LETTERS

Meteorological Satellites

The article "A silver lining for the weather satellites?" by M. Mitchell Waldrop (News and Comment, 14 Dec., p. 1289) is timely in drawing attention to the problems besetting the operation and replacement of the weather satellites. Although the article correctly notes that the primary mission for both polar orbiters and the GOES geostationary satellites is in support of weather forecasting, it does not point out that such satellites are also vital in areas related to climate, where the loss of a satellite results in the irretrievable loss of data and a break in the climate record. Such losses can be devastating to climate studies and climate forecasts.

For weather forecasting purposes, the loss of GOES-5 on 30 July 1984 was mitigated by moving GOES-6 from its position over the Pacific Ocean to a location south of Texas. It seems that a replacement satellite is unlikely to go up before October 1985 at the earliest—a gap of more than a year. A similar previous loss of the GOES satellite over the Pacific occurred from 25 November 1982 to 28 April 1983, which happened to coincide with the largest El Niño event in this century (*Science*, 16 Dec. 1983, p. 1189). An El Niño signifies a substantial anomalous warming of the sea surface in the tropical Pacific Ocean. It coincides with substantial perturbations in cloudiness and precipitation in the same area and is linked to major anomalies in the global atmospheric circulation. At the time of the 1982–1983 El Niño, devastating anomalies in weather and short-term climate occurred all over the globe—ranging from drought in Australia, India, Indonesia, and Africa to floods in Peru and Ecuador, coastal flooding in California and along the west coast of South America, displaced storm tracks across the United States, and unusual hurricane tracks (with Tahiti's worst modern hurricane and a rare November hurricane in Hawaii). The GOES satellite over the Pacific potentially provides unique data on cloudiness, precipitation, winds, and sea surface temperatures that signal the onset of such events. This information is vital for seasonal forecasting, but the data for that period are lost and irreplaceable.

A new international program called TOGA (Tropical Oceans Global Atmosphere) gets under way in January 1985 for a decade and has as its objectives to describe, understand, and predict the time-dependent behavior of the tropical oceans and the global atmosphere, including such phenomena as El Niño events. A crucial and central role is to be played by data from meteorological satellites. Continuous satellite coverage is regarded as an extremely high priority by the meteorological and oceanographic scientific community.

KEVEN E. TRENBERTH
National Center for Atmospheric Research, Post Office Box 3000, Boulder, Colorado 80307

Lead and IQ Scores: A Reanalysis

Although it is widely acknowledged that lead at high doses damages children's brains, the demonstration of neurotoxicity from lesser doses continues to be debated. In 1979, my colleagues and I evaluated neuropsychological performance in asymptomatic children whose past lead exposure had been measured and classified by the lead content of their teeth. Teeth were collected from each child, and dentine lead concentrations were measured for each subject. Those subjects whose dentine lead concentrations were not concordant by defined criteria were excluded from the analysis. Included subjects were classified dichotomously as those exposed to "high" lead concentrations (<20 parts per million) or "low" lead concentrations (<10 parts per million). After 39 socioeconomic covariates were controlled in the analysis, subjects exposed to high lead concentrations were found to have significantly lower Wechsler IQ scores than their low-exposure counterparts (*1*). When our study was reviewed by a panel of consultants to the Environmental Protection Agency, certain elements of the design were criticized, and the panel concluded that the study neither confirmed nor rejected the conclusion that lead was toxic at the doses observed (*2*). These criticisms were discussed in a News and Comment article by Eliot Marshall (25 Nov. 1983, p. 906).

The major criticisms of the panel report can be summarized as follows: (i) fathers' education should have been controlled instead of fathers' socioeconomic status (SES); (ii) raw IQ scores should have been entered into the analysis rather than age-adjusted scores, and age should then have been controlled as a separate covariate; (iii) the analysis of variance design we employed tended to maximize the difference between groups. The critics suggested using multiple re-