ENERGY BALANCE AT THE AIR-SEA INTERFACE OF THE TROPICAL ATLANTIC OCEAN

Lívia Dutra and Jacyra Soares
University of São Paulo, Brazil
Institute of Astronomy, Geophysics and Atmospheric Sciences
Department of Atmospheric Sciences

Introduction

This work is connected to the FluTuA project (Turbulent Fluxes over Atlantic; Bacellar, 2009), that uses a ten meter micrometeorological tower installed at the Saint Peter and Saint Paul Archipelago (SPSPA; *figs. 1* and *2*) to investigate the ocean-atmosphere interaction through the observation of meteorological parameters in the Tropical Atlantic ocean.

The SPSPA is formed by a group of small uninhabited rocky islands, which are devoid of any kind of vegetation, and it is located about 1.010 km from the Brazilian coast, in a prime position for the development of meteorological and oceanographic researches.

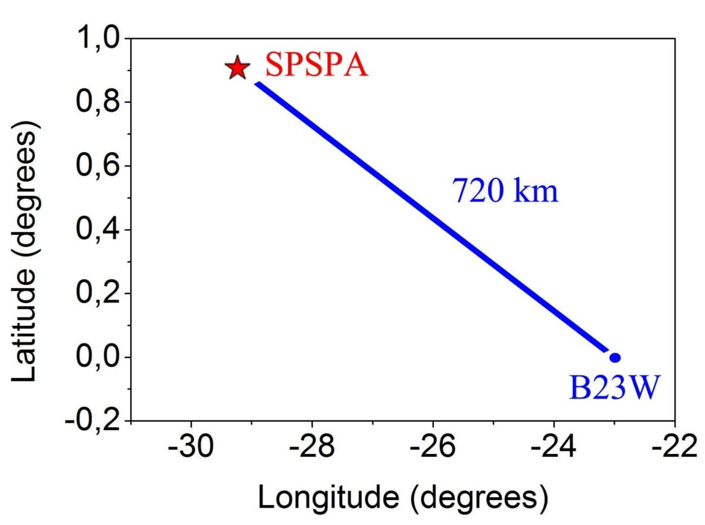

Fig. 1. Geographic position of SPSPA (red star) and of the PIRATA buoy utilized.

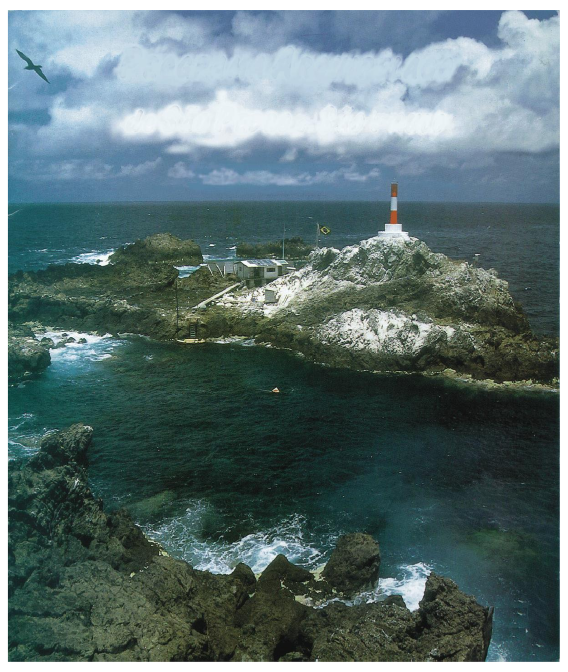

Fig. 2. SPSPA.

Data resources

Data from a buoy of the PIRATA project (Pilot Research Moored Array in the Tropical Atlantic; Servain *et al*., 1998; *fig. 1*);

Table 1. Data and its respective sources utilized in this work.

Source	Parameters	Period	Resolution
PIRATA	SW↓	1999 – 2007	2 min
	LW↓	2006 – 2008	2 min
	SST	1999 – 2006	10 min

Objectives

- Verify the occurrence of clear-sky days during the available period;
- Estimate and characterize the energy balance over the region.

Methods

The sensible heat flux (H) and the latent heat flux (LE) were estimated from the *bulk* equations (Friehe and Schmitt, 1976; Kubota *et al*., 2002), given by expressions (1) and (2):

$$H = -\rho_0 c_p C_H \, u \, (T_{air} - SST) \quad (1)$$

$$LE = -\rho_0 L C_E \, u \, (q_{air} - q_{sat}) \quad (2)$$

The net radiation (R_n) and the ocean net heat flux (Q_n) are given by (3) and (4), respectively.

$$R_n = SW\downarrow + SW\uparrow + LW\downarrow + LW\uparrow \quad (3)$$

$$Q_n = R_n + H + LE \quad (4)$$

Here, the negative ocean heat flux corresponds to the heat gain by the ocean.

