Monthly Anomaly Database of Atmospheric and Oceanic Parameters in the Tropical Atlantic Ocean

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Abstract :

The Tropical Atlantic Ocean Database and Monthly Anomalies of River Discharge on Atlantic Ocean datasets encompass the monthly anomalies of a variety of physical, biogeochemical parameters from the tropical Atlantic Ocean and the monthly anomalies of river runoff in the Atlantic Ocean and its adjacent seas. The parameters used as the base for the computation of anomalies come from the TROPFLUX, GPCP, ASCAT, SODA, GODAS, DASK, SeaWIFS, OAFUX, WAVEWATCH III, NOAA/ESRL 20th Century Reanalysis, GLOBAL_REANALYSIS_BIO_001_029, GLOBAL_REANALYSIS_BIO_001_033, OCEANCOLOUR_GLO_OPTICS_L4_REP_OBSERVATIONS_009_081, OSCAR, SMOS, MODIS-Aqua, CO2_Flux, and GRDC datasets. Several of the anomaly data are redundant, but come from different data sources making comparative studies possible. For ease of use, both datasets are provided in NetCDF format, CF convention. These datasets include 18 files in NetCDF format, which facilitates its handling due to the diversity of freeware tools that exist and are structured in two-, three- and four-dimensional grids. All these anomalies can be useful to oceanographers, meteorologists, ecologists and other researchers for studies of climate variation in the tropical Atlantic Ocean. These datasets are hosted at https://www.seanoe.org/data/00718/82962/ and https://data.mendeley.com/datasets/pn5b35vn6s/1.

Keywords : MARDAO dataset, TAAD dataset, Anomaly, Tropical Atlantic, Climate
### Specifications table

| Subject                                  | Oceanography, Atmospheric Sciences |
|------------------------------------------|-----------------------------------|
| **Subject**                              | Oceanography, Atmospheric Sciences |
| **Specific subject area**                | Physical, chemical and biological oceanography. Atmospheric surface fluxes. |
| **Type of data**                         | River stations (Time series, 1807–2021 monthly period). Tri-dimensional and fourth-dimensional grids (1947–2019 monthly period). |
| **How the data were acquired**           | The data were obtained through the computation of anomalies from the existing datasets: |
|                                          | TROPFLUX (Air-Sea Fluxes for the Global Tropical Oceans) |
|                                          | GPCP (Global Precipitation Climatology Project) |
|                                          | ASCAT (Advanced Scatterometer) |
|                                          | WAVEWATCH3 model |
|                                          | SODA (Simple Ocean Data Assimilation) |
|                                          | GODAS (Global Ocean Data Assimilation System) |
|                                          | DASK (Data Assimilation System of KIOST (Korea Institute of Ocean Science and Technology)) |
|                                          | SeaWiFS (Sea-viewing Wide Field-of-view Sensor) |
|                                          | OAFLUX (Objectively Analyzed air-sea Heat Fluxes) |
|                                          | NOAA/ESRL 20th Century Reanalysis (NOAA-CIRES-DOE 20th Century Reanalysis) |
|                                          | GLOBAL_REALANALYSIS_BIO_001_029 (Copernicus Marine Service) |
|                                          | GLOBAL_REALANALYSIS_BIO_001_033 (Copernicus Marine Service) |
|                                          | OCEANCOLOUR_GLO_OPTICS_L4_REP_OBSERVATIONS_009_081 (Copernicus Marine Service) |
|                                          | OSCAR (Ocean Surface Current Analysis in Real-time) |
|                                          | SMOS (Soil Moisture and Ocean Salinity) |
|                                          | MODIS-Aqua (Moderate Resolution Imaging Spectroradiometer) |
|                                          | CO2 Flux (Optimized air-sea CO2 flux for the Global Ocean) |
|                                          | GRDC (Global Runoff Data Centre from Bundesanstalt für Gewässerkunde) |
| **Data format**                          | NetCDF embedding metadata |
| **Parameters for data collection**       | All the parameters were obtained through time series with frequency of monthly means and distributed geospatially in two-dimensional and three-dimensional grids. |
| **Description of data collection**       | The original datasets were downloaded directly from the official websites |
| **Data source location**                 | Runoff river stations at Atlantic Ocean is limited by 113°W – 44°E/51°S – 70°N and grids at Tropical Atlantic Ocean is limited by 65°W – 20°E/30°S – 30°N. |
| Data accessibility |
|--------------------|
| The collection of NetCDF files is published at the following address: |
| Title: Tropical Atlantic Anomaly Database (TAAD). |
| Repository name: SEANOE |
| Data identification number: 10.17882/82962 |
| Direct URL to data: https://www.seanoe.org/data/0C718/82962/ |
| And |
| Title: MARDAO: Monthly Anomalies of River Discharge on Atlantic Ocean. |
| Repository name: Mendeley Data |
| Data identification number: 10.17632/pn5b35vn6s/1 |
| Direct URL to data: https://data.mendeley.com/datasets/pn5b35vn6s/1 |
| Tools for the creation of NetCDF files and for the calculation of anomalies: |
| Title: mNC: A tool for Oceanographers and Meteorologists to easily create their NetCDF files using Matlab. |
| Repository name: Zenodo |
| Data identification number: 10.5281/zenodo.5572749 |
| Direct URL to data: https://zenodo.org/record/5572749 |
| And |
| Title: CalcPlotAnomaly: Matlab function set for the calculation and plotting of anomalies. |
| Repository name: Zenodo |
| Data identification number: 10.5281/zenodo.5576889 |
| Direct URL to data: https://zenodo.org/record/5576889 |

