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Anomalies of sea temperature at Station 27 off Cape Spear and of air temperature at Torbay-St. John's

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Introduction

For the past 17 years temperatures at standard depths from surface to bottom have been taken once or twice monthly at Station 27 situated 2 nautical miles off Cape Spear, near St. John's, Newfoundland at 47°31'50"N, 52°35'10"W in 176 m.

To produce an average temperature for a year or part year the temperatures were first adjusted to the mid-monthly temperature and the average mean yearly temperature per 25 m water column calculated from the mid-monthly temperatures without allowance for the differing number of days in the months.

The mean yearly (calculated from mean daily and then mean monthly as above) air temperatures now taken at the Torbay Airport near St. John's but formerly taken at St. John's have all been adjusted to the Torbay level since they were taken at both places for an overlapping number of years. (For details of methods both for water and air temperatures see Templeman (1965).)

Templeman (1965) calculated the yearly temperature anomalies for Station 27 and the air temperature at Torbay on the bases of the average yearly temperatures, water and air respectively, for 1950-62 and for the air temperatures at St. John's-Torbay also for 1872-1962. The present paper extends the period of temperature-anomaly comparison to 1966 but base-line averages have not been recalculated and the present comparisons are with the 1950-62 and the 1872-1962 base-line averages as above.

Anomalies of water temperature at Station 27

In yearly temperatures (Fig. 1), January-May (Fig. 2) and June-November (Fig. 3) the pattern of average temperature by year in the water column and its different portions is usually fairly similar although there is naturally a greater amplitude of variation in the upper layers. There is also a close relation in trend, especially in the upper water layers, with the air temperature.

The general trend during this period in the yearly water temperatures (Fig. 1) has been fairly well balanced about or near the average, but with less yearly variability in recent years and with an upturn in 1966.

In the sea temperatures for January-May (Fig. 2) there was a slight decline over most of the period but no great or extensive departures from the average and with an upturn in 1966.

The June-December sea temperatures (Fig. 3) have also shown no very definite trends, possibly slightly downward in the deeper layers but well balanced above and below the average in the upper layer and in the whole water column.

Anomalies of air temperature, Torbay-St. John's

Years 1950-66

For the years 1950-66 (Fig. 2), in the period December-April the air temperatures showed close agreement in relative trend from year to year (allowing for the greater amplitude of the air temperature variations) with water temperatures at all levels. At this time of year local or local regional air temperatures apparently have the overriding influence in the water column to the depth of this station.

For this period of years also, the May-November air temperatures (Fig. 3) were usually closely related in trend to the June-December water temperatures, the agreement being best in the upper layers. Deeper down, and on the average for the whole water column, agreements in trend with air temperatures were usually present, but especially in the deeper layers there were enough differences to show outside influence, presumably of the southward-moving Labrador Current. Also, offshore and onshore winds and internal waves would have more effect in summer and autumn, when temperatures from top to bottom are very variable, than in winter and spring when temperatures are little different from surface to bottom.

The yearly air temperatures (Fig. 1) show the average effects of the winter spring and summer-autumn relationships and provide generally excellent agreements between air and surface water layer temperature trends, with fairly good but less agreement at the deeper levels.

Years 1872-1966

Because the air temperatures at Torbay-St. John's and the water temperatures at Station 27 off Cape Spear show an excellent relationship in trend but regular year-round water temperatures are only available for this station since 1950, the air temperatures for the St. John's (more recently Torbay) area which are available since 1872 should be indicative of water temperature changes in trend during this period. Over this period the December-April and May-November temperature trends (Fig. 4) show some differences. The December-April temperatures were at their lowest in the early part of the period, then ran through a period of fluctuating higher than average temperatures in the 1890's and early 1900's. Temperatures declined to lows in the early to mid-1920's and rose to their highest level in the whole period in the early to mid-1950's.

The May-November trend is often opposite to that of December-April. Temperatures for May-November were close to the average at the beginning of the period, gradually declined to their lowest level in the early 1900's. From this they gradually increased but were usually below average until the early 1920's, reaching their highest level in the 1930's and have since declined a little but remained usually above the average.

The temperature trend for the whole year began from a low point in the early part of the period, about or shortly after 1880 and rose slightly but remained generally below average until the late 1920's, increased to its highest level in the 1950's and has declined in recent years but is still above average.

The often different or opposite trends of the winter-early spring (called winter in discussion), late spring, summer and autumn (called summer in discussion) temperatures are presumable related in some way and need an explanation.

