Seasonal evolution of the surface radiation balance components in the Antarctic region

IAG-USP

Caio Jorge Ruman and Jacyra Soares (Supervisor)

Instituto de Astronomia, Geofísica e Ciências Atmosféricas – IAG-USP

Departamento de Ciências Atmosféricas – Grupo de micrometeorologia

Introduction

The Antarctic region not only exports climate signs, affecting the global climate, but also imports the global climatic signs, suffering its consequences. The anthropogenic environmental impact is also present in the Antarctic, especially those from the South Hemisphere. The cold continent responds to these aggressions in a potentialized form.

The scientific research performed in the polar regions has had great value in the comprehension of the implications of the climate change (Setzer e Kayano, 2009).

Objectives

• The main goal of this work is to describe the temporal evolution of the radiation balance components on the Antarctic surface region with emphasis in the identification of the effects on climate changes.

Data

Table 1: Data and sources.

Parameters	Symbol	Source	Resolution
Long wave emitted by the atmosphere	LW↓	NASA	3 hours
Long wave emitted by the surface	LW↑	NASA	3 hours
Incident Short wave	SW↓	EACF NASA	1 hour 3 hours

The monthly average values of the SW↓ were estimated from daily values observed in the meteorological station situated in the "Estação Antártica Comandante Ferraz" (EACF), located at King's George Island, at Antarctic Peninsula (62°05'07" S, 58°23'33" W). These data were obtained by the project "Meteorologia na EACF" (http://www.cnpq.br/programas/inct/_apresentacao/inct_pesq_amb_antartica.html) funded by CNPq/PROANTAR.

The monthly average values of the LW↓ and LW↑ were calculated from estimated values of these variables every 3 hours by the SRB (Surface Radiation Budget, a project from NASA (http://gewex-srb.larc.nasa.gov). In both cases the observation corresponds to the period from 1993-2007. The radiation values are considered positive when in agreement with vertical axis.

Results

SW↓

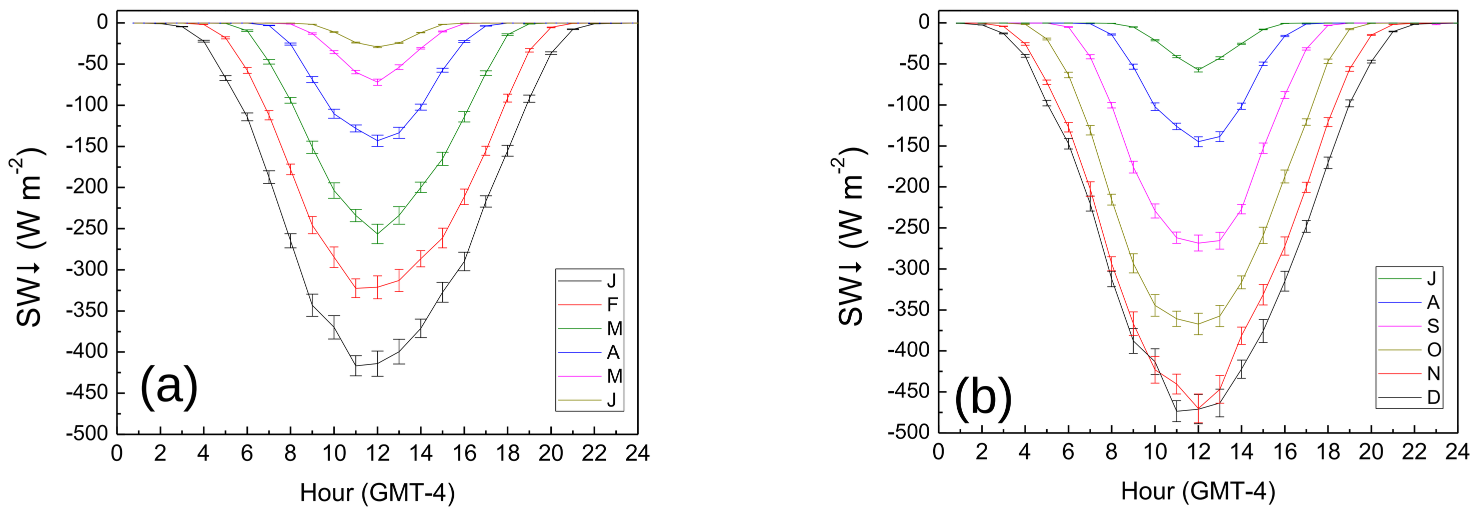

Fig. 1: Diurnal evolution of the monthly average hourly values of the SW↓
(a) January – June and (b) July – December. The vertical bars indicate the statistical error.