**Value of the data**

- The main objective of this work was to gather a series of products offering a reliable representation of past reality in the tropical Atlantic. Either by choosing gridded products based directly in-situ and satellite observations, or by choosing products based on numerical simulations and modelling approaches, constrained to realism by data assimilation (the so-called reanalysis) or other technics. The data presented here encompass the monthly anomalies of physical, chemical and biological parameters in the tropical Atlantic Ocean. This dataset can be useful for any researcher that may need these data for further analyses or interpreting physical, biogeochemical or biological patterns or processes of oceanographic and atmospheric parameters in the tropical Atlantic Ocean. It is relevant to study changes in ocean climate through statistical studies. It can also be used as a reference when compared to fully simulated representations of ocean and atmospheric dynamics during the past decades, like the
IPPC and CMIP6 coupled simulations. It can also be used for visualization for official uses, decision-makers, general public, education and outreach activities.

- This dataset is made up of multiple NetCDF files using the CF convention, sharing similar time coordinates, making it easy to share. It is extremely easy to use and does not require any prior processing.

**Data description**

These datasets present runoff anomalies at stations on all rivers discharging freshwater into the Atlantic Ocean and adjacent seas (MARDAO dataset) and anomalies of surface fluxes and physical, chemical and biological parameters at different ocean depths in the Tropical Atlantic Ocean (TAAD dataset), this last dataset was created in order to support the published article [1]. Figure 1 shows the geographical boundaries of each dataset, the position of all river runoff stations. In the TAAD dataset there are redundant parameter anomalies (e.g., water temperature, salinity, ocean currents, winds, chlorophyll concentration, etc.), this is to facilitate researchers to make comparative studies of monthly climatic variations, the points WPP, SPP, CHLP, CURP and WINP will be used to show such comparisons (Figure 1, Table 1).

![Geographical location of the MARDAO and TAAD dataset regions.](image_url)

*Figure 1. Geographical location of the MARDAO and TAAD dataset regions. Geographical location of WPP (Warm Pool Point), SPP (Salty Pool Point), CHLP (Chlorophyll Concentration Point), CURP (Surface Currents Point) and WINP (Surface Winds Point), and river stations.*
Table 1. Geographical locations of the MARDAO and TAAD regions and the coordinates of the WPP, SPP, CHLP, CURP and WINP points.

| Description                  | Name of the region or point | Geographical location                           |
|------------------------------|-----------------------------|-------------------------------------------------|
| MARDAO region                | -                           | 112.5°W – 43.5°E/50.5°S – 69.5°N                |
| TAAD region                  | -                           | 65°W - 20°E/30°S – 30°N                         |
| Warm Pool region             | Northeastern Brazil         | 44.25°W - 31.25°W/11.25°S - 1.25°S              |
| Salty Pool region            | Northeast and Southeast Brazil | 40.25°W - 26.25°W/22.25°S - 12.25°S             |
| Warm Pool Point              | WPP                         | 32.4°W, 9.25°S                                 |
| Salty Pool Point             | SPP                         | 28.25°W, 17.25°S                               |
| Chlorophyll Concentration Point | CHLP                      | 50.75°W, 6.1°N                                 |
| Current Speed Point          | CURP                        | 39°W, 7.5°N                                   |
| Wind Speed point             | WINP                        | 33.5°W, 7.5°N                                  |

All anomaly data files are in NetCDF format, CF convention, the Monthly Anomalies of River Discharge on Atlantic Ocean dataset (MARDAO) contains only one anomaly data file (located in the https://seanoe.org/ repository), while the Tropical Atlantic Anomaly Database (TAAD) contains 14 zip files (Located in the repository https://data.mendeley.com/), which contain 20 files in NetCDF format, the 87798.zip file contains 2 NetCDF files because the anomalies of the marine current components are separated from the rest. Table 2 shows the details of the original datasets used to calculate the monthly anomalies, such as the center that produces it, the periods, the spatial resolution of each grid and the filename that each file has in the repository.