The winter temperatures show 2 long period fluctuating changes of which the first was about 50 years or longer and the second has thus far lasted about 40 years but is evidently incomplete. In each of these periods the winter temperatures have varied through a greater amplitude than the summer temperatures.

The recent period in summer temperatures could be considered to have lasted since about 1902, that is for 64 years, and is still incomplete.

Acknowledgments

I am grateful to the scientists and technicians of the St. John's Station who over the years have taken so many temperatures at Station 27 and particularly to Mr. A.O. Kelland who has been most closely associated with the hydrographic work at the St. John's Station. I am grateful also to the Meteorological Service and Mr. C.F. Rowe of the Torbay Meteorological Station of the Department of Transport for records of the Torbay-St. John's area temperatures.

Reference

Templeman, Wilfred. 1965. Anomalies of sea temperature at Station 27 off Cape Spear and of air temperature at Torbay-St. John's. Int. Comm. Northw. Atlantic Fish., Special Pub. No. 6, p. 795-806.

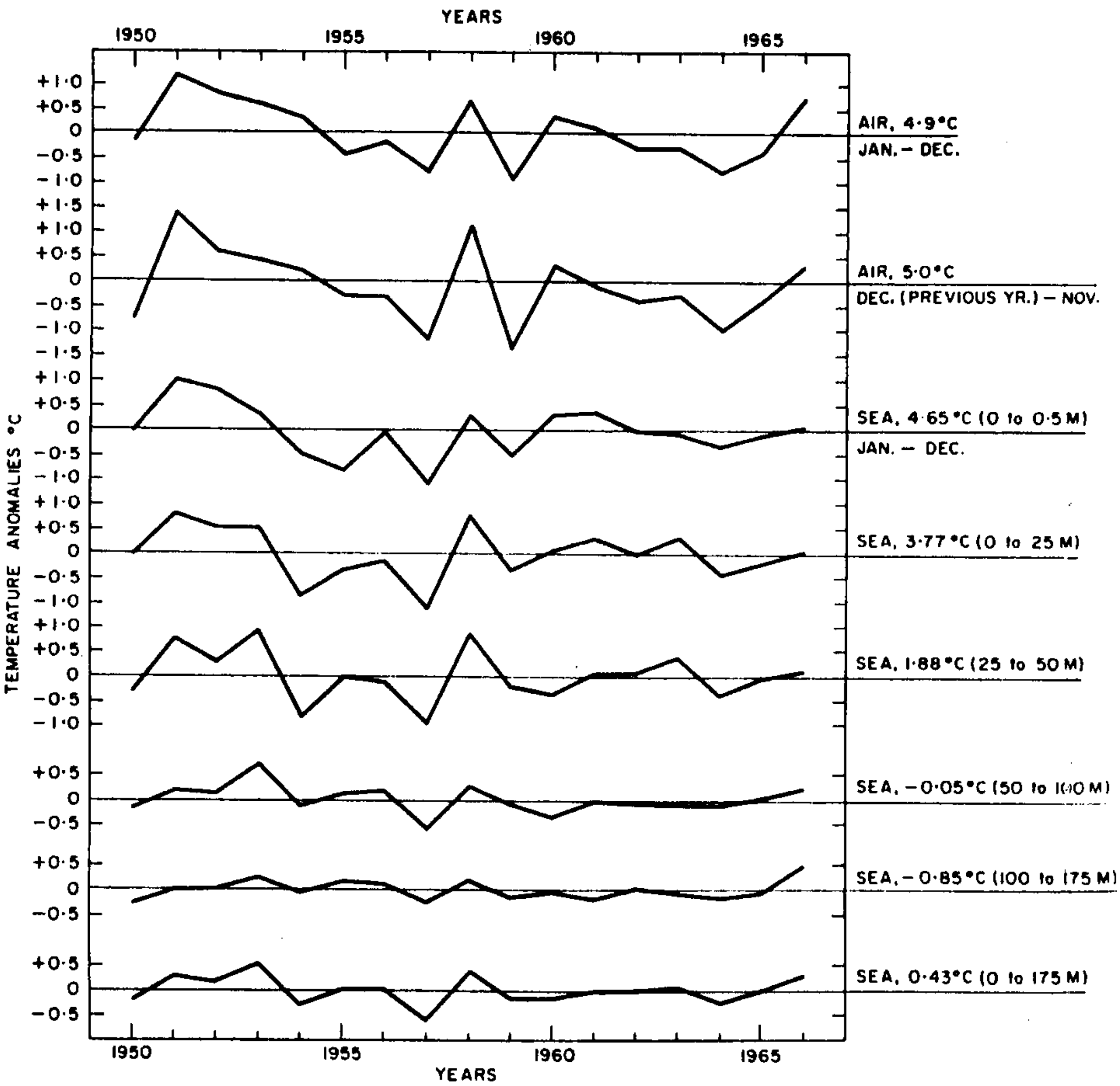

Fig. 1. Anomalies of yearly sea-surface and water column temperatures at station 27 and of air temperatures at Torbay-St. John's, for 1950-66 from the average yearly temperatures for 1950-62.

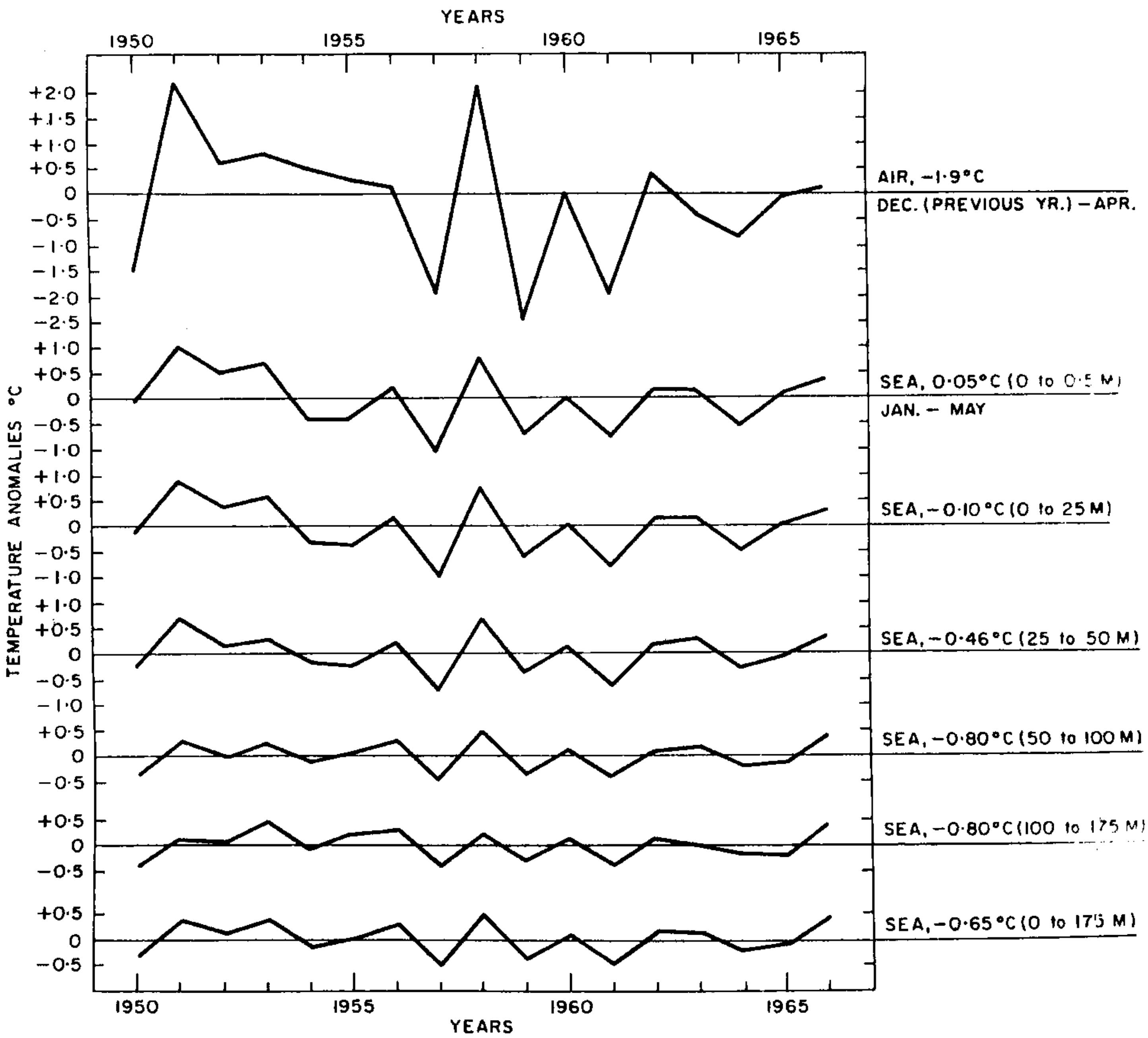

Fig. 2. Anomalies of yearly January-May sea-surface and water column temperatures at Station 27 and of December (of previous year) - April air temperatures at Torbay-St. John's, for 1950-66 from the average temperatures during these periods for 1950-62.

