Western Region Technical Attachment
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ANOTHER LOOK AT GLOBAL WARMING

[Editor's Note: This technical Attachment was summarized from a paper by D. E. Parker (Meteorological Office, Bracknell) and P. D. Jones (Climate Research Unit, University of East Anglia, Norwich) entitled, "Global Warmth in 1990", Weather, October 1991.]

Introduction

In the referent paper, the authors examine the global surface temperature record using a technique usually not employed in these types of investigations. Rather than computing a mean global temperature, they computed temperature anomalies using an appropriate reference period. This method minimizes the sampling problem associated with averaging surface temperatures geographically where the results depend strongly on the spatial distribution of the data, something which has varied through history.

Analysis Techniques

For each month that the anomalies were computed, they were averaged into 5° x 5° latitude/longitude grid boxes. These monthly grid box anomalies were then time-averaged into seasonal anomalies (January-March, April-June, etc.). The seasonal anomalies were then further averaged spatially using weightings proportional to the areas of the 5° grid boxes. Finally, these seasonal averages were used to compute an annual anomaly.

Results

The hemispheric and global surface temperature anomalies are shown in Fig. 1, for the years 1856-1990. From this global record, 1990 was the warmest year in the series, followed by 1988, 1983, 1944, 1981, and 1989. However, unlike recent years, the warmth of 1990 was greatest in the Northern Hemisphere. The geographical areas exhibiting the largest warm anomalies (not shown) in 1990 were Siberia and the United Kingdom. As shown in Fig. 2a, parts of Siberia were as much as 10°C above the reference climatology in March 1990. It is believed that the lack of snow cover in the Northern Hemisphere during February and March of 1990 (the least since the satellite-based record began) was a strong contributor to this anomaly. Even though most of Siberia was snow covered during this period, advection of warm air from anomalously snow free areas to the west and south of Siberia accounted for this anomaly. Note the spike for March in the monthly surface temperature anomaly series in Fig. 2b.

The decade of 1981-1990 was certainly the warmest in the series as shown in Fig. 1, and these results are consistent with other studies. Were these results influenced by the El Nino events of 1982-83 and 1986-87? The 1982-83 El Nino event was the largest in the twentieth century. The previous largest event was during 1877-78 which made 1878 a very warm year globally (see Fig. 1). During El Nino events, the eastern equatorial Pacific Ocean surface usually warms by 2-4°C, influencing the global average temperature upwards

by a few tenths of a degree Celsius. However, after factoring out the effects of the two El Nino events during 1981-90, the warmth of this decade still stands out in the global surface temperature anomaly time series (not shown).

Summary

The results of this study are consistent with other investigations that show a marked warming trend in the last 15 years. It is probable that the enhancement of the greenhouse effect, through the increase of carbon dioxide and other trace gases is a contributing factor to the recent warming. However, strong warmings have occurred in the past without major changes to the greenhouse gas concentrations, i.e., the large warming during 1920-40 in Fig. 1). Thus, the must recent warming may include contributions from natural causes as well as from an enhanced greenhouse effect.