Table 2. Original dataset from which the monthly anomalies were calculated. ESSO/INCOIS - Indian National Centre for Ocean Information Services. ECMWF - European Centre for Medium-Range Weather Forecasts. PSL - Physical Sciences Laboratory. DASK - Data Assimilation System of KIOST (Korea Institute of Ocean Science & Technology). OCO - NOAA Office of Climate Observations. CCDD - Climate Change Data and Detection. CMEMS - Copernicus Marine Environment Monitoring Service. NIES - National Institute for Environmental Studies. ESR - Earth & Space Research. ESRL - Earth System Research Laboratories. BfG - Bundesanstalt für Gewässerkunde. * Means that it contains two netcdf files.

| Original dataset source | Producer center | Reference | Time period            | Frequency | Spatial resolution | Filename |
|------------------------|-----------------|-----------|------------------------|-----------|-------------------|----------|
| TROPFLUX               | ESSO/INCOIS     | [1]       | Jan/1979 - Dec/2017    | Daily     | 1°                | 87822.zip |
| GPCP                   | NOAA /University of Maryland | [2] | Oct/1996 - Dec/2020 | Daily     | 1°                | 87800.zip |
| ASCAT                  | NOAA            | [3]       | Mar/2007 - Nov/2018    | Daily     | 0.25°             | 87796.zip |
| WAVEWATCH III          | NOAA            | [4]       | Jan/1997 - May/2019    | 3 hours   | 1.25° x 1°        | 87823.zip |
| Dataset                        | Provider                  | Start Date | Frequency | Resolution | File Size |
|-------------------------------|---------------------------|------------|-----------|------------|-----------|
| SODA                          | ECMWF [5]                 | Jan/1980 - Dec/2017 | Monthly | 0.5 | 87828.zip |
| GODAS                         | PSL/NOAA [6]              | Jan/1980 - Sep/2020 | Monthly | 1° x 0.333° | 87809.zip |
| DASK                          | KIOST [7]                 | Jan/1947 - Dec/2012 | Monthly | 1° x 1° - 1/3° | 87798.zip* |
| SeaWiFS                       | NASA [8]                  | Sep/1997 - Dec/2010 | Weekly | 0.25° | 87820.zip |
| OAFLUX                        | NOAA (OCO – CCDD) [9]     | Jan/1958 - Jun/2019 | Daily | 1° | 87801.zip |
| NOAA/ESRL 20th Century Reanalysis | NOAA [10]            | Jan/1836 - Nov/2015 | Daily | 1° | 87802.zip |
| GLOBAL REANALYSIS BIO 001_029 | CMEMS [11]               | Jan/1993 - Nov/2019 | Monthly | 0.25° | 87795.zip |
| GLOBAL REANALYSIS BIO 001_033 | CMEMS [12]               | Jan/1998 - May/2019 | Weekly | 0.25° | 87799.zip |
| OCEANCOLOUR R GLO OPTICS L4 REP OBSERVATION S 009_081 | CMEMS [13] | Sep/1997 - Feb/2020 | Monthly | 0.041667° | 87805.zip |
| OSCAR                         | ESR [14]                  | Oct/1992 - Nov/2020 | 5 days | 0.3333° | 87819.zip |
| SMOS                          | ESA [15]                  | Jan/2010 - Nov/2020 | 4 days | 0.259366° | 87821.zip |
| MODIS-Aqua                    | NASA [16]                 | Aug/2002 - Jun/2020 | Daily | 0.041667° | 87803.zip |
| CO2 Flux                      | NIES [17]                 | Jan/1980 - Dec/2009 | Monthly | 1° | 87797.zip |
| GRDC (Global Runoff Data Centre) | BfG [18]            | Jan/1806 - Mar/2021 | Monthly | - | anomGRD C- Monthly.nc |

Table 3 shows the description of all physical, chemical and biological parameters for which anomalies were calculated. In this Table are listed the name of each parameter, to which the suffix _anom was added, with the exception of the parameter runoff_mean of the MARDAO dataset (this parameter contains the original runoff data at all stations of each river). In addition to the name of each parameter, the unit, the type of grid and the original set to which they belong are included. In the TAAD dataset the data are organized in two types of grids, the 3D type grids, which are the parameters that are found at the ocean surface or at a fixed depth,
therefore, they depend on longitude, latitude and time. The 4D type grids are organized similarly to the 3D type grids, but in addition to longitude, latitude and time they also depend on depth. In the case of the MARDAO dataset the anomaly data are organized in time series for each station.

