



Abstract View

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The Annual March of Heat Storage and Export in the Tropical Atlantic Ocean

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ABSTRACT

The annual cycle and spatial patterns of subsurface heat storage Q_t and divergence of heat transport Q_v in the tropical Atlantic Ocean (30°N–20°S, east of 80°W) are studied on the basis of subsurface temperature soundings compiled until 1978 and evaluations of the net heat gain through the ocean surface (Q_t+Q_v) from long-term ship observations (1911–70). The net oceanic heat gain (Q_t+Q_v) follows in large part, but not exclusively, the annual cycle of insolation with largest gain in the respective summer, and loss in the winter half-year. The Q_t has an annual range and spatial gradients considerably larger than those of (Q_t+Q_v). Poleward of about 15°N, Q_t exhibits an annual cycle similar to (Q_t+Q_v) and insolation. By contrast, temporal and spatial variations of Q_t are more complicated in the equatorial Atlantic (about 10°N–10°S). For the average over this latitude band, heat depletion (negative Q_t) is found around March–May and largest storage around August–September. The divergence of oceanic heat transport Q_v is obtained as the difference between (Q_t+Q_v) and Q_t , and exhibits patterns broadly complementary to those of Q_t .

Calendar monthly maps indicate two major systems of annual cycle changes of Q_t . (i) A west–east seasaw variation is apparent in the equatorial belt (about 10°S–10°N), with heat depletion prevailing in the western equatorial Atlantic around March and April, and heat storage continuing in the Gulf of Guinea from January to around May. This heat budget pattern is associated with a deepening of isothermal surfaces to the west from about May to July, with concomitant shallowing in the Gulf of Guinea. (ii) The zone 0–15°N is dominated by a northwestward shift of a band of negative Q_t from around March to August, and an inverse displacement thereafter. Both systems (i) and (ii) of

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seasonal changes in Q_t broadly parallel the annual cycle of the surface wind field over the tropical Atlantic, characterized by extrema around April and August.

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