Pacific Science (1973), Vol. 27, No. 4, p. 406–408
Printed in Great Britain

Pacific Ocean Equatorial Temperature and Wind[1]

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ABSTRACT: Equatorial ocean temperatures at long. 165° W during 1957–1971 are presented. Their correlation with Canton Island surface wind is found to be −0.57, which is not so close as might be expected from a recent paper by Hires and Montgomery. When the annual cycles are removed, the correlation becomes −0.69. The annual cycle of Canton Island wind shows a primary maximum in August and a secondary maximum in February–March, somewhat inverse to the previously found cycle of equatorial temperature.

EQUATORIAL TEMPERATURE at the naviface (sea surface) in the central Pacific Ocean is lowered as a consequence of upwelling produced by easterly winds. Evidence of corresponding fluctuations in temperature and wind has been found in two studies. Bjerknes (1972: fig. 1) showed that at Canton Island (lat. 2° 46′ S, long. 171° 43′ W) the monthly means of navifacial temperature and of westward component of wind were inversely related during the years 1962–1967. Hires and Montgomery (1972: fig. 9) found an apparently close inverse relationship between the annual variations of equatorial navifacial temperature (1957–1965) and of wind speed in the previous month at Canton Island (7 years).

The latter relationship is reexamined with more detailed data in the present note. Navifacial temperatures on 100 equatorial crossings near 165° W by the S.S. *Mariposa* and S.S. *Monterey* of Pacific Far East Line, Inc., 1957–1971, are shown by the dots in Fig. 1. The data were made available to me by the National Marine Fisheries Service, Honolulu, a subdivision of the National Oceanic and Atmospheric Administration (NOAA). The temperature used for each crossing shown in Fig. 1 is the lower of the two readings (spaced about 80 miles apart) closest to the equator. As noted by Hires and Montgomery (1972: 181), the temperatures are uncorrected and are too high by about 1° C. Canton Island monthly resultant winds computed from hourly surface observations from November 1949 to August 1967 were made available to me by NOAA National Climatic Center, Asheville, North Carolina. The zonal components for the years 1956–1967 are shown by the bars in Fig. 1.

There is seen to be a noticeable, but not close, correlation between the two series. Both wind and upwelling were weak during parts of 1957–1959 and again in late 1963 and late 1965. The correlation is not so pronounced as that between Canton wind and Canton navifacial temperature (Bjerknes 1972: fig. 1).

The annual variations are compared in Fig. 2. The water temperature is the 1957–1965 average computed by Hires and Montgomery. The westward component of wind is based on the complete calendar years 1950–1966. The relationship between the annual variations of wind and temperature is not so close as was indicated by the preliminary comparison by Hires and Montgomery (1972: fig. 9). The coefficient of correlation between the two variables in Fig. 2 is only −0.30. It is interesting, though, that the wind goes through a double annual cycle, just so Hires and Montgomery found that the equatorial temperature does. The primary wind maximum is in August, the secondary maximum is in February–March. Such maxima are seen to occur in 1956, 1957, 1960, 1961, 1963, 1965, and 1966 (Fig. 1).

Because Hires and Montgomery found an

[1] Contribution 193, Chesapeake Bay Institute, Johns Hopkins University. This study was supported by the Oceanography Section, National Science Foundation, NSF grant GA-11047, and by the Office of Naval Research, contract N = 000 = 14-67-A-0163-006. Manuscript received 16 March 1973.

