COMPARATIVE ANALYSIS OF DIFFERENT SATELITE-BASED RAINFALL RETRIEVAL MODELS OVER SOUTH AMERICA

Éder Paulo Vendrasco1* ; Wagner Flauber de Araújo1 ; Daniel Alejandro Vila1,2

1CENTRO DE PREVISÃO DE TEMPO E ESTUDOS CLIMÁTICOS (CPTEC/INPE), Cachoeira Paulista, São Paulo/Brasil, 12630000. Email: eder.vendrasco@cptec.inpe.br
2COOPERATIVE INSTITUTE FOR CLIMATE AND SATELLITES - CICS/ESSIC/UMD, College Park, MD.

INTRODUCTION

The distribution and intensity of rainfall are some of the most important parameters in the earth energy balance. Much effort has been employed over the years in order to collect measurements of precipitation over land. However, the observation network is very heterogeneous, favoring some areas and leaving others virtually with no coverage. Within this context, satellite data can address this lack of information on clouds and precipitation. However, the accuracy of satellite precipitation estimates at high spatial and temporal resolutions is still limited, especially those using the infrared (IR) techniques, given the character's of indirect estimate. Thus, the objective of this study is to investigate the quality of these precipitation estimates over South America making a temporal and spatial analysis of those results.

DATA AND METHODOLOGY

Algorithms validated:

- 3B42RT [1], CMORPH [2], GSMAP [3] & HIDROESTIMADOR [4].

Ground truth used:

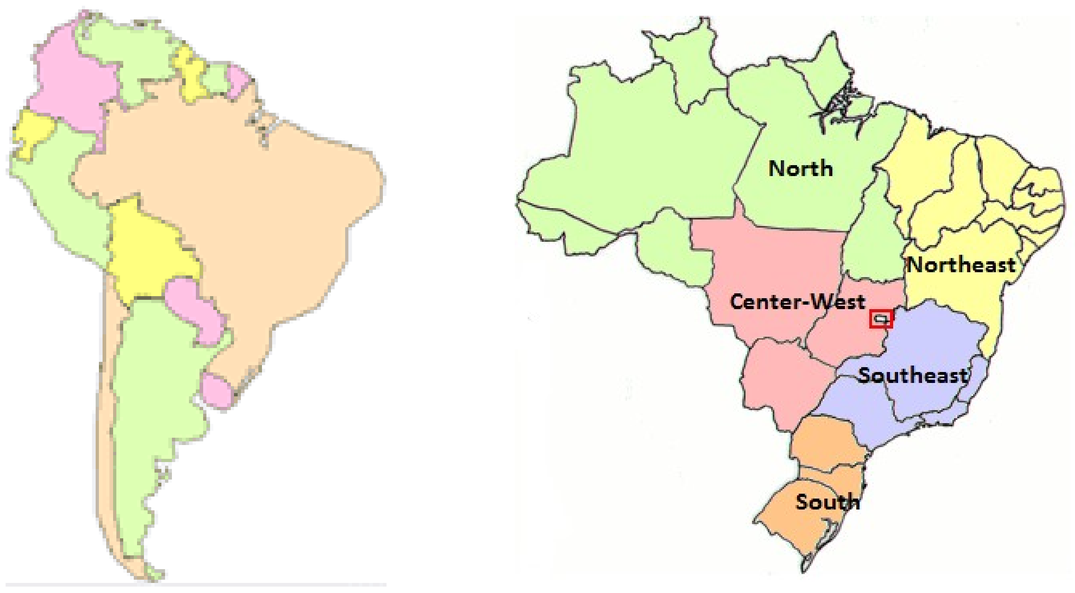
- Regional networks and synoptic stations reported regularly by the "Global Telecommunication System" (GTS),

Statistical Analysis Methodology

- False Alarm (FAR), Prob. of Detection (POD), Bias e Correlation.

Region and Period:

- South America and political regions of Brazil (see figure above);
- January 1st, 2009 - June 30th, 2012 – 1275 days.



RESULTS

Four satellite-based rainfall retrieval models have been validated. It was observed that all estimates perform better in the summer caused by the greater amount of convective events (Figure 1). In regions where convection is predominant, as the northern region, the models have less dispersion in the results, on the other hand, in regions with a greater variety of systems, such as the South and Southeast, the dispersion is quite pronounced, as can be seen Figures 2 and 3.

Figure 1. FAR, POD, BIAS and COR (from left to right) for South America. Upper panel: Box & Whisker plot of 25% (Q25), 75% (Q75), maximum, minimum values and outliers (1.5XQ15 and 1.5xQ75). Lower panel: Temporal series.

Figure 2. False Alarm for Brazil, Northern, Northeastern, Center-West, Southeastern e Southern regions. Box & Whisker plot of 25% (Q25), 75% (Q75), maximum, minimum values and outliers (1.5XQ15 and 1.5xQ75).

Figure 3. Idem Figure 2 for Probability of Detection.

CONCLUSIONS

- ✓ Overall, the best performance was in summer.
- ✓ The Northern region showed the best results, while the southern and southeastern regions showed high dispersion.
- ✓ GSMAP model proved to be very efficient and, in some cases, surpassing the 3B42RT.
- ✓ The Northeastern region, having a predominance of warm cloud systems, showed the worst results.
- ✓ The CMORPH tends to underestimate precipitation events while GSMAP tends to overestimate. However, GSMAP had other strengths, including low bias. CMORPH presented one of the highest correlations.

REFERENCES

[1] Huffman, G.J. et al., 2003: Analysis of TRMM 3-Hourly Multi-Satellite Precipitation Estimates Computed in Both Real and Post-Real Time. Combined Preprints CD, 83rd AMS Annual Meeting, Poster P4.11 in: 12th Conf. on Sat. Meteor. and Ocean., 9-13 Feb, Long Beach, CA, 6pp, 2003
[2] Joyce J., et al., 2004: CMORPH:A Method that Produces Global Precipitation Estimates from Passive Microwave and Infrared Data at High Spatial and Temporal Resolution. J.Hydrom.,5,487– 503.
[3] K. Aonashi, J. Awaka, M. Hirose, T. Kozu, T. Kubota, G. Liu, S. Shige, S. Kida, S. Seto, N. Takahashi, and Y. N. Takayabu, 2009: GSMaP passive, microwave precipitation retrieval algorithm: Algorithm description and validation. J. Meteor. Soc. Japan, 87A, 119-136.
[4] Vicente, G. A.: The operational GOES infrared rainfall estimation technique. Bulletin of the American Meteorological Society, 79(9), 1883-1898, 1998.

The authors acknowledge Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPQ) for financial assistance (Process nº 476599/2010-5).