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# Non-Linear Weather Time Series Explain Why The Drought Period Length 2011 At Coast North NEB and Semi-Arid Region NEB are Different?

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## INTRODUCTION

The NEB region has rainy season depending on NINO/NINA (interannual), Madden-Julian Oscillation (intraseasonal) and others weather systems (e.g. ITCZ[seasonal]). These weather factors are forced by sea temperature surface (SST), sea level pressure (SLP), long wave radiation (LWR) relative humidity (RUMI) and others variables [1, 2] with termodinamyc process dominant.

## GOAL

The motivation for this research was based on the need to identify drought period length triggers in time series of weather variables within the NEB rainy season without using supercompaction. In this context, The goal of this work is to propose a new mathematical alternative method for forecasting dry spells when they coincide with drought period length.

## DATA AND METHODS

Data set websites *(ftp://ftp.cdc.noaa.gov/Datasets/cpc_global_precip/);
+ ▪(www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis.surface.html);
•(https://www.esrl.noaa.gov/psd/). Accessed at Oct./1th/2020.

Time series rainfall daily (PREC) was obtained by GPCP* data base 0.5 degree resolution at average area as box 2S-9S, 45W-30W (**Fig. 1**). To SST [0.25º r.]+ and SLP▪ [2.5º r.] was applied at average NINO 3.4 region 5N–5S, 120–170W and same of PREC. Tropical North Atlantic SST averaged over the domain of 6–22N and 80–15W, and South Atlantic SST averaged over the domain of 25S–2N and 35W–10E. RUMI ▪ [2.5º r.] area between 40-20W, 15S-1S (2d). LWR • anomaly *Hovmoller* diagram [1º r.] 5N-5S, 20E-120W in 20-70 days dec./2011 to feb./2012 (2e). The

Method [3] adapted [SOUSA, NV. 2019.] for NEB (**Fig. 2**):

DPL(t) = min { Q : Anom d (t+ Q}year i ≥ 0, Q [0, ∞)}

ΔSPL (SST/RUMI/PREC)=SPL (t+1) – SPL(t)

SLP will be increase of phase if ΔSPL is +, but the opposite is the same with with signal different. To quantify the changes in "spatial difference" was use These equations:

$$r_D^M = \frac{\#\{\Delta SLP>0\}}{\#DPL_{ATOT(t)}\geq threshold}.$$

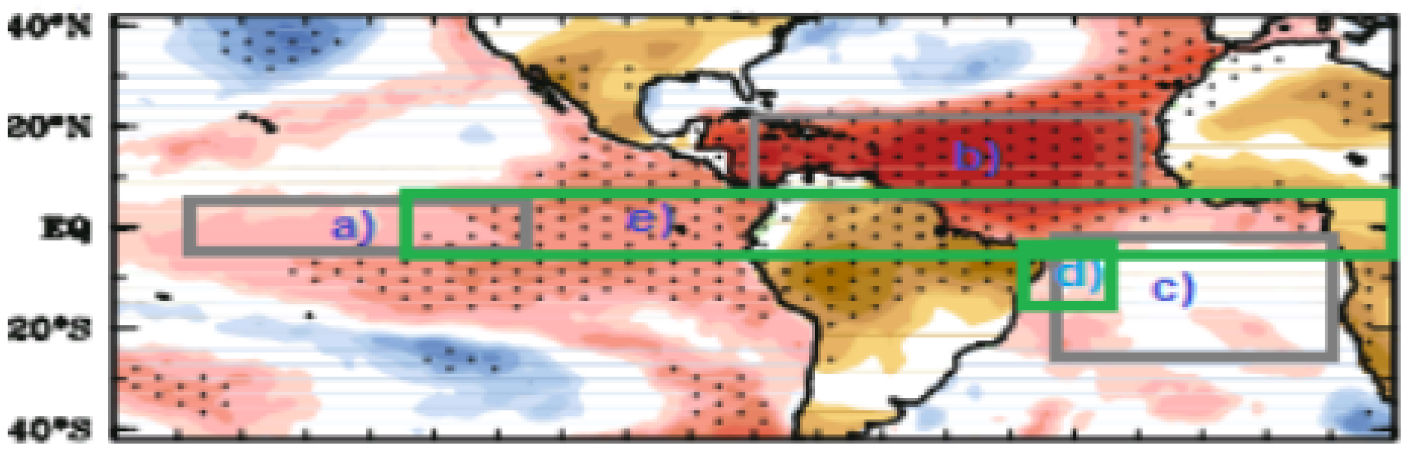
$r_D = \sum r_D^M \frac{1}{4}$ (average Feb, Mar, Apr. and May). If $r_D^M = 0$ and dry spell wasn´t identified,