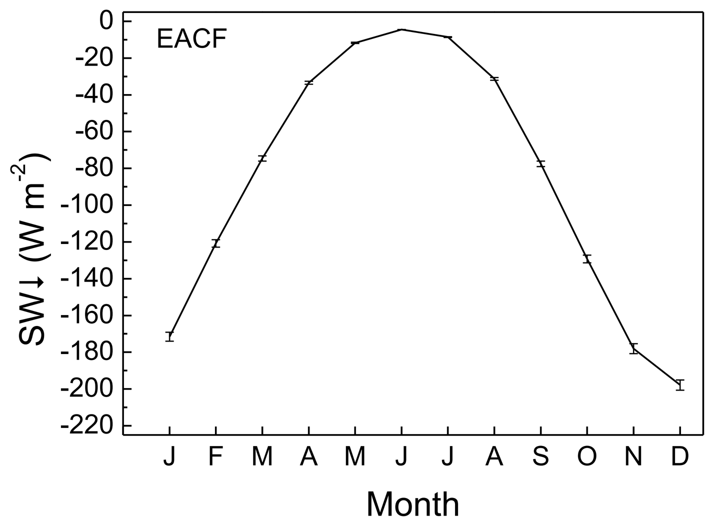

Fig. 2: Temporal variation of the average monthly values of the SW↓. The vertical bars indicate the statistical error.

LW↓

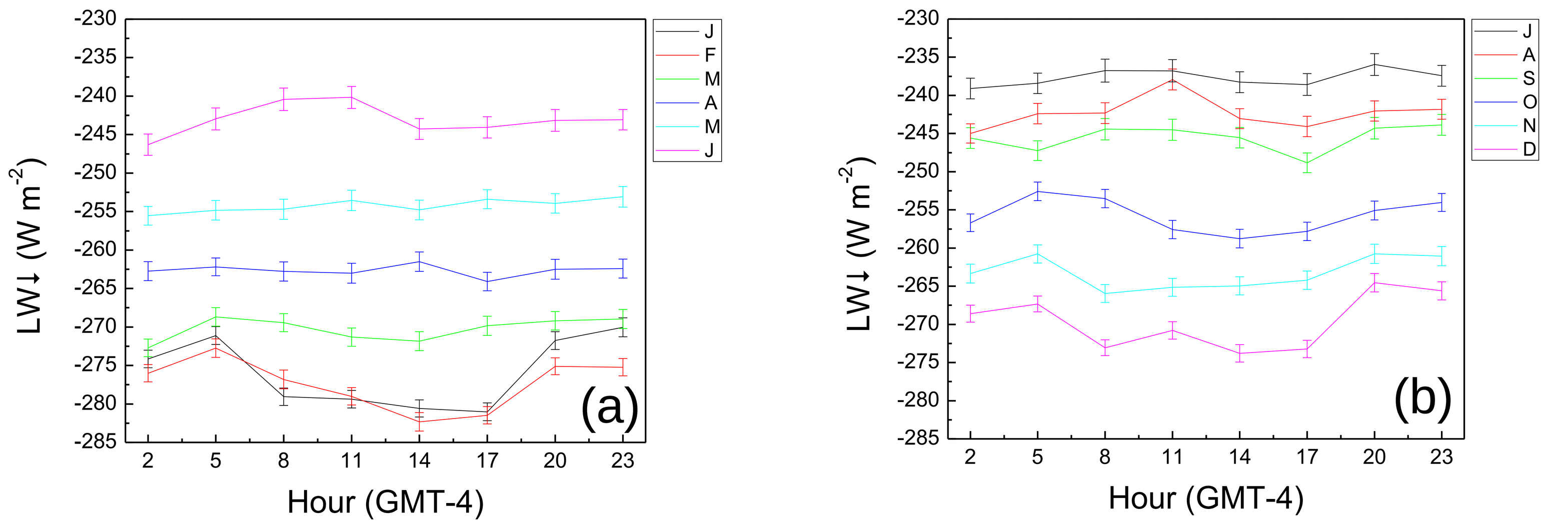

Fig. 3: Diurnal evolution of the monthly average hourly values of the LW↓
a) January – June; b) July – December. The vertical bars indicate the statistical error.

