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A MODEL STUDY OF THE SEASONAL MIXED LAYER HEAT BUDGET IN THE EQUATORIAL ATLANTIC

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In the present study, the physical processes that control the seasonal cycle of sea surface temperature in the tropical Atlantic Ocean were investigated. A high-resolution ocean general circulation model was used to diagnose the various contributions to the mixed layer heat budget. The simulation accurately reproduced the main features of the circulation and thermal structure of the tropical Atlantic, and thus provided confidence in the three-dimensional circulation and thermal structure of the model. A close examination of the mixed layer heat budget that controls the mixed layer temperature was thus undertaken.

At a first order, the sea surface temperature balance at the equator was established to be the result of both cooling by subsurface processes (through vertical mixing at the base of the mixed layer, vertical advection and entrainment), and heating by both atmospheric net heat fluxes and eddies (mainly tropical instability waves). Cooling by subsurface processes was strongest in June-August, when easterlies are strong, with a second maximum in December. Heating by the atmosphere was maximum in February-March and September-October, whereas eddies were most active in boreal summer. On the other hand, horizontal advection by low frequency currents (period > 35 days) only played a minor role in the heat budget. Off equator, the sea surface temperature variability was mainly governed by atmospheric forcing all year long, except in the northeastern part of the basin where strong eddies generated at the location of the thermal front significantly contributed to the heat budget in boreal summer.

Finally, the results were discussed and compared to previously published heat budgets calculated from observations.

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Convective wind system with aerosols, named “haboob”, Hombori in Mali, West Africa.