# Observational investigation of the radiation balance at the Brazilian Antarctic station - preliminary results

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## Introduction

Measuring the surface radiation balance components at the Antarctic region is important for diagnostic and prognostic studies of climate change and environmental monitoring.

This work is running within the framework of the "*Instituto Nacional de Ciência e Tecnologia - Antártico de Pesquisas Ambientais (INCT-APA)*". The data is part of the project ETA (*Estudo da Turbulência na Antártica*) and its visualization is available in real-time on www.iag.usp.br/meteo/labmicro/ (http://bit.ly/antartica-eta) and the raw data is available upon request.

The primary objective of this investigation is to characterize the seasonal and diurnal variations of the surface radiation balance components using *in situ* observations at the Comandante Ferraz Brazilian Antarctic Station (EACF) on King George Island (62º05'S, 58º23'W), as Fig. 1.

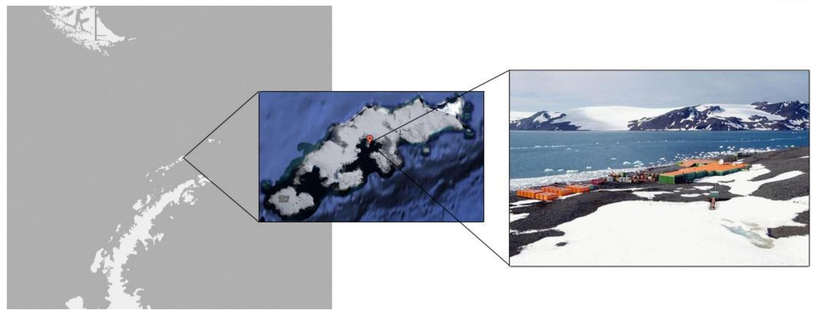

**Fig. 1:** Comandante Ferraz Brazilian Antarctic Station (EACF) on King George Island (62º05'S, 58º23'W).

## Instruments

| Instrument | Model | Measurement | Response time ($s^{-1}$) |
|---|---|---|---|
| Pyranometer (Kipp & Zonen) **Fig. 2** | CPM11 | SW↓ | < 5 |
| Pyrgeometer (Kipp & Zonen) **Fig. 3** | CGR3 | LW↓ | < 18 |
| Net radiometer (Kipp & Zonen) **Fig. 4** | CNR4 | SW↓, SW↑, LW↓, LW↑ | < 18 |

**Table 1**: Instruments used in the investigation. The data was obtained using the South Tower (Fig. 5) with a sampling rate of 0,05 Hz.

**Fig. 2**: Pyranometer CPM11.

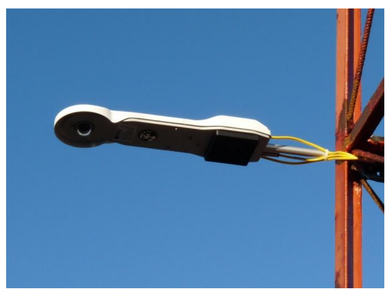

**Fig. 3**: Net radiometer CNR4.

**Fig. 5**: Southeast view of the 12 meter South Tower instrumented with radiation sensors.

**Fig. 4**: Pyrgeometer CGR3.

**Here, by convention, the radiation components are positive when in agreement with the vertical axis.**

## Data

| Jan | Fev | Mar | Abr |
|---|---|---|---|
| 18h28min | 15h39min | 12h40min | 9h40min |
| **Mai** | **Jun** | **Jul** | **Ago** |
| 6h55min | 5h16min | 6h06min | 8h37min |
| **Set** | **Out** | **Nov** | **Dez** |
| 11h31min | 14h33min | 17h34min | 19h33min |

**Table 3**: Daily average, in hours, of daylight per month in the EACF region.

| Parameter | Symbol | Source |
|---|---|---|
| Longwave emitted by the atmosphere | LW↓ **Fig. 6** | ETA |
| Longwave emitted by the surface | LW↑ **Fig. 7** | ETA |
| Incident shortwave | SW↓ **Fig. 8 e 9** | ETA / EACF |
| Reflected shortwave | SW↑ **Fig. 10** | ETA |
| Net radiation | Rn **Fig. 11** | ETA |