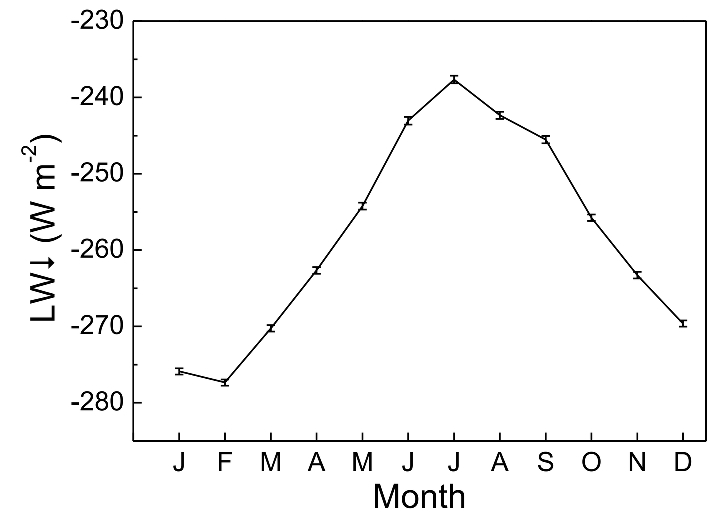

Fig. 4: Temporal variation of the average monthly values of the LW↓. The vertical bars indicate the statistical error.

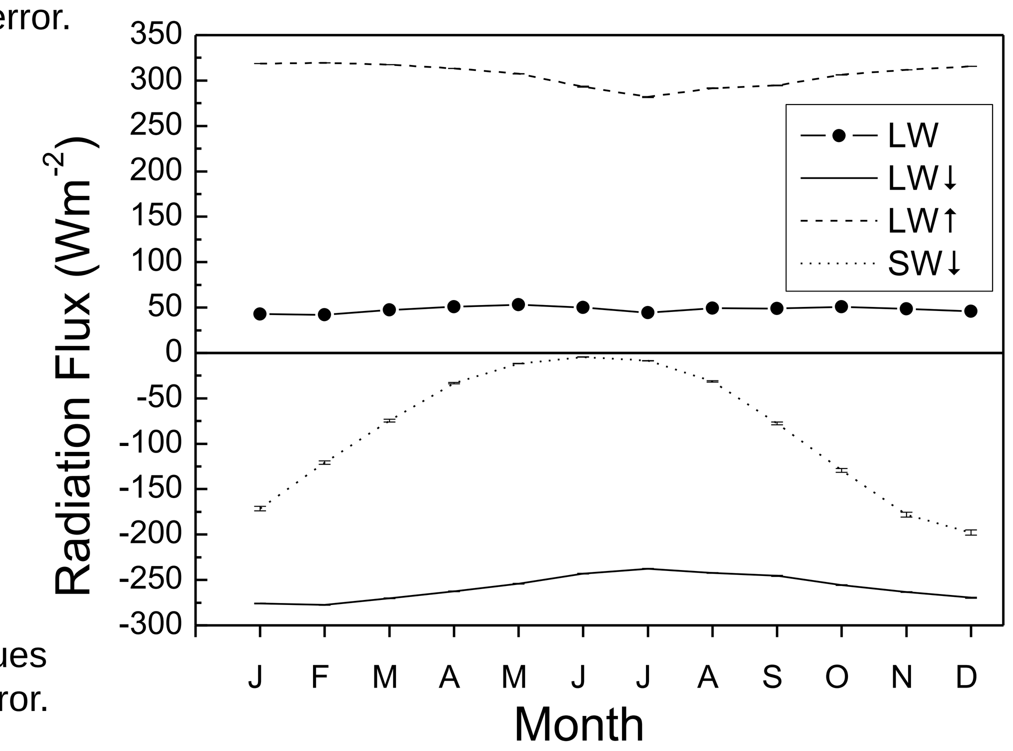

Fig. 7: Temporal variation of the average monthly values of LW ↑, LW↓, SW↓ and net value of LW. The vertical bars indicate the statistical error.