Table 3. Parameter Description. * Means parameter added to dataset. WW3 - WAVEWATCH III and GFS models. GFS - Global Forecast System. 20CRv3 - NOAA/ESRL 20th Century Reanalysis. 001_029 - means product GLOBAL_REANALYSIS_BIO_001_029. 001_033 – means product GLOBAL_REANALYSIS_BIO_001_033. 009-081 – means product OCEANCOLOUR_GLO_OPTICS_L4_REP_OBSERVATIONS_009_081.

| Parameter name  | Description                                                                 | Unit   | Grid type | Original dataset source |
|-----------------|------------------------------------------------------------------------------|--------|-----------|-------------------------|
| lhf_anom        | Latent heat flux (downward is the positive direction)                         | W m⁻²  | 3D        | TROPFLUX                |
| lwr_anom        | Net surface longwave radiation (downward is the positive direction)          | W m⁻²  | 3D        | TROPFLUX                |
| netflux_anom    | Net surface heat flux (downward is the positive direction)                    | W m⁻²  | 3D        | TROPFLUX                |
| q2m_anom        | Specific humidity at 2m                                                      | g kg⁻¹ | 3D        | TROPFLUX                |
| shf_anom        | Sensible heat flux (downward is the positive direction)                       | W m⁻²  | 3D        | TROPFLUX                |
| sst_anom        | Sea surface temperature                                                      | °C     | 3D        | TROPFLUX                |
| swr_anom        | Short wave radiation                                                         | W m⁻²  | 3D        | TROPFLUX                |
| t2m_anom        | Air temperature at 2 m                                                       | °C     | 3D        | TROPFLUX                |
| tau_anom        | Wind stress magnitude                                                        | N m⁻²  | 3D        | TROPFLUX                |
| tauv_anom       | Zonal wind stress                                                           | N m⁻²  | 3D        | TROPFLUX                |
| taur_anom       | Meridional wind stress                                                       | N m⁻²  | 3D        | TROPFLUX                |
| ws_anom         | Wind speed at 10m                                                            | m s⁻¹  | 3D        | TROPFLUX                |
| precip_anom     | Daily precipitation rate at ocean surface                                    | mm day⁻¹ | 3D        | GPCP                    |
| uwnd_anom       | Zonal wind speed                                                            | m s⁻¹  | 3D        | ASCAT                   |
| vwnd_anom       | Meridional wind speed                                                        | m s⁻¹  | 3D        | ASCAT                   |
| wspd_anom*      | Wind speed                                                                   | m s⁻¹  | 3D        | ASCAT                   |
| ugrdsfc_anom    | Surface zonal wind speed                                                     | m s⁻¹  | 3D        | WW3                    |
| vgrdsfc_anom    | Surface meridional wind speed                                                | m s⁻¹  | 3D        | WW3                    |
| perpwsfc_anom   | Surface primary wave mean period                                             | s      | 3D        | WW3                    |
| htsgwscfc_anom  | Surface sig height of wind waves and swell                                   | m      | 3D        | WW3                    |
| wspdfc_anom*    | Wind speed                                                                   | m s⁻¹  | 3D        | WW3                    |
| temp_anom       | Seawater potential temperature                                               | °C     | 4D        | SODA                    |
| salt_anom       | Seawater salinity                                                            | psu    | 4D        | SODA                    |
| Variable           | Description                                                                 | Unit   | Resolution | Source |
|--------------------|-----------------------------------------------------------------------------|--------|------------|--------|
| ssh_anom           | Sea surface height above geoid                                               | m      | 3D         | SODA   |
| mlt_anom           | Mixed layer depth determined by temperature criteria                         | m      | 3D         | SODA   |
| mlp_anom           | Depth of potential density mixed layer                                       | m      | 3D         | SODA   |
| mls_anom           | Mixed layer depth determined by salinity criteria                            | m      | 3D         | SODA   |
| net_heating_anom   | Surface ocean heat flux coming through coupler and mass transfer              | W m^{-2}| 3D         | SODA   |
| prho_anom          | Potential density referenced to 0 dbar                                         | Kg m^{-3}| 4D         | SODA   |
| u_anom             | Seawater zonal velocity                                                      | m s^{-1}| 4D         | SODA   |
| v_anom             | Seawater meridional velocity                                                 | m s^{-1}| 4D         | SODA   |