Clear-sky days

Total of days: 2778
Total of clear sky days: 27

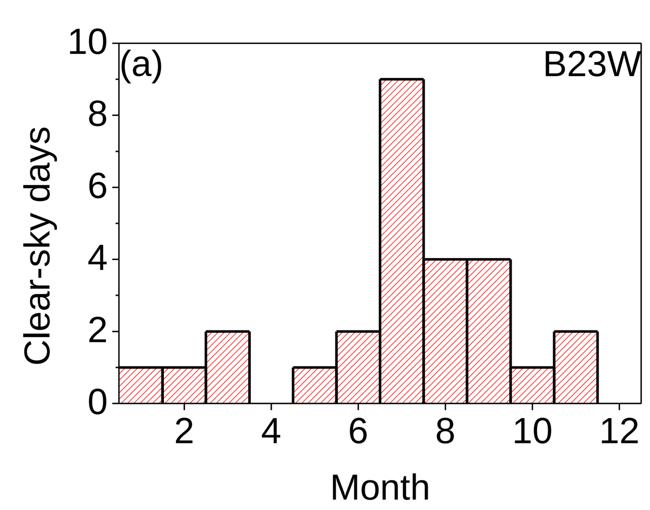

Fig. 3. Frequency distribution of the clear-sky days, for the B23W.

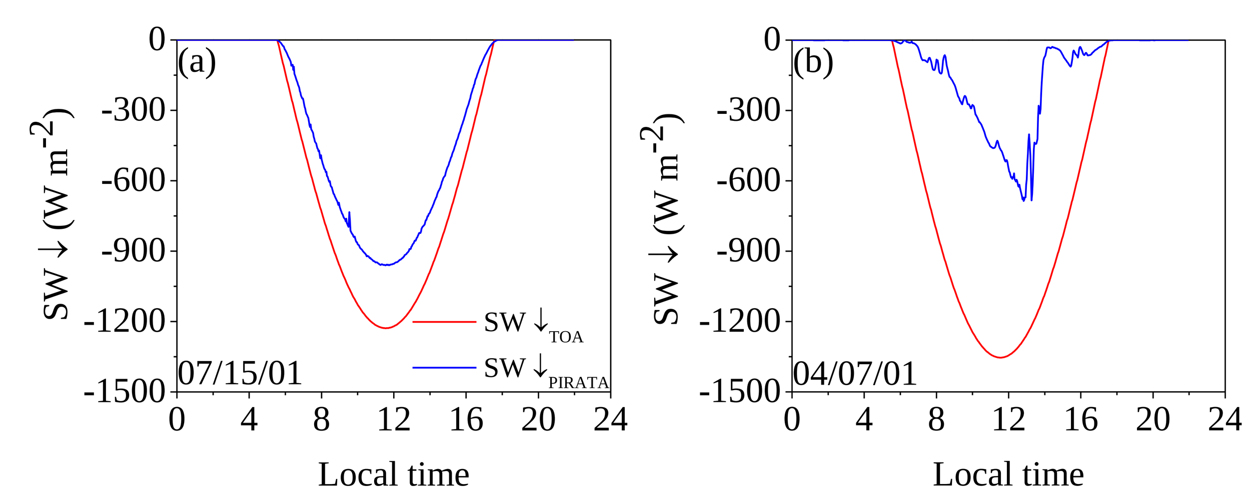

Fig. 4. Example of the diurnal evolution of solar radiation incident at the top of atmosphere (TOA) and on the sea-surface (W m^{-2}) in (a) a clear-sky day and (b) a cloudy day, in the B23W buoy region.

