A mesoscale index to describe the regional ocean circulation around the Balearic Islands

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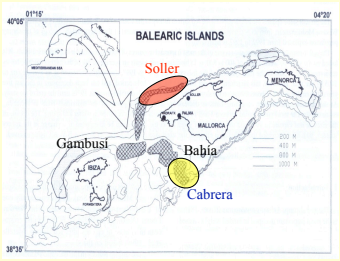
1.- Motivation

One of the objectives of the IDEA project was to better understand how the inter-annual variability of **abiotic factors** could impact on the **population dynamics** of two demersal ecosystems in the Balearic Islands. This inter-annual variability has been shown to be related to the presence/absence of **Western Mediterranean Intermediate Water (WIW)** in the Balearic channels

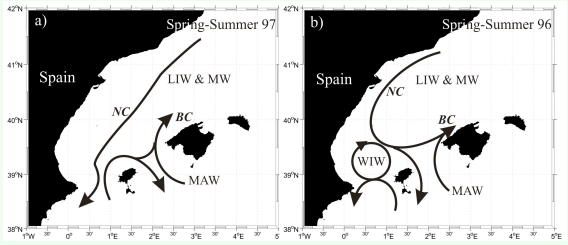


Fishing grounds on the Balearic Islands. Movements of the fishing fleets are observed between the areas of Cabrera and Soller

IDEA project: Influence of oceanographic structure and dynamics on demersal populations in waters of the Balearic Islands

2.- Interannual variability

The regional circulation in the northwestern Mediterranean in late spring is generally dominated by the Northern Current, which carries down Atlantic waters from the Gulf of Lions along the continental slope of the Iberian Peninsula into the Balearic subbasin. This current bifurcates when reaching the Ibiza Channel; one significant part crosses the channel transporting waters from the Mediterranean into the Algerian subbasin, while other part cyclonically returns to the northeast forming the Balearic Current along the northern coasts of the Balearic Islands (a).
However, if previous winter has been colder than usual (b), the circulation changes dramatically: the Northern Current may be blocked when reaching the Ibiza Channel and then recirculates cyclonically joining the Balearic Current without significant transport of waters through the Ibiza Channel

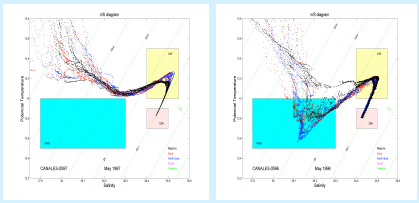


Late spring circulation in the NW Mediterranean after a mild winter (a) and cold winter (b)

It is generally accepted that this interannual variability is strongly related to the properties and the amount of WIW reaching the channels in late spring

3.- Presence of WIW from hydrographic data

The clearest way to track the presence of WIW in the channels is by means of a θS diagram where water properties for given water masses are limited by their **thermohaline properties**

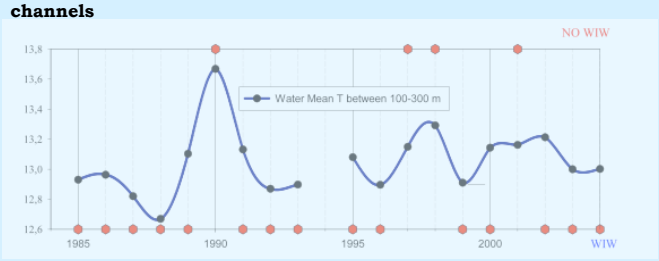


After a mild winter *After a cold winter*

Year	WIW	Campaign - month
1985	YES	BALEARES - July and October
1986	YES	In Algerian Basin - June
1987	YES	BALEARES – March and May
1988	YES	BALEARES – April and June
1989	YES	FE – May
1990	NO	-
1991	YES	IBIZA – March and July
1992	YES	IBIZA – June and July
1993	YES	IBIZA – March, May and June
1994	?	-
1995	YES	-
1996	YES	CANALES – April, May, June and July
1997	NO	
1998	NO	
1999	YES	CANALES - May
2000	YES	HERCULE - May, CIRBAL - September
2001	NO	
2002	YES	CIRBAL - March
2003	YES	CIRBAL-May, TUNIBAL-June
2004	YES	CIRBAL, TUNIBAL-June

Available oceanographic cruises in the channels since 1985 allow tracking the WIW presence/absence in the Balearic Channels. This qualitative information may be complemented with quantitative data available from **MEDATLAS** data base in the region defined by the coordinates 0° E-2° E and 38°N – 40°N (Ibiza Channel) and from other hydrographic campaigns around the Balearic Islands.

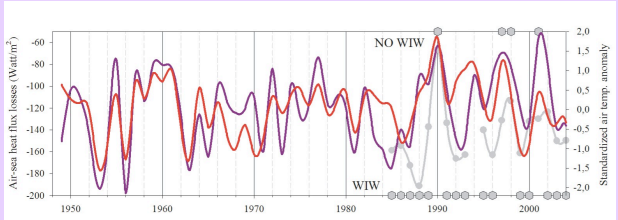
WIW in Ibiza and Mallorca channels



In-situ mean water temperatures at Ibiza channel computed for the period between May and September at depths ranging between 100 m and 300 m. Qualitative information about presence/absence of WIW from the table above is also included.

4.- The IDEA index

Both methods shown in **3** are short in time and have gaps in the series. In order to obtain **a longer and continuous index** for WIW presence and then for regional circulation, the meteorological **NCEP/NCAR reanalysis dataset** was investigated.
Despite WIW formation should in principle be more related to sea–air heat flux losses, the comparison with in situ oceanographic data seem to suggest that correlation is much better when **air surface temperature anomalies** are used instead.



Time series of air-sea heat flux losses from the NCEP/NCAR reanalysis data set averaged for the period December-March at the grid point closest to the Gulf of Lions (red line) and standardized winter (December-March) air surface temperature anomalies (purple line). Data from hydrographic surveys are also included (in grey) for a better comparison.