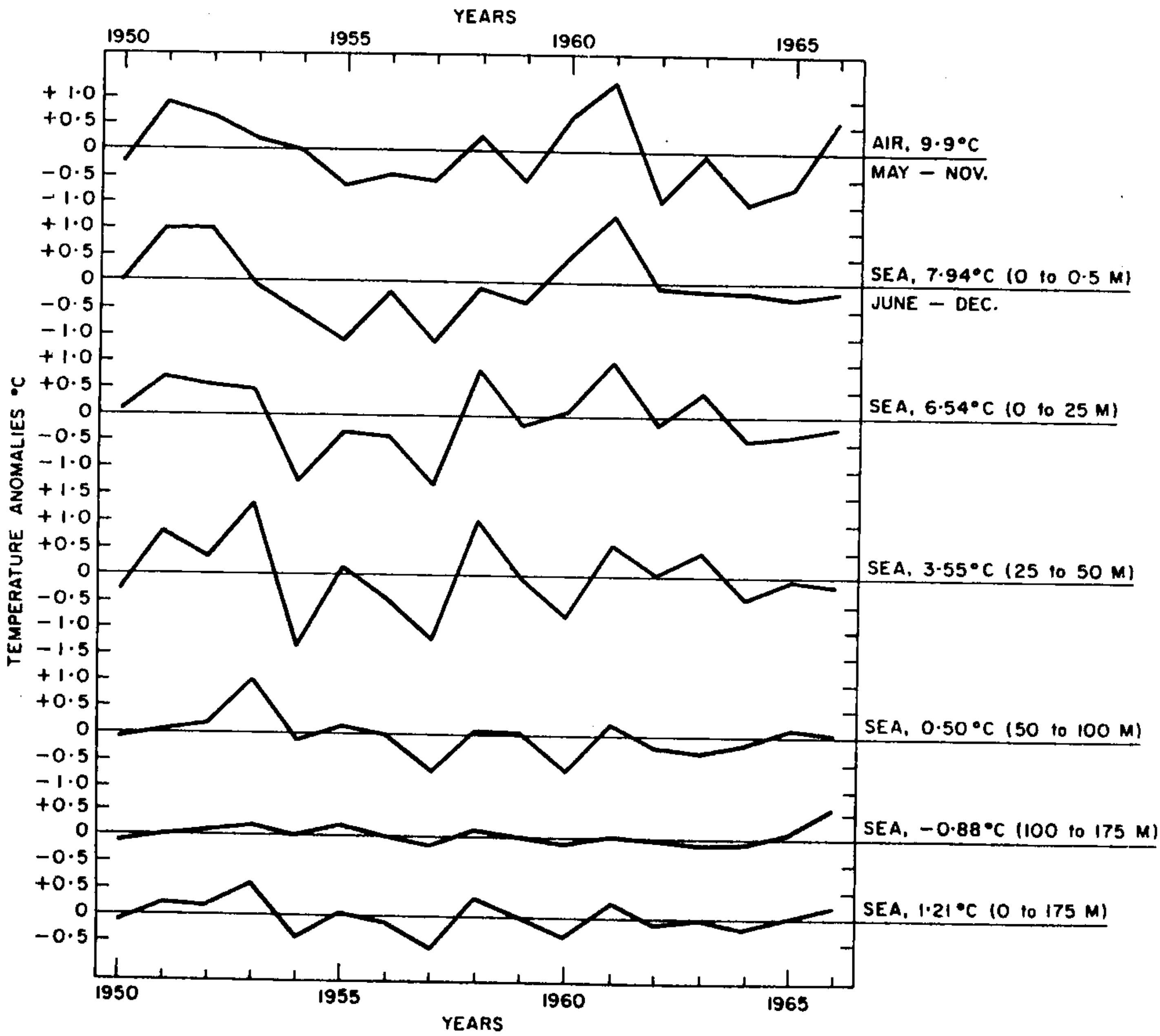

Fig. 3. Anomalies of yearly June-December sea-surface and water column temperatures at Station 27 and of May-November air temperatures at Torbay-St. John's for 1950-66 from the average temperatures during these periods for 1950-62.

