have synthesized spectra, which give a best fit to the observed spectra, by summing the individual spectra for adenine–uridine (AU) and guanine–cytosine (GC) base pairs and for unpaired A, U, C, and G (*8*). Therefore we have assumed that only Crick-Watson base pairs exist. The observed and synthetic spectra for 16*S* and 23*S* rRNA's (Fig. 2) are in close agreement. An exact fit is not expected since perturbations in the spectra of those unpaired bases in stacked configurations are neglected in this method (*2*). The percentage of each species used to obtain the best-fit synthesis is interpreted as the percentage of that species occurring in the RNA (Table 1). The base composition of the base-paired and unpaired regions of the RNA was calculated from Table 1 and is shown in Table 2.

These data are useful in comparing the secondary structures of 16*S* and 23*S* rRNA's rather than as an absolute measure of structure (*9*). The 16*S* and 23*S* rRNA's from *E. coli* have similar amounts of AU and GC base pairs in their secondary structures (Table 1). At 26°C, both 16*S* and 23*S* rRNA's have about 60 percent of their bases in paired regions and contain appreciably more GC than AU pairs (*10*). These *E. coli* rRNA's exhibit less base pairing than yeast rRNA (which is 64 percent paired at 30°C) but have a similar percent of GC pairs and less AU pairs (*2*). In contrast, 72 percent of the bases of formylmethionyl tRNA are paired, but only 32 percent of the bases of the anticodon fragment of this tRNA are paired (*5, 6*). It is clear that differences in base sequence between these species of RNA cause significant differences in secondary structure.

The data also show that significant differences exist in the secondary structures of 16*S* and 23*S* rRNA's from *E. coli*. Thus 16*S* has more total pairing and more GC and less AU pairs than does 23*S*. We may expect that some of the paired regions of 16*S* will have a greater stability than those of 23*S*. The 16*S* rRNA may also have larger continuous regions of pairing because regions with higher GC content would have sufficient stabilization energy to accommodate more base mispairing of the Wobble type (*11*) than would regions of low GC content. The single-stranded nonpaired regions of 16*S* rRNA contain more G than do similar regions in 23*S* (39 versus 34 percent) (Table 2). We may therefore expect a larger stacking interaction in the nonpaired regions of 16*S* than in 23*S*, which may mean that 23*S* rRNA is more flexible than 16*S* rRNA. Differences in secondary structure will determine differences in tertiary structure. Because the single-stranded regions of both 16*S* and 23*S* rRNA's from *E. coli* have a similar percent of pyrimidines, it might be expected that the rates of hydrolysis of these species by ribonuclease A would be similar. The fact that the rates are different (*7*) indicates that differences in tertiary structure may well exist as suggested by the data presented here.

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8. The component spectra were obtained by using the spectrum of poly(A · U) for AU, poly-(G · C) for GC, and the respective 5′-nucleotides for unpaired A, U, G, and C.
9. The sensitivity of the values in Table 1 is ± 1 percent, whereas the accuracy may be as low as ± 10 percent. Therefore comparison within Table 1 is meaningful, even though systematic error may exist for all values.
10. These results are consistent with those obtained in (*4*) for unfractionated *Escherichia coli* rRNA.
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20 August 1970

Climatic Anomaly over the United States during the 1960's

Abstract. *The past cool decade over the eastern United States is attributed to increased deployment of polar air masses set in motion by responses of the upper-air wind circulation of the Northern Hemisphere to large-scale air-sea coupling over the North Pacific.*

Climatic fluctuations on all time scales have always received a great deal of attention, and the cooling trend observed in numerous areas of the world during the 1960's has been no exception (*1*). Speculation as to the cause of the cooling has involved air pollution, volcanic activity, solar variations, and other more bizarre phenomena. Generally omitted from consideration is large-scale and long-term air-sea interaction—perhaps because of the unavailability of reliable long series of oceanic temperature data or because of