| taux_anom          | Surface downward zonal stress                                                | N m^{-2}| 3D         | SODA   |
| wt_anom            | Vertical current velocity                                                    | m s^{-1}| 4D         | SODA   |
| tauy_anom          | Surface downward meridional stress                                           | N m^{-2}| 3D         | SODA   |
| thfix_anom         | Total downward heat flux at ocean surface (downward is positive)              | W m^{-2}| 3D         | GODAS  |
| sltfi_anom         | Salt flux at ocean surface                                                   | g cm^{-3} s | 3D     | GODAS  |
| sshg_anom          | Sea Surface Height Relative to Geoid                                           | m      | 3D         | GODAS  |
| dbss_obil_anom     | Isothermal layer depth                                                       | m      | 3D         | GODAS  |
| dbss_obml_anom     | Mixed layer depth                                                            | m      | 3D         | GODAS  |
| ufux_anom          | Momentum flux, zonal component                                               | N m^{-2}| 3D         | GODAS  |
| vfux_anom          | Momentum flux, meridional component                                          | N m^{-2}| 3D         | GODAS  |
| salt_anom          | Salinity                                                                    | psu    |            | GODAS  |
| ucur_anom          | Zonal component of the ocean current                                         | m s^{-1}| 4D         | GODAS  |
| vcur_anom          | Meridional component of the ocean current                                    | m s^{-1}| 4D         | GODAS  |
| spd_anom*          | Current speed                                                                | m s^{-1}| 4D         | GODAS  |
| dzdt_anom          | Vertical velocity of the sea current                                         | m s^{-1}| 4D         | GODAS  |
| pottmp_anom        | Potential temperature                                                       | K      | 4D         | GODAS  |
| co2_anom           | CO₂ flux, positive downward                                                  | Mole m^{-2}s | 3D     | CO2_Flux |
| sfc_hflux_pme_anom | Heat flux (relative to 0°C) from Precipitation minus Evaporation transfer of water across ocean surface | watts m^{-2}| 3D         | DASK   |
| Variable     | Description                                           | Unit          | Resolution | Source          |
|--------------|-------------------------------------------------------|---------------|------------|-----------------|
| river_anom   | Mass flux of river (runoff + calving) entering ocean | Kg m⁻³ * m s⁻¹ | 3D         | DASK            |
| mld_anom     | Mixed layer depth determined by density criteria    | m             | 3D         | DASK            |
| temp_anom    | Potential temperature                                | °C            | 4D         | DASK            |
| salt_anom    | Salinity                                             | psu           | 4D         | DASK            |
| u_anom       | Zonal component of the ocean current                 | m s⁻¹         | 4D         | DASK            |
| v_anom       | Meridional component of the ocean current            | m s⁻¹         | 4D         | DASK            |
| spd_anom*    | Current speed                                        | m s⁻¹         | 4D         | DASK            |
| sss_anom     | Sea surface salinity                                 | psu           | 3D         | SMOS            |
| chlor_a_anom | Chlorophyll concentration, oci algorithm             | mg m⁻³        | 3D         | MODIS-Aqua      |
| sst_anom     | Sea surface temperature                              | °C            | 3D         | MODIS-Aqua      |
| chla_anom    | Chlorophyll concentration                            | mg m⁻³        | 3D         | SeaWiFS         |
| cvapr_anom   | Evaporation rate at ocean surface                    | mm day⁻¹      | 3D         | OAFLUX          |
| ucurr_anom   | Zonal component of the ocean current                 | m s⁻¹         | 3D         | OSCAR           |
| vcurr_anom   | Meridional component of the ocean current            | m s⁻¹         | 3D         | OSCAR           |
| spd_anom*    | Current velocity                                     | m s⁻¹         | 3D         | OSCAR           |
| tmninc_anom  | Minimum temperature at 2m                             | °C            | 3D         | 20CRv3          |
| Variable   | Description                                                                 | Unit         | Damage Level | Sensor Calibration |
|------------|------------------------------------------------------------------------------|--------------|--------------|--------------------|
| tmn_anom   | Maximum temperature at 2m                                                    | °C           | 3D           | 20CRv3             |
| airc_anom  | Air temperature at 2m                                                       | °C           | 3D           | 20CRv3             |
| dwrf_anom  | Downward longwave radiation flux at ocean surface                          | W m⁻²        | 3D           | 20CRv3             |
| dswrf_anom | Downward solar radiation flux at ocean surface                              | W m⁻²        | 3D           | 20CRv3             |
