Bay of Biscay's Temperature and Salinity Climatology - BoByClim

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Abstract

The Bay of Biscay climatology is the synthesis of all the in situ data collected in the bay of Biscay area as far as 15°W, in the 20th century and mainly by IFREMER, SHOM, and WDCA. It shows temperature and salinity monthly information through the whole water column with a 1/10 degree resolution. The resulting atlas was produced by an optimal analysis which can reflect different scales: shelf and abyssal plain. A fine scale on the coast reveals all the local effects, including plume and upwelling, and a large scale on the shelf where a slower signal is obtained due to the large scale circulation

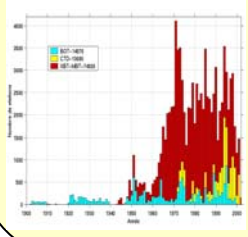
I - Data base

Description of the data used to compute the different climatologies

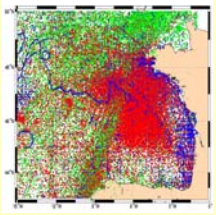
- **Parameters :** *Temperature and salinity*
- **Geographic area :** *50°N – 43°N / 15°W – 1°W*
- **Temporel period :** *1862 à fin 2004*
- **Measure type :** *Bottles, CTD, MBT, XBT, profilers, buoys*
- **Origin of data :** *46 % Service Hydrographique de la Marine (SHOM), 35% World Data Center A (WDCA), 17% IFREMER (SISMER), 1% United Kingdom Hydrographic Office (UKHO), 1% Marine Environmental Data Service (MEDS)*

Data type	Number of profiles
Bottles	13682
CTD	11423
MBT	22616
XBT	51533
Profilers	969
Buoys	2938
TOTAL	103161

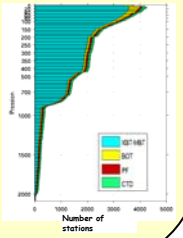
Temporal distribution



Spatial distribution of temperature and salinity profiles



Distribution by depth for January



II - Optimal estimation method

The method used to compute the map is the optimal estimation as exposed by Bretherton & al, 1976 and Autret & Gaillard, 2004.

$$x^a = x^f + C_{ao}(C_o + R)^{-1} d$$

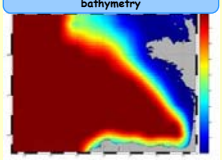
- ✓ x^a is the resulting temperature field or salinity field
- ✓ The solution is resolved as an anomaly field relative to a monthly climatology of profiles x^f.
- ✓ All the data are converted to anomaly d relative to x^f.
- ✓ The covariance matrices C_{ao} C_o are constructing using the gaussian structure functions in space including the data noise R
- ✓ The method allows to obtain error maps for each analysis. These errors maps give information on the reliability of the result.

III - Different scales function of influence's radius:coastal and deep-sea

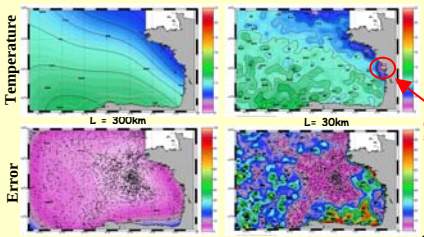
The radius of influence (noted L) is the main parameter of the optimal estimation method.

- ➢ This parameter is used to compute the covariance matrices.
- ➢ It defined the distance until which the data are included in the analysis.
- ➢ A high value of the radius of influence means that many data will be used to define the analysis, so we will obtain a low error, but without coastal scales. The information is much averaging.
- ➢ A low value of influence radius will make the contrary, high error values especially where there is no data. But it will let more weight to the local data, so the field will let appear coastal scales effects like plume or upwelling.

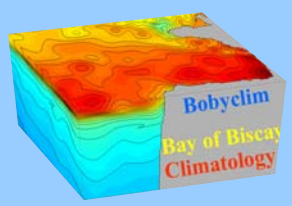
Spatial variation of the radius of influence in function of the bathymetry

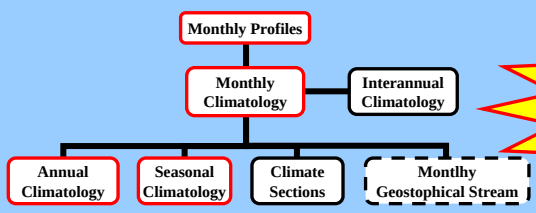


Optimal analysis for January, function of radius of influence (L)