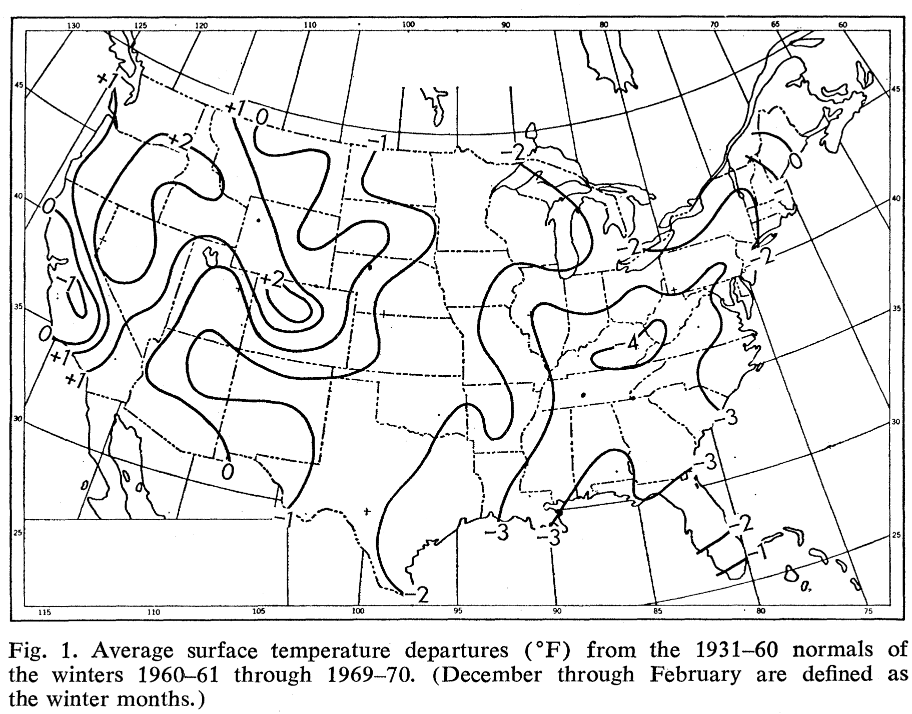

Fig. 1. Average surface temperature departures (°F) from the 1931–60 normals of the winters 1960–61 through 1969–70. (December through February are defined as the winter months.)

the tacit assumption that the sea is always a slave to the atmosphere. It seems to me that, in the quest for causes of climatic fluctuations, scientists may be overlooking the most important factor by neglecting this interaction.

Although most hypotheses dealing with short- and long-period climatic changes invoke uniformly acting global mechanisms, it is quite possible that regional mechanisms interacting with each other through atmospheric dynamics can produce hemispheric and even global fluctuations. In the following paragraphs I shall describe and attempt to explain one such regional interaction—namely, between the North Pacific and North America.

The winter weather over the contiguous United States was indeed colder than normal across the eastern two-thirds of the nation, where temperatures averaged from 1° to 4°F (approximately 0.5° to 2°C) below the 1931–60 mean (Fig. 1). West of the continental divide, temperatures averaged above normal. During practically all of the ten winters, temperatures averaged below normal in the eastern half of the nation.

These temperature anomalies are easily associated with the prevailing flow pattern of the winds in midtroposphere, as shown by average decadal height contours at the 700-mb pres-

