**3.3. Data Assimilation data**

In this part, we decided to assimilate the Argo data into the coupling model, and the various parameters about the Argo data are shown in Table 1. Argo data were obtained from https://dataselection.euro-argo.eu/, and the quality control of temperature and salinity should be performed by using the method of He et al. (2021).

Table 1. The various parameters about the Argo data

|  |  |  |
| --- | --- | --- |
| Parameters | | |
| BBP700 | CDOM | CHLA |
| DOWNWELLING\_PAR | DOWN\_IRRADIANCE380 | DOWN\_IRRADIANCE412 |
| DOWN\_IRRADIANCE490 | DOXY | MTIME |
| NB\_SAMPLE\_CTD | NITIRTE | PH\_IN\_SITU\_TOTAL |
| PRES | PSAL | TEMP |

**3.4 Data Validation of the Model Results**

**3.4.1 SLA, SST and SSS data**

For the sea level anomaly (SLA) data output by the model, we can use the Copernicus Marine Environment Monitoring Service (CMEMS) SLA data for comparison which is available at [http://marine.copernicus.eu](http://marine.copernicus.eu/)/. Besides, it is mainly constructed by fusing the information obtained from multiple altimeter satellites (ESR-1/2, Topes/Poseidon, ENVISAT and Jason-1/Jason-2), which cover the global ocean (Qiu et al. 2022).

When data validation of the sea surface temperature (SST) data output from the model is required, it is useful to use the National Oceanic and Atmospheric Administration (NOAA) 1/4°Daily Optimum Interpolated Sea Surface Temperature (Daily OISST, version 2) data. This data is readily available at https://www. ncdc.noaa.gov/oisst/. It is a reanalysis data set constructed by combining observations from different platforms, including satellites, ships and buoys, on a regular global grid. Optimum interpolation is applied to fill in the gaps and make it a spatially complete SST data set. To obtain a continuous long time series of SSTs, we choose the AVHRR-Only SSTs, which use satellite SSTs from only the AVHRR (Reynolds & Chelton, [2010](https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2021JC017515" \l "jgrc24620-bib-0024)), cover the global ocean and provide the daily SST values from September 1, 1981 to present.

Finally, data validation of the SSS data output from the model is also required to be used to characterize the accuracy of the model. Same process as SST's validation method. Validation data about SSS can be found easily at https://glodap.info.

**3.4.2 Temperature and Salinity data**

The WOA/WOD data can be used to validate the temperature and salinity profiles produced by the Model output.

We can use the data from several independent stations in the study area to compare the temperature and salinity with the model output data, so as to check the bias and root mean square error (RMSE) of a single point. In addition, long time series observation data can also be used to compare with the model output data, so as to better view the overall matching degree between the model data and the observation data.

**3.4.3 Other data**

For the Mixed Layer Depth (MLD) data output by the model, we can use an independent source such as MILA-GPV for comparison, where the point of clarification is that this does not mean that MILA-GPV is true (Toyoda et al.2015). There is a lot more MLD data like this, like on the website (https://www.seanoe.org/data/00806/91774/) that can also be considered for validation. For some variables in the ecosystem, such as O2, CO2 , NO3, etc. we can also get the data from the above same URL to validate against the model outputs.

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