (150 rev/min) in continuous light ($\sim 30 \mu\text{E}/\text{m}^2$ per second).
9. The *Chlorella* cultures were grown to a density of 5×10^6 cells per milliliter and inoculated with virus sterilized with a 0.4- μm Nucleopore filter at a multiplicity of infection of 5 to 10.
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Global Mean Sea Level: Indicator of Climate Change?

Etkins and Epstein (1) have combined surface air temperature and sea level time series to draw erroneous conclusions concerning the discharge of polar ice sheets. They used records of Northern Hemisphere land-surface air temperature (2, 3) that are unrepresentative of global sea-surface temperature, which should be used for comparison with global sea level records. In the climate model experiment they cited (4), surface air temperatures over land increased by 0.43°C in January and 0.48°C in July in response to a doubling in the atmospheric CO₂ concentration when sea-surface temperatures are fixed at their climatological values, thus completely negating their assertion that this experiment

shows that land-based surface air temperature records indicate changes in ocean temperature.

Actually, a record of the global surface temperature, incorporating sea-surface temperatures, measured with buckets from ships, does exist (5) and is plotted in Fig. 1 together with a correct plot of sea level change (6); this plot uses the correct scale and omits the dashed portion on the right in figure 1B of (1), which was added by Etkins and Epstein and does not appear in (6). From Fig. 1 it is evident that the sea level change from 1910 to 1960 is, given the quality of the data, due to thermal expansion and it is not necessary to consider the discharge of polar ice sheets.

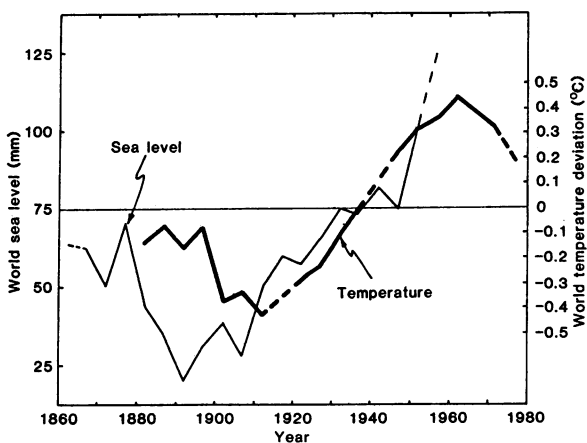


Fig. 1. Five-year averages of global average surface temperature (5) and global average sea level (6), plotted so that 80 mm of sea level change is equivalent to 1°C of temperature change. The dashed portions at the ends of both curves signify that the end point is only a 3- or 4-year average. The dashed portions in the middle of the temperature curve signify one missing data point for each portion, due to World War I and World War II.

Emery, whose data (7) were used by Etkins and Epstein (1) to give sea level changes for the past 40 years, arbitrarily excluded stations with no sea level trend significant at the 80 percent level and also excluded all stations with a downward sea level trend. My recalculation, based on the use of all his stations with significant trends, gives a sea level rise of 1.7 mm per year for the period, not 3 mm, and this is an overestimate because all stations with zero trend have been excluded. Thus the 45-mm rise from 1940 to 1960 (Fig. 1) accounts for most, if not all, of the total sea level rise since 1940, and it is not necessary to postulate any cause other than thermal expansion.

The claim (1) of 0.4°C as the externally imposed change in mean surface temperature from 1890 to 1980 is based on one study (8) of the effects of CO₂ and completely neglects volcanic dust, which has been shown in both observational (2, 9) and modeling (10) studies to have been the major external forcing of climate during the past 90 years.

Externally imposed volcanic dust and CO₂ forcings can adequately account for the observed temperature changes of the last 100 years. Global sea level has changed in passive response to climate change as a result of thermal expansion. Discharges of polar ice need not be invoked to explain the records, have not been observed (11), and indeed could not have taken place without substantially increasing sea level faster than has been observed.

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