| lhtfi_anom | Latent heat net flux at ocean surface                                        | W m⁻²        | 3D           | 20CRv3             |
| pevpr_anom | Potential evaporation rate at ocean surface                                 | W m⁻²        | 3D           | 20CRv3             |
| prate_anom | Precipitation rate at ocean surface                                         | Kg m⁻² s⁻¹   | 3D           | 20CRv3             |
| rhum_anom  | Relative humidity at 2m                                                     | Kg Kg⁻¹      | 3D           | 20CRv3             |
| shfl_anom  | Sensible heat net flux at ocean surface (downward is the positive direction)| W m⁻²        | 3D           | 20CRv3             |
| shum_anom  | Specific humidity at 2m                                                     | Kg Kg⁻¹      | 3D           | 20CRv3             |
| ulwrf_anom | Upward longwave radiation flux at ocean surface                             | W m⁻²        | 3D           | 20CRv3             |
| uswrf_anom | Upward solar radiation flux at ocean surface                                | W m⁻²        | 3D           | 20CRv3             |
| uwnd_anom  | Wind zonal velocity at 10m                                                  | m s⁻¹        | 3D           | 20CRv3             |
| vwnd_anom  | Wind meridional velocity at 10m                                             | m s⁻¹        | 3D           | 20CRv3             |
| wspd_anom  | Wind velocity                                                               | m s⁻¹        | 3D           | 20CRv3             |
| hflb_anom* | hflb = lhtfi - shfl                                                        | W m⁻²        | 3D           | 20CRv3             |
| spco2_anom | Surface partial pressure of carbon dioxide in sea water                     | Pa           | 3D           | 001_029            |
| o2_anom    | Mole concentration of dissolved molecular oxygen in sea water               | mmol m⁻³     | 4D           | 001_029            |
| chla_anom  | Mass concentration of chlorophyll a in sea water                            | mg m⁻³       | 4D           | 001_029            |
| no3_anom   | Mole concentration of nitrate in sea water                                  | mmol m⁻³     | 4D           | 001_029            |
| po4_anom   | Mole concentration of phosphate in sea water                                | mmol m⁻³     | 4D           | 001_029            |
| phytc_anom | Mole concentration of phytoplankton expressed as                            | mmol m⁻³     | 4D           | 001_029            |
| Parameter     | Definition                                                                 | Unit                | Scale | Identifier     |
|--------------|---------------------------------------------------------------------------|---------------------|-------|----------------|
| si_anom      | Mole concentration of silicate in sea water                                | mmol m\(^{-3}\)     | 4D    | 001_029        |
| ph_anom      | Sea water PH reported on total scale                                       | -                   | 4D    | 001_029        |
| nppv_anom    | Net primary production of biomass expressed as carbon per unit volume in sea water | mg m\(^{-3}\) day\(^{-1}\) | 4D    | 001_029        |
| fe_anom      | Mole concentration of dissolved iron in sea water                          | mmol m\(^{-3}\)     | 4D    | 001_029        |
| depth_epi_anom | Sea water epipelagic layer depth                                           | m                   | 3D    | 001_033        |
| depth_lmeso_anom | Sea water lower mesopelagic layer depth                                    | m                   | 3D    | 001_033        |
| depth_umeso_anom | Sea water upper mesopelagic layer depth                                    | m                   | 3D    | 001_033        |
| mnkc_epi_anom | Mass concentration of epipelagic micronekton expressed as wet weight in sea water | g m\(^{-2}\)       | 3D    | 001_033        |
| mnkc_lhmmeso_anom | Mass concentration of lower highly migrant mesopelagic micronekton expressed as wet weight in sea water | g m\(^{-2}\) | 3D    | 001_033        |
| mnkc_lmeso_anom | Mass concentration of lower mesopelagic micronekton expressed as wet weight in sea water | g m\(^{-2}\)       | 3D    | 001_033        |
| mnkc_lmmeso_anom | Mass concentration of lower migrant mesopelagic micronekton expressed as wet weight in sea water | g m\(^{-2}\)       | 3D    | 001_033        |
| mnkc_umeso_anom | Mass concentration of upper mesopelagic micronekton expressed as wet weight in sea water | g m\(^{-2}\)       | 3D    | 001_033        |
| mnkc_ummmeso_anom | Mass concentration of upper migrant mesopelagic micronekton expressed as wet weight in sea water | g m\(^{-2}\)       | 3D    | 001_033        |
| zooc_anom    | Mass concentration of zooplankton expressed as carbon in seawater         | g m\(^{-2}\)       | 3D    | 001_033        |
| CDM_anom     | Colored dissolved and detrital organic materials - Mean of the binned pixels | m\(^{-1}\)          | 3D    | 009_081        |
| KD490_anom  | Diffuse attenuation coefficient - Mean of the binned pixels               | m\(^{-1}\)          | 3D    | 009_081        |
RRS443_anom  Fully normalized remote sensing reflectance at 443 nm - Mean of the binned pixels  sr\(^{-1}\)  3D  009_081