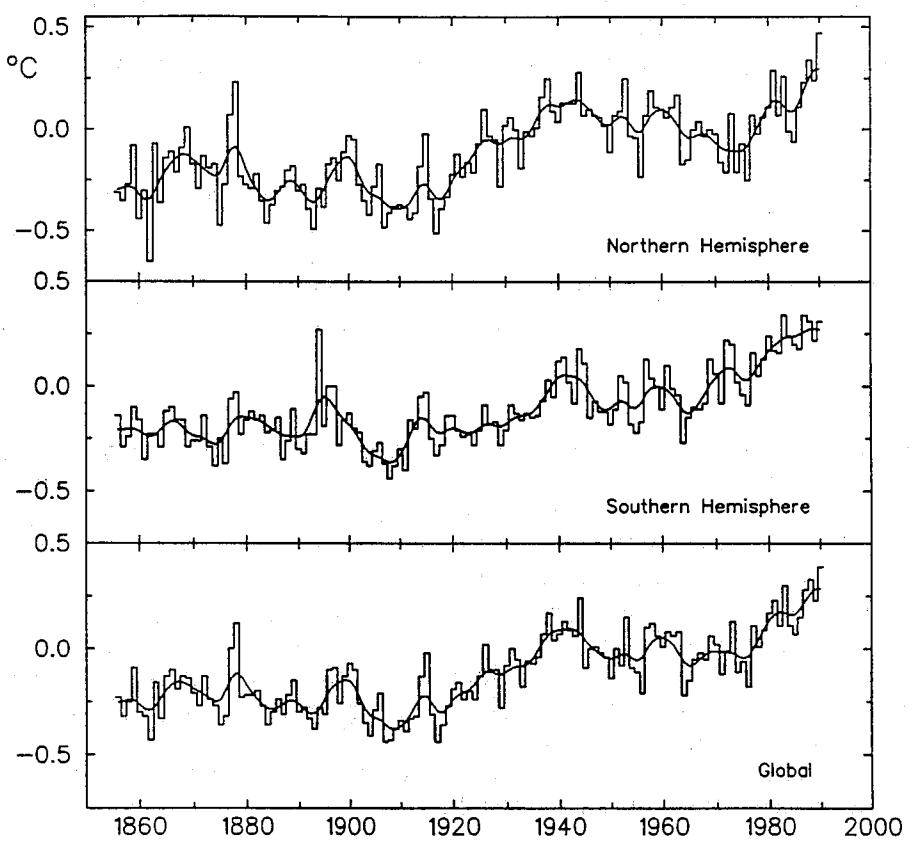

Fig. 1 Hemispheric and global surface temperature anomalies (degC) for 1856–1990 (with respect to 1951–80)

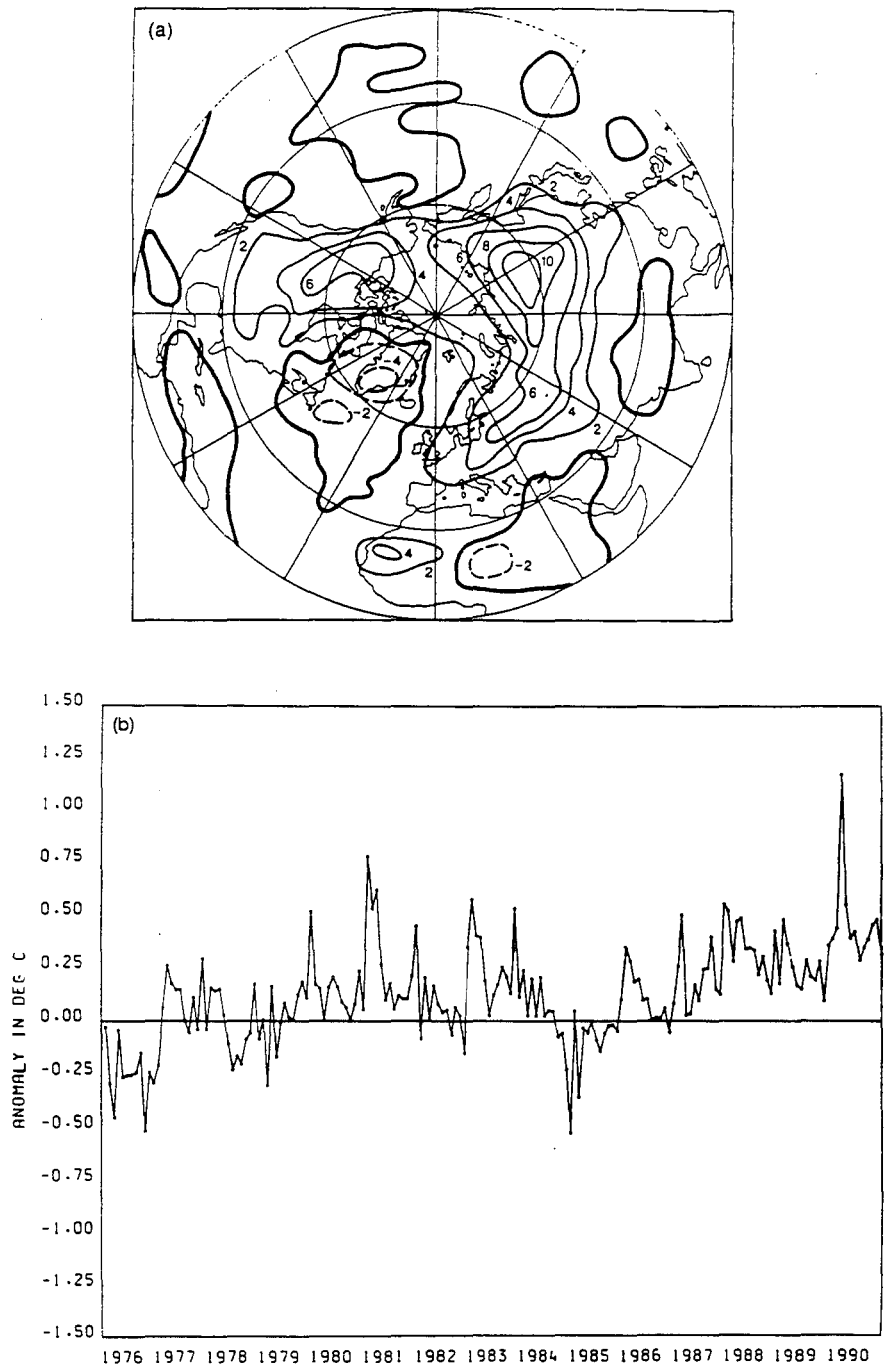

Fig. 2 (a) Surface temperature anomalies (degC) for March 1990 and (b) monthly surface temperature anomalies (degC) for 1976–90. Both are for the Northern Hemisphere and are with respect to 1951–80.