Results

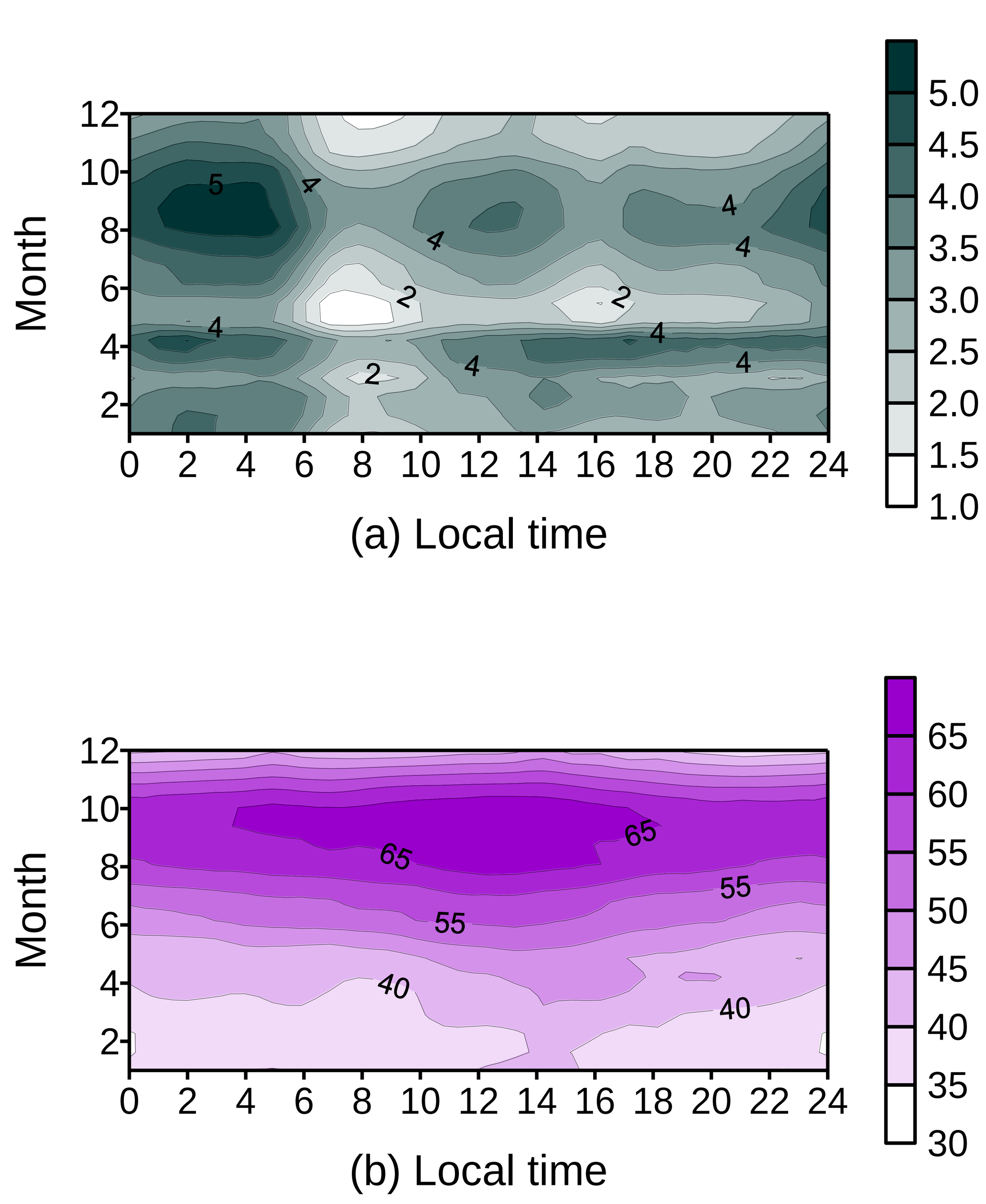

Fig. 5. Mean hourly and monthly variation of (a) the sensible heat turbulent fluxes (W m^{-2}) and (b) the latent heat turbulent fluxes (W m^{-2}) for the B23W region.