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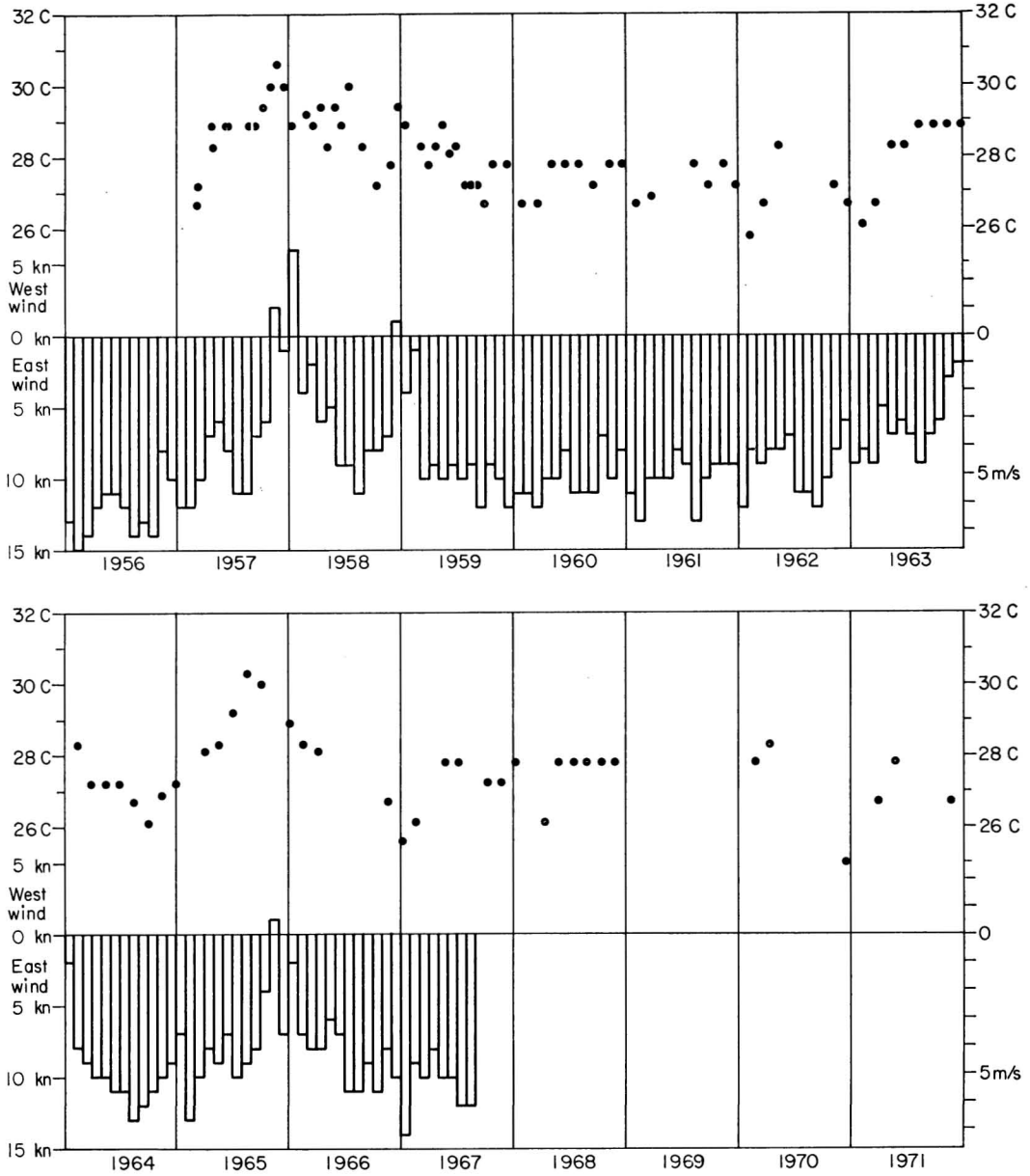

FIG. 1. Equatorial navifacial temperature at long. 165° W (dots) and monthly mean zonal component of wind at Canton Island (lat. 3° S, long. 172° W) (bars).

indication that Canton Island wind is closely related (inversely) to equatorial temperature in the following month, correlations of the two variables in Fig. 1 are presented in Table 1 for lags of various multiples of 1 month. (When two equatorial crossings occurred in the same calendar month, as happened eight times, the two temperatures were averaged to form a single statistic.) The next-to-last column lists the correlations between the actual values shown in Fig. 1. The last column lists the correlations after the annual variations have