LW ↑

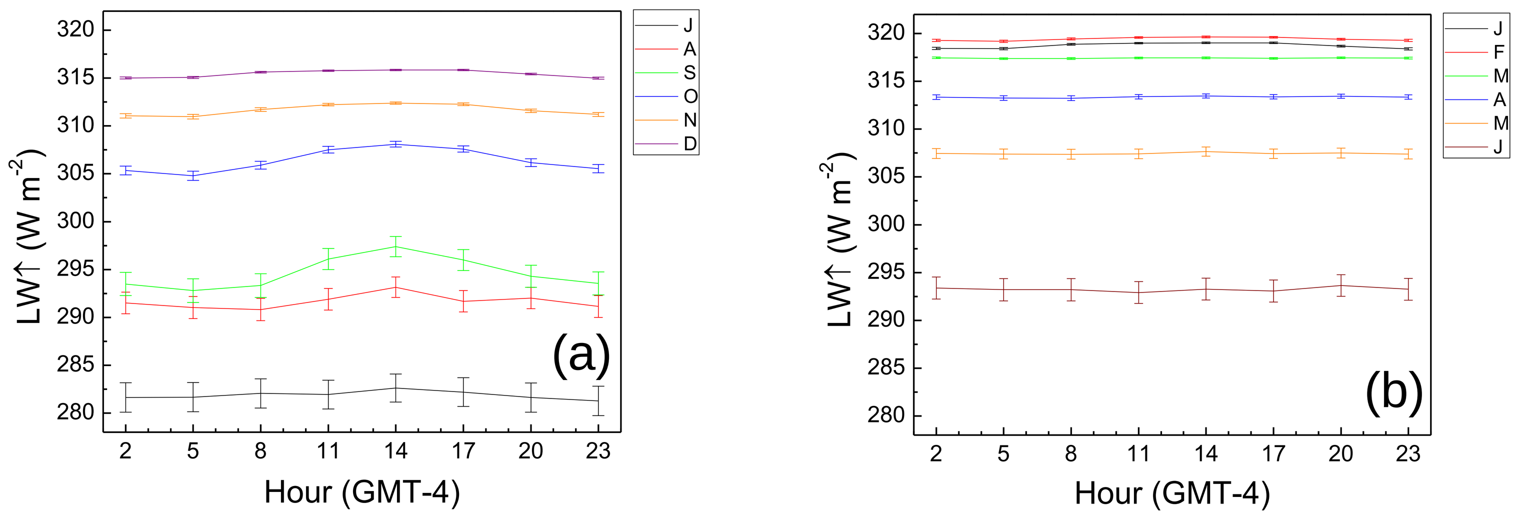

Fig. 5: Diurnal evolution of the monthly average hourly values of the LW ↑
(a) January – June and (b) July – December. The vertical bars indicate the statistical error.

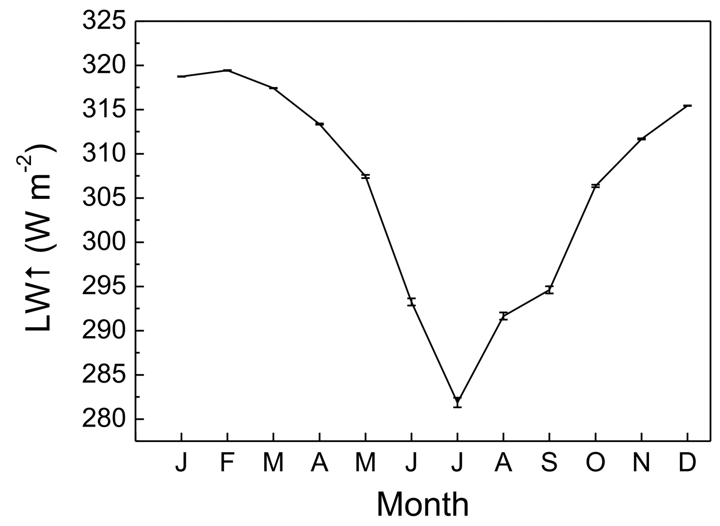

Fig. 6: Temporal variation of the average monthly values of the LW ↑. The vertical bars indicate the statistical error....

Conclusion

• As expected, the SW↓ is larger during noontime (Fig 1) and the seasonal variation presents larger values during summer time (Fig. 2).

•Analyzing the results, it was found that the SW↓ presents a larger variation (from -5 Wm^{-2} during winter time to -198 Wm^{-2} during summer time, Fig.2) than the longwave components LW↓ (from -238 Wm^{-2} to -277 Wm^{-2} , Fig.4) and LW↑ (from 282 Wm^{-2} to 319 Wm^{-2}, Fig.6) .

• There is little variation of the LW↓ (Fig.4) and LW↑ (Fig.6) during the year due to the small temperature variation (not shown here) in the studied region.

• Both LW↑ and LW↓ show a maximum in February (319 Wm^{-2} and -277 Wm^{-2}, respectively) and a minimum in July (282 Wm^{-2} and -238 Wm^{-2} , respectively).

•During the year, the net value of LW is approximately constant (~50 Wm^{-2} , as Fig. 7)

References

• Setzer, A. e M. Kayano, 2009: Limitações das reanálises para altas latitudes no Hemisfério Sul. Revista Brasileira de Meteorologia, 24 (3) 254-261, 2009.

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