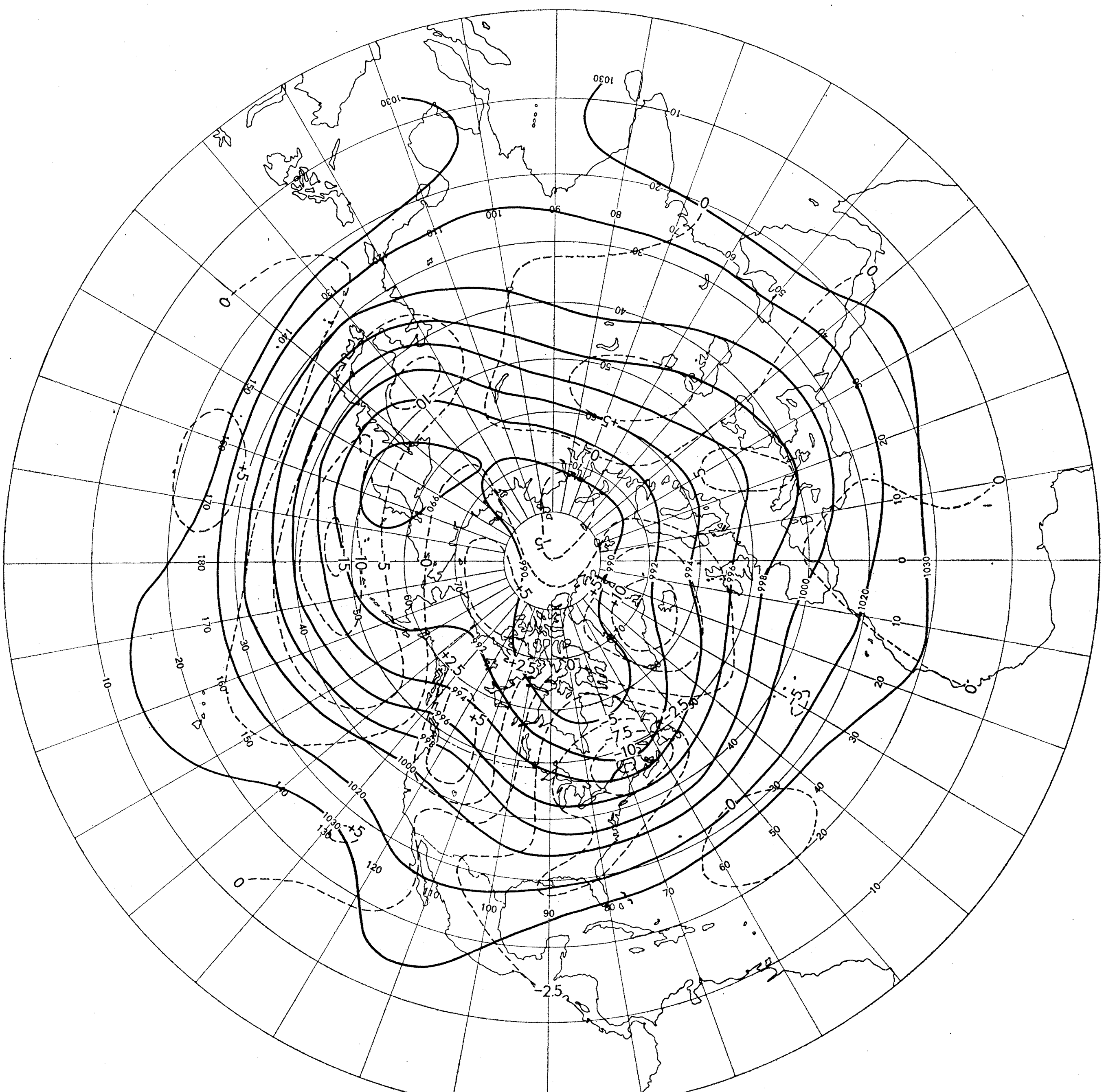

Fig. 2. Mean 700-mb height contours (solid lines) and isopleths of departure from normal (broken lines) for the winters of the decade from 1960–61 through 1969–70. Contours and isopleths of anomaly are labeled in tens of feet (multiply by 3.048 for meters).