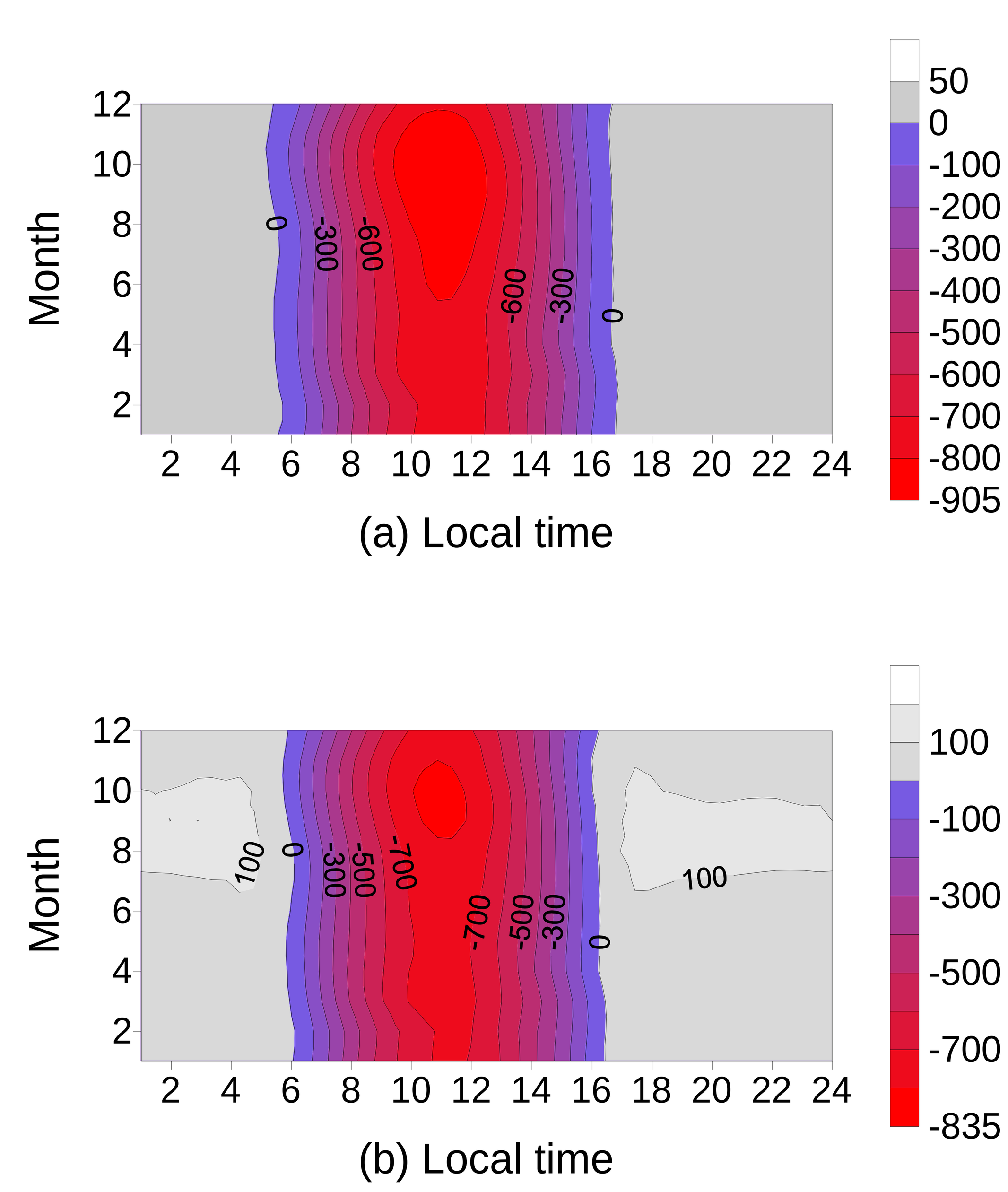

Fig. 6. Mean hourly and monthly variation of (a) the net radiation flux (W m^{-2}) and (b) the net ocean heat flux (W m^{-2}) for the B23W region.

Acknowledgments

The authors would like to thank CNPq, FAPESP and CMOS financial assistance.

The TAO Project Office of NOAA/PMEL provided the access to the PIRATA data utilized in this research.

References

BACELLAR, S., OLIVEIRA, A. P., SOARES, J., SERVAIN, J., 2009: Assessing the diurnal evolution surface radiation balance over the Tropical Atlantic Ocean using in situ measurements carried out during the FluTuA Project. Meteorological Application, 16, 255-266.

FRIEHE, C., A. and SCHMITT, K. F., 1976: Parameterization of Air-Sea Interface Fluxes of Sensible Heat and Moisture by the Bulk Aerodynamic Formulas.

KUBOTA, M., KANO, A., MURAMATSU, H., TOMITA, H., 2002: Intercomparison of Various Surface Latent Heat Flux Fields. Journal of Climate, 16, 670-678.

SERVAIN, J.; BUSALACCHI, A. J.; McPHADEN, M. J.; MOURA, A. D.; REVERDIN, G.; VIANNA, M.; ZEBIAK, S.E., 1998: A Pilot Research Moored Array in the Tropical Atlantic (PIRATA). The Bulletin of American Meteorological Society, 79, 2019–2031.