



## Database of oceanographic anomalies and atmospheric surface fluxes for the study of climate change in the Brazilian Northeast.

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### ABSTRACT

This paper presents three datasets of anomalies of oceanic physical parameters and surface atmospheric fluxes in the northeast region of Brazil, geographically limited by 42.5°W - 29.75°W / 20.5°S - 1.25°N, calculated from the SODA, TROPFLUX and GPCP datasets. The DASAF-BNE (Daily Anomalies of the Surface Atmospheric Fluxes of the Brazilian Northeast), DRA-BNE (Daily Rainfall Anomalies in the Brazilian Northeast), and MAOP-BNE (Monthly Anomalies of Oceanographic Parameters in the Brazilian Northeast) datasets are generated with 0.25° resolution bilinearly interpolating the original datasets. This database includes four files in NetCDF format, which facilitates its handling due to the diversity of freeware tools that exist, DASAF-BNE and DRA-BNE have a daily frequency, while MAOP-BNE has a monthly frequency. This database is mainly intended to research climate changes in the Brazilian Northeast.

**Keywords:** SODA; TROPFLUX; GPCP; Anomalies; Brazilian Northeast.

### DATA IMPORTANCE

- This dataset is made up of multiple NetCDF files, making it easy to share, is extremely easy to use, and does not require any prior processing.
- The data presented here cover physical parameter anomalies in the northeastern region of Brazil and may be useful to any researcher who may need these data for further analysis or to interpret physical patterns or processes.
- These data are relevant for studies of climate changes in the northeastern region of Brazil and can be reused for statistical studies of coastal and oceanic climate variations.

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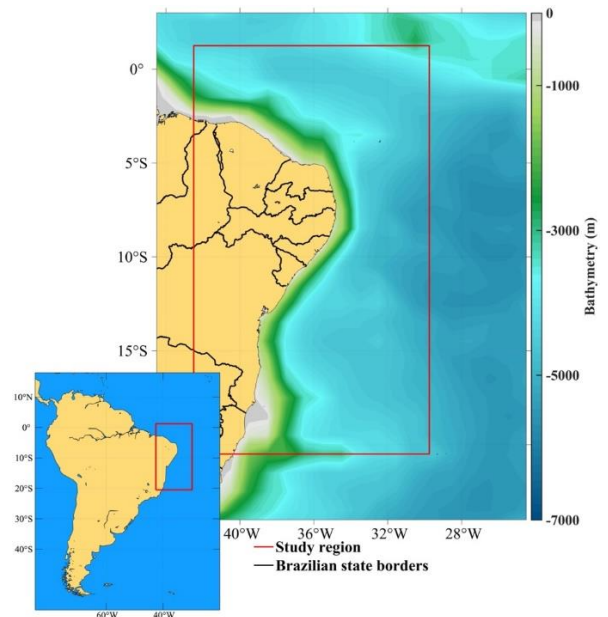
## MATERIALS AND METHODS

This dataset presents the anomalies of ocean physical parameters and surface atmospheric fluxes obtained from the SODA (Simple Ocean Data Assimilation, CARTON; GIESE, 2008), GPCP (Global Precipitation Climatology Project, ADLER et al., 2003), and TROPFLUX datasets (Air-Sea Fluxes for the Global Tropical Oceans, KUMAR et al., 2011). The anomalies of all the parameters of these three datasets were calculated and reduced to the limits  $42.5^{\circ}\text{W} - 29.75^{\circ}\text{W} / 20.5^{\circ}\text{S} - 1.25^{\circ}\text{N}$  (Fig. 1), which corresponds to the northeastern region of Brazil. All files in these three datasets are in standard NetCDF format. The time reference of these datasets was standardized with the same time offset (days since 1900-1-1 00:00:00) and for all parameters, the missing data is represented by NaN (Not a Number), in the metadata of each parameter `_FillValue` and `missing_value` are assigned to NaN.