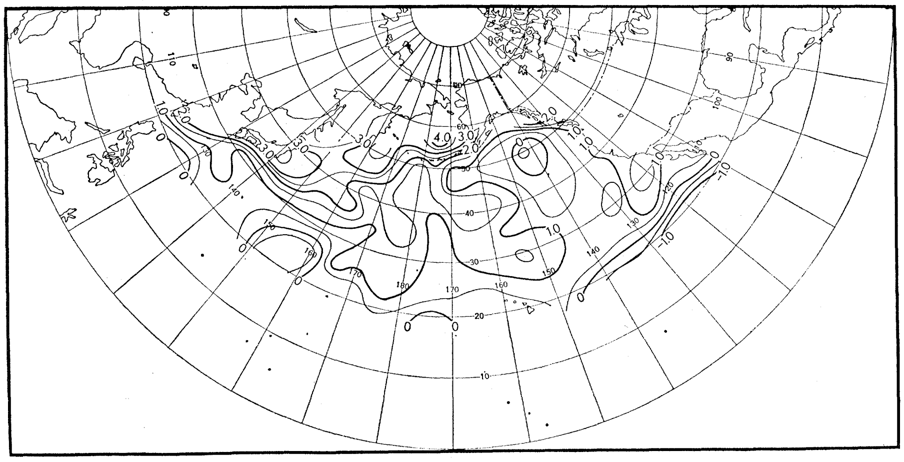

Fig. 3. Average departures of sea-surface temperature for the ten winters, 1960–70, from long-term (about 40-year) means ending about 1945. Temperatures were extracted from monthly means published by the Bureau of Commercial Fisheries (*7*) and from values furnished by the Japanese Meteorological Agency. Isopleths are constructed at 0.5°F (approximately 0.3°C) intervals.

sure level and by isopleths of departure from normal (here, normal is defined as an average for the winters of 1947–63) for the ten winters (Fig. 2).

Since the prevailing winds flow along the contours with low heights to the left, this chart shows that the long wave pattern affecting much of the Northern Hemisphere, and especially North America, was appreciably amplified above the normal. With a stronger ridge (northward bulge in the flow) over western North America and a stronger trough (southward bulge) to the east, the more frequent deployment of Arctic air masses into the eastern half of the nation is assured. This is obvious from the isopleths of 700-mb height anomaly and is verifiable from an objective system (*2*) for specifying mean temperature anomalies at the earth's surface from 700-mb height anomalies. In view of this relationship, it seems unlikely that increased air pollution, variation in volcanic activity, or human intervention was the cause of the decadal temperature fluctuation over the United States. If these factors do not cause the U.S. temperature fluctuation, then it is possible that fluctuations elsewhere are caused by direct regional interactions and their further consequences (*3*).

At the same time that the eastern United States was abnormally *cold*, the sea surface over much of the North Pacific was abnormally *warm*. Figure 3 shows the average departures of sea-surface temperatures in the winters of the 1960's from normals based on a period of more than 40 years prior to 1945 (*4*). Whatever the cause of the oceanic warming, it is likely to have produced an aberration in the wintertime atmospheric circulation over the North Pacific—most probably by abnormal excitation of cyclones, as I have described elsewhere (*3*). Once the cyclonic activity increased and the vorticity (or curl of the winds) was transported aloft, the resulting standing (or forced) long-wave central Pacific trough created downstream perturbations in the manner shown in Fig. 2. These perturbations are the well-known long or Rossby waves, and their observed positions agree with theoretical (*5*) or empirically derived (*6*) teleconnections.

The *fall* sea-surface temperature anomalies of the last decade (not shown) averaged up to 1°F (approximately 0.5°C) warmer than those of the following winters over much of the central North Pacific. Thus, the winter storms had an unusually warm initial reservoir on which to feed, and some of the anomalous heat was extracted through increased latent and sensible heat losses associated with stronger winds.

There seems to be no strong reason why repetitive conditions such as those described cannot lead to climatic fluctuations of a much longer time scale than a decade. It may be shortsighted to invoke extraterrestrial or man-made activity to explain these fluctuations.

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Actomyosin from Physarum polycephalum: Electron Microscopy of Myosin-Enriched Preparations

Abstract. *Negatively stained slime mold actomyosin examined by electron microscopy consists mainly of actin-like filaments with occasional angular projections. If some of the actin is removed, the myosin-enriched actomyosin appears as continuous arrowhead structures similar to those of vertebrate striated muscle actomyosin. Together with other evidence, the findings suggest that cytoplasmic streaming in* Physarum *may involve a contractile process operating at a relatively low myosin-actin ratio.*

Actomyosin preparations purified from *Physarum polycephalum* by a slight modification of the method of Hatano and Tazawa (*1*) have been shown (*2*), when examined in the electron microscope after negative staining, to consist of beaded filaments of various lengths up to about 1.2 μm long with projections at intervals. Sometimes the projections are clearly at an angle with respect to the filaments, and occasionally thin (about