**Table 2**: Data and sources.

## Results

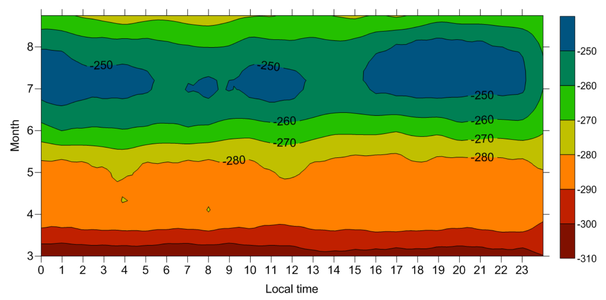


**Fig. 6**: Diurnal evolution of the monthly average hourly values of the LW↓. March-August of 2011. ETA Project.

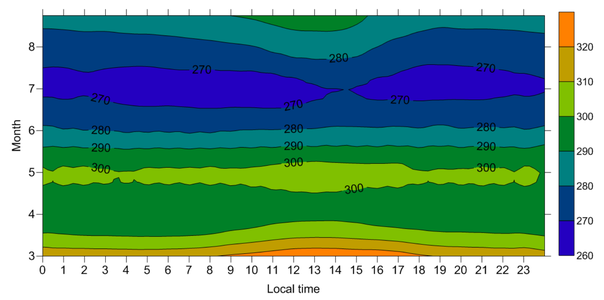


**Fig. 7**: Diurnal evolution of the monthly average hourly values of the LW ↑ . March-August of 2011. ETA Project. .

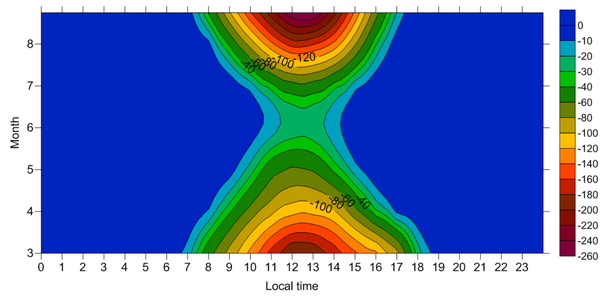


**Fig. 8:** Diurnal evolution of the monthly average hourly values of the SW↓. March-August of 2011. ETA Project .

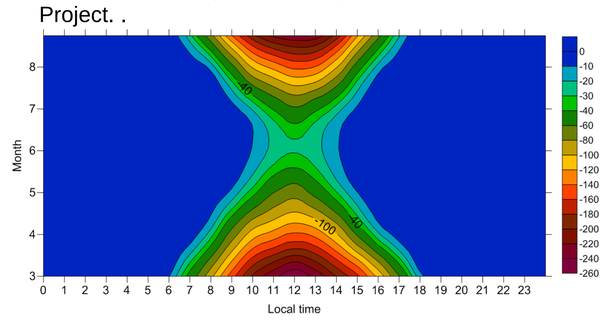


**Fig. 9:** Diurnal evolution of the monthly average values of the SW↓. March -August 1993-2009. Project Meteorologia na EACF (Setzer and Aquino, 2001 - antartica.cptec.inpe.br/ )

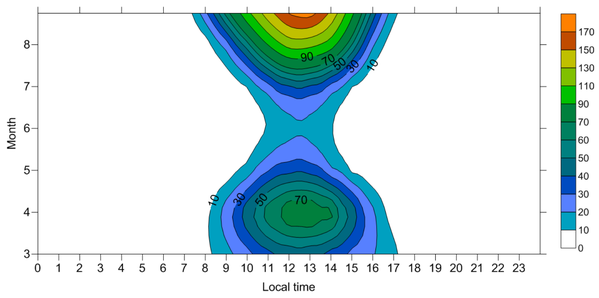


**Fig. 10:** Diurnal evolution of the monthly average hourly values of the SW ↑. March-August of 2011. ETA Project.

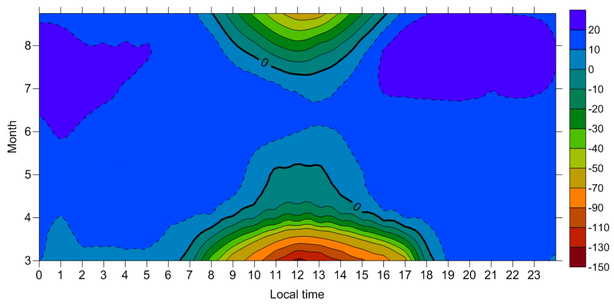


**Fig. 11**: Diurnal evolution of the monthly average hourly values of the net radiation . March-August of 2011. ETA Project .

## Future work

• Average values of atmospheric variables will be obtained, at three different height levels, using an instrumented 12-meter tower. Besides surface radiation components, precipitation, atmospheric pressure, soil temperature and soil heat flux will also be available. These measurements will provide the required information to estimate turbulent fluxes indirectly.

•Turbulence measurements will be carried out using 3-axis sonic anemometer and fast-response temperature, humidity and $CO_2$ sensors during short-duration campaigns, between November and February. The data collected will provide the information necessary to estimate the turbulent fluxes directly.

## Reference

• Setzer, A. e Aquino, F. E. 2001: Projeto CNPq/Proantar: Meteorologia na Estação Antártica Com. Ferraz, 2001-2003.

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