All files were created with the Matlab script `set mNC` of Varona (2021a) after being bilinearly interpolated to  $0.25^{\circ}$  resolution with the Matlab function `griddata`. Using the Matlab script `CalcPlotAnomaly` (VARONA, 2021b) the anomaly calculations were performed. The freeware programs `ncview` (visual browser for netCDF, PIERCE, 2016), `ncdump` (Unidata's Utility for viewing the NetCDF file structure), `nco` (netCDF operators, ZENDER, 2008) and `CDO` (Climate Data Operator, SCHULZWEIDA, 2006) were used for pre-and post-processing (metadata creation) of all datasets.

Table 1 shows the characteristics of the original and created datasets: DASAF-BNE (Daily Anomalies of the Surface Atmospheric Fluxes of the Brazilian Northeast), DRA-BNE (Daily Rainfall Anomalies in the Brazilian Northeast), and MAOP-BNE (Monthly Anomalies of Oceanographic Parameters in the Brazilian Northeast), as well as, the names of the files corresponding to each of these datasets. The time period, frequency and resolution of the data are also shown.

**Figure 1.** Geographical location of the datasets presented in this datapaper ( $42.5^{\circ}\text{W} - 29.75^{\circ}\text{W} / 20.5^{\circ}\text{S} - 1.25^{\circ}\text{N}$ ), the bathymetry of the region and the study region.



## DATA DESCRIPTION

The dataset presented here are 4 files in NetCDF format, these files contain the physical parameter anomalies calculated from the SODA, TROPFLUX and GPCP datasets. The NetCDF files are self-descriptive, so by reading the metadata in the structure of each file you can know the names of the parameters, their description, unit of measurement, as well as the time offset value and the missing data value.

### Dataset

The file `anom_TROPFLUX_NE_CIMARII.nc` (DASAF-BNE dataset) encompass the surface atmospheric flux anomalies calculated from the daily mean values of the parameters of the TROPFLUX dataset. In the DRA-BNE dataset, there is a single file named `anom_Precip_NE_CIMARII.nc` which contains the anomalies of the mean values of the precipitation accumulated in one day. The MAOP-BNE dataset consists of two files, `anom_uvSODA_NE_CIMARII.nc` contains the anomalies of the zonal and meridional

components and the current velocity modulus, as well as the zonal and meridional components of the wind stress, the second file, named `anom_oSODA_NE_CIMARII.nc` contains the anomalies of the remaining parameters from the SODA dataset, including the vertical velocity of the currents.

The reason the MAOP-BNE dataset is divided into two files is that the horizontal components of ocean currents and wind stress have a different coordinate system (longitude and latitude) than the rest of the parameters. Table 2 shows the short name of each parameter, the standard name, and the units of measurement, as well as, the grid types for each of the anomaly datasets

presented here. The grid-type defines the location of each data in the structure of each parameter, 4D type grids are organized similarly to 3D type grids, but in addition to horizontal coordinates and time (lon, lat, time) they also depend on depth (lon, lat, depth, time), lon and lat are the longitudes and latitudes respectively where each data is geographically located. The parameter `wt` (vertical velocity of the currents), has a different vertical coordinate system than the rest of the parameters, depending on `wt(lat, lon, vdepth, time)`, where `vdepth` is the vertical coordinate for `wt` and `depth` is the vertical coordinate for the rest of the parameters.

**Table 1.** Characteristics of each dataset created: DASAF-BNE (Daily Anomalies of the Surface Atmospheric Fluxes of the Brazilian Northeast), DRA-BNE (Daily Rainfall Anomalies in the Brazilian Northeast), and MAOP-BNE (Monthly Anomalies of Oceanographic Parameters in the Brazilian Northeast).

Datasource	Final dataset	Time range	Frequency	Original resolution	Final resolution	Filename
TROPFLUX (KUMAR et al., 2011)	DASAF BNE	From Jan/1979 to Dec/2017	Daily	1°	0.25°	<code>anom_TROPFLUX_NE_CIMARII.nc</code>
GPCP (ADLER et al., 2003)	DRA BNE	From Oct/1996 to Dec/2020	Daily	1°	0.25°	<code>anom_Precip_NE_CIMARII.nc</code>
SODA (CARTON and GIESE, 2008)	MAOP BNE	From Jan/1980 to Dec/2017	Monthly	0.5	0.25	<code>anom_oSODA_NE_CIMARII.nc</code> <code>anom_uvSODA_NE_CIMARII.nc</code>

## SUPPLEMENTARY MATERIALS

Data deposited in recognized open repositories

Monthly Anomalies of Oceanographic Parameters in the Brazilian Northeast (MAOP-BNE).