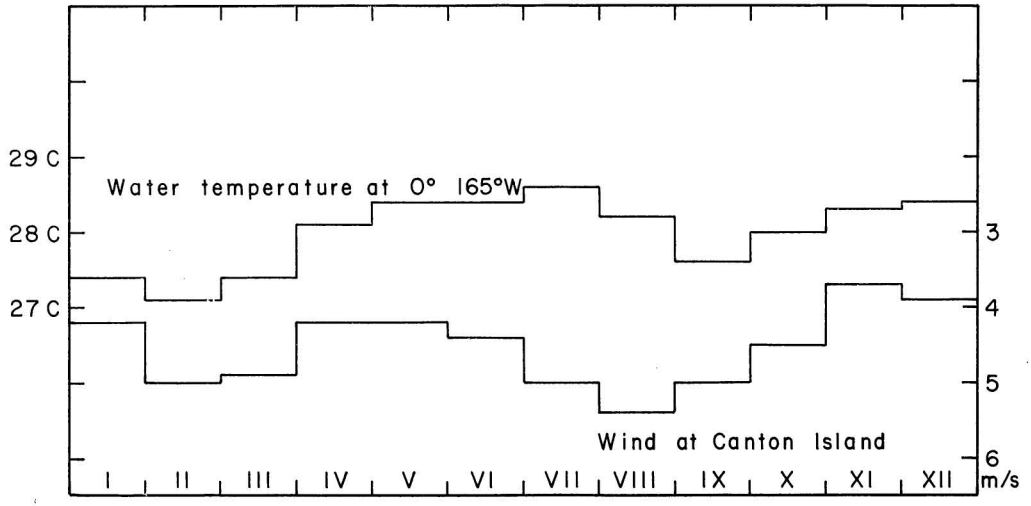

FIG. 2. Annual variations in the mean equatorial navifacial temperature at long. 165° W, 1957–1965, and in the mean westward component of wind at Canton Island (lat. 3° S, long. 172° W), 1950–1966. Note that the wind scale is inverted.

TABLE 1

COEFFICIENTS OF CORRELATION BETWEEN EQUATORIAL NAVIFACIAL TEMPERATURE AT LONG. 165° W AND MONTHLY MEAN WESTWARD COMPONENT OF WIND AT CANTON ISLAND

NO. OF MONTHS BY WHICH WIND LEADS TEMPERATURE	PAIRS	ANNUAL VARIATION INCLUDED	ANNUAL VARIATION REMOVED
8	81	+0.04	+0.09
7	80	−0.13	0.00
6	80	−0.27	−0.13
5	80	−0.24	−0.17
4	79	−0.35	−0.41
3	79	−0.35	−0.52
2	78	−0.41	−0.57
1	77	−0.55	−0.67
0	77	−0.57	−0.69
−1	77	−0.55	−0.64
−2	76	−0.43	−0.52
−3	76	−0.42	−0.49
−4	75	−0.36	−0.36
−5	75	−0.46	−0.39
−6	75	−0.40	−0.28
−7	74	−0.29	−0.22
−8	73	−0.10	−0.13

been removed by subtracting from each value the mean monthly value shown in Fig. 2.

Table 1 does not indicate any tendency of the wind to lead the temperature. Such a tendency might appear if the time interval were shorter than 1 month. The correlation between equatorial temperature and Canton Island wind in the same month is −0.57, and the correlation increases to −0.69 when the annual variations have been removed from both series.

This correlation agrees with the idea that the degree of equatorial upwelling depends on the strength of the easterly wind.

I thank Dr. F. A. Berson and Dr. O. M. Phillips for advice and Dr. W. C. Boicourt for computer-programming the correlation coefficients.

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