IV - Different climatologies : BOBYCLIM_V2.0



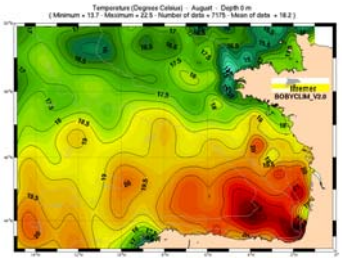


Schematic illustration of the different climatologic atlases constructed and validated (in red)

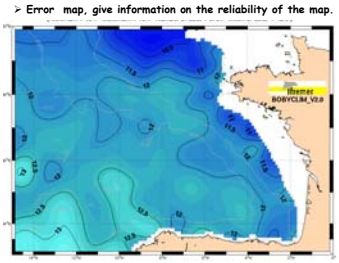
All the maps and the numerical files are be available on the internet site :
http://www.ifremer.fr/climatologie-gascogne

1. Monthly Climatology

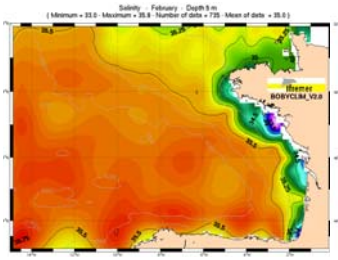
- ➢ After changing the data in anomalies according to the reference profiles, we can compute optimal analysis for each month for standard levels between 0 to 4000 meters, for temperature and salinity.
- ➢ Output: field map, error map and netcdf files including all information.
- ➢ 1/10 degree resolution and radius of influence L= 30 to 75 km.
- ➢ Error map, give information on the reliability of the map.
- ➢ Data profiles from Brest harbour and the Loire estuary were not used.
- ➢ Data profiles with a salinity value of less than 20 were not used.
- ➢ Matab and Fortran codes : sequential and parallel jobs
- ➢ Cpu time for one parameter: 9 – 28 hours for 12 months and memory max 15 G



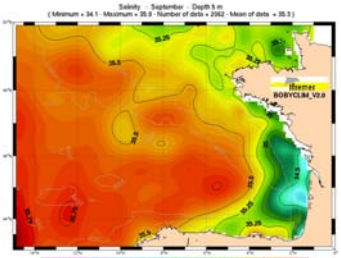
Temperature - August - 0 m



Temperature - August - 100 m



Salinity - February - 5 m



Salinity - September - 5 m

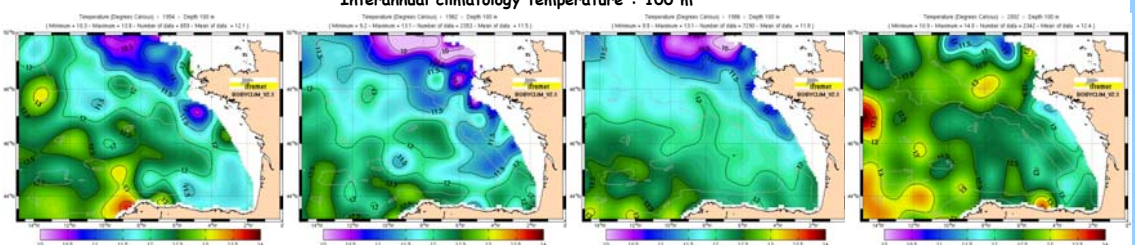
2. Seasonal, annual and interannual climatologies

From the monthly climatology, we can deduce others information like seasonal, annual or interannual climatologies. Density,then geostrophical stream could be computed later for month, season and annual intervals.

Seasonal and annual climatologies
We have deduced these both climatologies by averaging the monthly climatology. We have averaged the monthly information in order to keep the same weight for each month. Also the result is representative of the mean of the season or of the year, and not to the month with the more data.

Interannual climatology
We want to show the annual changes in temperature and salinity over 50 years. This climatology is constructed by computing, for a fixed month, optimal estimations for each year with a temporal window of 4 years around the year, which we made slide over 50 years.

Interannual climatology temperature : 100 m



1954 -57 | 1962-65 | 1986-89 | 2002-05

References:
- Bretherton, F.P., Davis R.E., 1976 : A technique for objective analysis and design of oceanographic experiments applied to MODE-73. Depp-Sea Research 23: 559-582.
- Autret E., Gaillard F., 2004 : Système opérationnel d'analyse des champs de température et de salinité mis en œuvre au centre de données CORIOLIS. Version 3.02. 63pp.

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