Repository name: Zenodo

DOI of the dataset: <https://doi.org/10.5281/zenodo.5559266>

Link to access the data: <https://zenodo.org/record/5559266>

Daily Rainfall Anomalies in the Brazilian Northeast (DRA-BNE).

Repository name: Zenodo

DOI of the dataset: <https://doi.org/10.5281/zenodo.5813779>

Link to access the data: <https://zenodo.org/record/5813779>

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Daily Anomalies of the Surface Atmospheric Fluxes in the Brazilian Northeast (DASAF-BNE).

Repository name: Zenodo

DOI of the dataset: <https://doi.org/10.5281/zenodo.5559230>

Link to access the data: <https://zenodo.org/record/5559230>

**Table 2.** Description of parameters of the DASAF-BNE (Daily Anomalies of the Surface Atmospheric Fluxes of the Brazilian Northeast), DRA-BNE (Daily Rainfall Anomalies in the Brazilian Northeast), and MAOP-BNE (Monthly Anomalies of Oceanographic Parameters in the Brazilian Northeast) datasets.

Parameter name	Description	Unit	Grid type	Dataset
lhf	Latent heat flux	W m <sup>-2</sup>	3D	DASAF-BNE
lwr	Net surface longwave radiation	W m <sup>-2</sup>	3D	DASAF-BNE
netflux	Net surface heatflux	W m <sup>-2</sup>	3D	DASAF-BNE
q2m	Specific humidity at 2msensible heat flux	g kg <sup>-1</sup>	3D	DASAF-BNE
shf	Sensible heat flux	W m <sup>-2</sup>	3D	DASAF-BNE
sst	Sea surface temperature	°C	3D	DASAF-BNE
swr	Short wave radiation	W m <sup>-2</sup>	3D	DASAF-BNE
t2m	Air temperature at 2 m	°C	3D	DASAF-BNE
tau	Wind stress magnitude	N m <sup>-2</sup>	3D	DASAF-BNE
taux	Zonal wind stress	N m <sup>-2</sup>	3D	DASAF-BNE
tauy	Meridional wind stress	N m <sup>-2</sup>	3D	DASAF-BNE
ws	Wind speed at 10m	m s <sup>-1</sup>	3D	DASAF-BNE
precip	Daily precipitation rate	mm day <sup>-1</sup>	3D	DRA-BNE
temp	Sea water potential temperature	°C	4D	MAOP-BNE
salt	Sea water salinity	psu	4D	MAOP-BNE
ssh	Sea surface height above geoid	m	3D	MAOP-BNE
mlt	Mixed layer depth determined by temperature criteria	m	3D	MAOP-BNE
mlp	Depth of potential density mixed layer	m	3D	MAOP-BNE
mls	Mixed layer depth determined by salinity criteria	m	3D	MAOP-BNE
net_heating	Surface ocean heat flux coming through coupler and mass transfer	W m <sup>-2</sup>	3D	MAOP-BNE
prho	Potential density referenced to 0 dbar	Kg m <sup>-3</sup>	4D	MAOP-BNE
u	Seawater zonal velocity	m s <sup>-1</sup>	4D	MAOP-BNE
v	Seawater meridional velocity	m s <sup>-1</sup>	4D	MAOP-BNE
current_speed	Seawater velocity	m s <sup>-1</sup>	4D	MAOP-BNE
wt	Vertical current velocity	m s <sup>-1</sup>	4D	MAOP-BNE
tauy	Surface downward meridional stress	N m <sup>-2</sup>	3D	MAOP-BNE
taux	Surface downward zonal stress	N m <sup>-2</sup>	3D	MAOP-BNE

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