SPM_anom  Inorganic suspended particulate matter in sea water - Mean of the binned pixels  g m\(^{-3}\)  3D  009_081

ZSD_anom  Secchi disk depth - Mean of the binned pixels  m  3D  009_081

runoff_mean  Monthly river runoff  m\(^3\) s\(^{-1}\)  Station  GRDC

runoff_anom  Monthly anomaly river runoff  m\(^3\) s\(^{-1}\)  Station  GRDC

Note that the product GLOBAL_REANALYSIS_BIO_001_033 was removed from the CMEMS catalog, and replaced in 2021 by the product GLOBAL_MULTIYEAR_BGC_001_033. Both are based on the SEAPODYM ecosystem model, the former at the 1/4° resolution with one week frequency estimates. It is forced by weekly means of Mercator Ocean circulation model (without assimilation), ERA-Interim atmospheric fields, and primary production issued from the CMEMS derived GLOBCOLOUR surface chlorophyll concentration.

Only evaporation has been taken from the OAFLUX dataset because the rest of the parameters coincide with those of the TROFLUX dataset. 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. The time reference for the MARDAO dataset is "days since 1700-01-01 00:00:00" and for the TAAD dataset is "days since 1900-01-01 00:00:00".

In the MARDAO dataset in addition to the data file containing the runoff anomalies at all stations of all rivers there are 3 directories, the figures directory containing the figures fig_RiverStationsMap.jpeg (Map with the representation of all stations) and fig_AmazonRiverAnomaly.jpeg (figure showing the runoff anomalies at 3 stations of the Amazon River), the matlab directory containing the script get_and_plot_data.m script showing how to use this dataset and finally the Stationlist directory containing several files (in CSV, DBF, HTML, LibreOffice Calc and Microsoft Excel formats) with the ID of all stations, the name of each station as well as the name of the rivers to which each station belongs and the data owner.

As mentioned earlier, in the TAAD dataset encompasses redundant parameters to facilitate comparative studies of anomalies according to different data sources. As an example of the value of this we have chosen several points to show a comparison between anomalies according to different datasources (see Figure 2 and Table 1 for the locations of these points). The WPP was chosen due to the presence of a Warm Pool that appears in that region from February to April or May (Figure 2a), the location of the SPP is due to the presence of a permanent Salty Pool in that region (Figure 2b), at the CHLP the chlorophyll concentration varies according to the Amazon River plume (Figure 2c, adapted from [19]), at the CURP is where the retroflexion of the North Brazil Current (NBC) feeds the north equatorial countercurrent (figure 2d, adapted from [20]) and finally the WINP is chosen because this is the place where the Intertropical Convergence Zone (ITCZ) shows maximum variability (Figure 2e). Figure 3 shows comparisons of anomalies between similar parameters (the term "similar parameter" means that they are the same parameters but obtained from different datasets, see
Table 4) with different data sources (Sea Surface Temperature, Sea Surface Salinity, Chlorophyll concentration, current velocity and surface wind), also showing a comparison between runoff anomalies (MADAO dataset) at station 3629000 (Amazon River) and station 1147010 (Congo River).