$$r_S^M = \frac{\#\{\Delta SLP>0\}}{\#DPL_{ATOT(t)}\geq threshold}.$$

$r_S = \sum r_S^M \frac{1}{4}$ positive anomalies during southern fall.

## RESULTS AND DISCUSSIONS

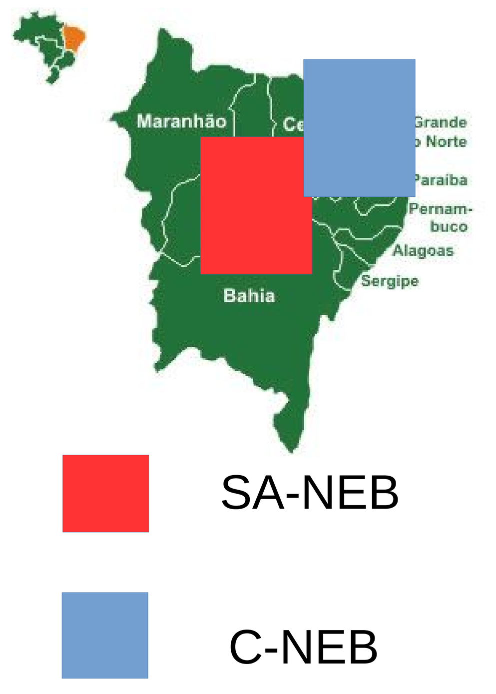
Figure 1 – Map domain




[SOUSA, NV, 2019]
Power-law
Semi-log distribution

[a, b, c) SLP Pacific NINO3.4 and SST North/South Atlantic-Trop. Oceans; d) RUMI; e) LWR.

Figure 2 – NEB region




**2011 – Original space $r_s$**

| | DPL* | SLP1 | SLP2 | n-Atl | s-Atl | RHUM |
|---|---|---|---|---|---|---|
| SA-NEB | 05 | 0.31 | 0.43 | 0.20 | 0.33 | 0.25 |
| C-NEB | 08 | 0.41 | 0.33 | 0.18 | 0.27 | 0.28 |

**2011 – Differenced space $r_D$**

| | DPL* | SLP1 | SLP2 | n-Atl | s-Atl | RHUM |
|---|---|---|---|---|---|---|
| SA-NEB | 05 | 0.18 | 0.21 | 0.11 | 0.65 | 0.71 |
| C-NEB | 08 | 0.12 | 0.19 | 0.22 | 0.31 | 0.42 |

**2011 – Original space $r_s$ M**

| | DPL* | SLP1 | SLP2 | n-Atl | s-Atl | RHUM |
|---|---|---|---|---|---|---|
| SA-NEB | 05 | 0.22 | 0.18 | 0.31 | 0.12 | 0.21 |
| C-NEB | 08 | 0.11 | 0.12 | 0.25 | 0.17 | 0.10 |

**Original space $r_D$ M**

| | DPL* | SLP1 | SLP2 | n-Atl | s-Atl | RHUM |
|---|---|---|---|---|---|---|
| SA-NEB | 05 | 0.18 | 0.24 | 0.19 | 0.11 | 0.23 |
| C-NEB | 08 | 0.12 | 0.21 | 0.14 | 0.23 | 0.19 |

## CONCLUSIONS

Considering SLP-NINO3.4 and s-atlantic was possible to find excellent correlations distribution to triggers to DPL 5 and 8 days for both NEB regions.

When the ,etohd was applied to average monthly (parts 3th and 4th on the table) the perception of triggers was decreasead in this time step, nowhever was also to figure out a solution when it considers a climatology data base, i.e., 30 years of date with daily time step.

To weather variable LOR (to characterize Maden-Julian oscilation) was not possible to obtain conclusions. But it will be investigate with more deeply on the method.

The method has been results successfully even though with unique one year of data base considering daily time step.

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