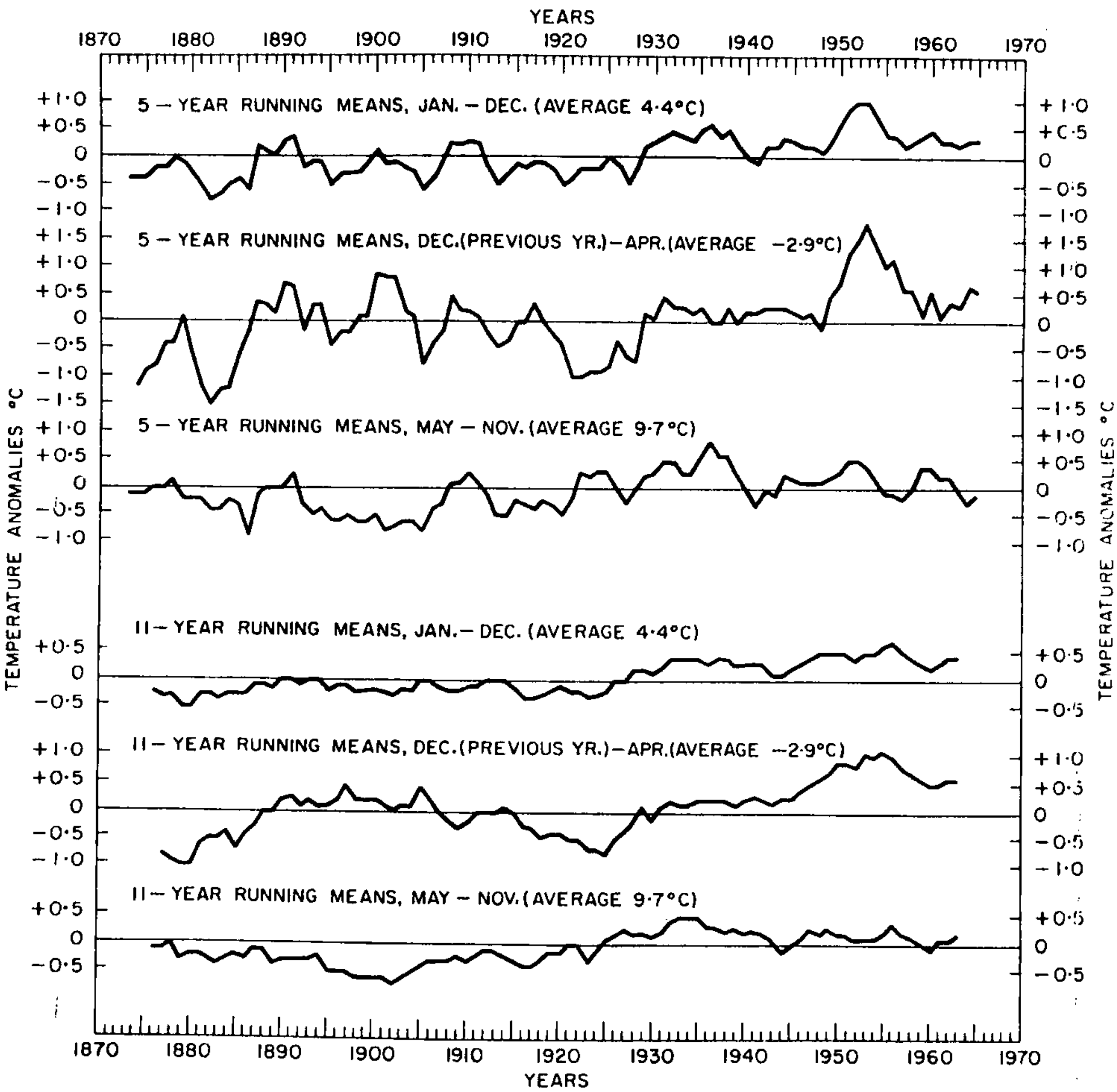

Fig. 4. Five-year and eleven-year anomalies of running means of air temperatures at Torbay-St. John's for 1872-1966 from the averages for 1872-1962. (The running means are attributed to the median year. The December-April average air temperature in the corresponding figure of Templeman, 1965 (fig. 5) should be $-2.9^{\circ}C$ instead of $2.9^{\circ}C$.)