Table 4. Similar parameters based on your source dataset.
*It is also included in the datasets that have potential temperature and salinity.

| Similar parameters                  | Datasets                                      |
|------------------------------------|----------------------------------------------|
| sst_anom*                          | TROPFLUX, MODIS-Aqua, 20CRv3                 |
| sss_anom*                          | SMOS                                         |
| salt_anom                          | SODA, GODAS, DASK                            |
| ssh_anom, sshg_anom                | SODA, GODAS                                  |
| temp_anom, pottmp_anom             | SODA, GODAS                                  |
| ws_anom, wspd_anom, wspdfc_anom    | TROPFLUX, ASCAT, WW3, 20CRv3                 |
| precip_anom, prate_anom            | GPCP, 20CRv3                                 |
| lwr_anom, dlwrf_anom               | TROPFLUX, 20CRv3                             |
| swr_anom, dswrf_anom               | TROPFLUX, 20CRv3                             |
| lhf_anom, lhtfl_anom               | TROPFLUX, 20CRv3                             |
| shf_anom, shftl_anom               | TROPFLUX, 20CRv3                             |
| uwnd_anom, ugrdfsfc_anom           | ASCAT, WW3, 20CRv3                           |
| vvmd_anom, vgrdfsfc_anom           | ASCAT, WW3, 20CRv3                           |
| netflux_anom, net_heating_anom     | TROPFLUX, SODA                               |
| spd_anom                           | GODAS, DASK, OSCAR                            |
| u_anom, ucurr_anom                 | SODA, GODAS, DASK, OSCAR                     |
| v_anom, vcurr_anom                 | SODA, GODAS, DASK, OSCAR                     |
| chlor_a_anom, chla_anom            | MODIS-Aqua, 001_029                          |
| t2m_anom, airc_anom                | TROPFLUX, 20CRv3                             |
| wt_anom, dzdt_anom                 | SODA, GODAS                                  |
| q2m_anom, shum_anom                | TROPFLUX, 20CRv3                             |
| mlp_anom, mild_anom                | SODA, DASK                                   |
| taux_anom                          | TROPFLUX, SODA                               |
| tauy_anom                          | TROPFLUX, SODA                               |
Figure 2. Geographical location of the points chosen for the comparison of anomalies; a) Sea Surface Temperature, March 1980 (SODA dataset); b) Sea Surface Salinity, annual mean (SODA dataset); c) Mean weekly climatology of chlorophyll concentration, first week of October, Moderate-Resolution Imaging Spectroradiometer (MODIS), near the mouth of the Amazon River (adapted from [19]); d) Sea currents in the tropical Atlantic Ocean (adapted from [20]); NBC (North Brazil Current); NBC-R (North Brazil Current North Brazil Current Retroflection); cSEC (central branch of South Equatorial Current); nSEC (north branch of South Equatorial Current); NECC (North Equatorial Countercurrent); EUC (Equatorial Undercurrent); SEUC (South Equatorial Undercurrent); NEUC (North Equatorial Undercurrent). e) Surface winds in the tropical Atlantic Ocean, annual mean (ASCAT dataset).
Figure 3. Comparison of similar parameter anomalies with different data sources; a) Sea Surface Temperature anomalies at WPP point; b) Sea Surface Salinity anomalies at SPP point; c) Chlorophyll concentration anomalies at CHLP point; d) Surface current velocity anomalies at CURP point; e) Surface wind velocity anomalies at WINP point; f) Comparison of runoff anomalies of the Amazon (Station ID 3629000) and Congo (Station ID 1147010) rivers, MARDAO dataset.
Experimental design, materials and methods

The data from the original datasets that were used to calculate the anomalies had different frequencies: every 3 hours, every 6 hours, daily and monthly. The MARDAO and TAAD datasets are presented with monthly anomalies so first the monthly averages were calculated for the datasets that had a frequency lower than monthly. In the case of precipitation of the GPCP dataset, the data were organized in daily precipitation, so the accumulated precipitation in each month was calculated.

Once all the grids (TAAD dataset) and stations (MARDAO dataset) had monthly frequency, the anomalies were calculated using the Matlab script set called CalcPlotAnomaly, the creation of all the NetCDF files was done using the Matlab script set called mNC. Once these processes were completed, all metadata were added using the nco software.

Ethics statements

Not applicable.

CRediT author statement

H. L. Varona: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing- Original draft, Visualization. F. Hernandez: Methodology, Validation, Visualization, Writing- Reviewing and Editing. A. Bertrand: Conceptualization, Methodology, Validation, Visualization, Writing- Reviewing and Editing. M. Araujo: Conceptualization, Visualization, Writing- Reviewing and Editing, Supervision, Project administration, Funding acquisition.

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Declaration of interests

The authors declare that there is no conflict of interest regarding the publication of this article. The authors also declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.
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