Inertial waves and tidal motion in the Ibiza Channel

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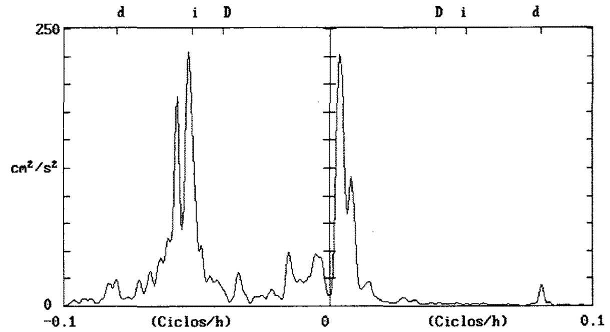
From the fifteenth of November 1990 to the twenty fourth of July 1991, and as a part of the programme "Dynamic Study and Biological Production of the Ibiza Channel", six current meters were moored in the Ibiza Channel (38°49.3' N, 0°47.9' E) at depths, 90, 115, 165, 265, 465 and 715 meters, in order to study the water mass fluxes through the Channel.

Current meters were placed in two successive moorings, the first one goes from the beginning to the fifteenth of March 1991 and the following one from the twentieth of March 1991 until the end.

Preliminary results from the analysis of the recorded data are presented here. Well differentiated peaks close to the inertial frequency and a weaker one, related to the semidiurnal tide, are observed in the spectrum (See Figure). Tidal ellipses have practically degenerated in straight lines, as it can be observed in both, figure and table.



Rotatory spectrum (negative frequencies correspond to the clockwise rotation) at 115 m. depth.
Letters **d** and **D** denote the semidiurnal and diurnal frequencies bands, respectively; **i** corresponds to the inertial frequency.

A harmonic analysis at the various depths shows a no very intense signal but easily detectible corresponding to M_2, clearly barotropic and with the tidal ellipse oriented according to the N-S axis of the Channel (See Table).

Table: Tidal current ellipses of the M_2 constituent in the Ibiza Channel (38°49.3' N, 0°47.9' E). Phase is referred to Greenwich meridian. A denotes anticlockwise rotation. C clockwise rotation.

Depth (m)	Major semiaxis (cm/s)	Minor semiaxis (cm/s)	Orientation (0° eastwards)	Phase	Rotation
90	1.3	0.2	104	138	A
115	1.6	0.0	93	145	-
165	1.5	0.2	102	144	C
265	1.8	0.2	91	144	C
465	1.5	0.2	93	145	C
715	1.4	0.2	65	147	C

The spectral analysis shows a more intense inertial peak centred at 0.054 c/h., a 4 percent larger than the local inertial frequency (0.052 c/h.), with clockwise rotation sense.

A previous analysis of this peak of frequency indicates a phase propagation for these waves of the order of 0.01 cm/s. The vertical wave length is of the order of 200 m.

Inertial currents are more intense at the three first levels of depth, decreasing very rapidly below the 200 m. level.

A particular characteristic of the spectra, more noticeable at the three superficial levels, is the appearance of a second peak on the frequency 0.058 c/h. which we think is due to a modulation of period $(0.058\text{-}0.054)^{-1}$ hours (10 days approximately) in the inertial waves, related possibly with the variations in the wind impulses.

Air-sea Interaction Fluxes of the Mediterranean Sea

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This work presents monthly analysis of the heat and momentum fluxes for the Mediterranean Sea for the period 1980-1988.
The upper ocean thermodynamics must be well represented in the Mediterranean since it is a mid-latitude basin with intense buoyancy fluxes (high evapoıation and sensible heat flux transfer). This work shows the total heat budget of the basin calculated with standard bulk parameterization formulas from available atmospheric and oceanic data sets.
The monthly, seasonal and interranual variability of the atmospheric forcing parameters is also known to be important in the Mediterranean region and it is clearly expected to have important effects on the oceanic flow field. Thus we also analyze the seasonal and interannual variability of the heat and momentum fluxes.
The main data source for this work is the NMC data set for the surface atmospheric quantities (wind components, air temperature and relative humidity) and the "Reynolds SST data" for the sea surface temperatures. All these basic fields, processed and analyzed, have been set up for the interested region. Also we had available monthly cloud data, that allow us to calculate the fluxes under cloudy sky conditions.
We used bulk parameterizations for the sensible and latent heat and parameterizations for incoming short wave radiation and net outgoing long wave radiation. The same formulas and atmospheric parameters have been used to force a general circulation model (GCM) of the world ocean and of the Mediterranean Sea. We followed the heat flux computations used by ROSATI and MIYAKODA (JPO,1988), that seemed more appropriate in forcing the GCM.
We calculated both clear and cloudy sky heat fluxes, the momentum fluxes and also the curl of the wind stress for each month of the aforementioned period along with time series of these quantities averaged on the surface of the Mediterranean basin.
The results show the strength of the latent heat flux on the net total flux, that confirm the fact the Mediterranean is a strong supplier of moisture over the year. The overall long term time mean of the net surface heat flux at the sea surface integrated over the Mediterranean area is $95W/m^2$ which is clearly unrealistic for this area. However if we use the sea surface temperatures simulated by the GCM and we compute the same net heat budget we get only $7W/m^2$. This points out to the importance of adequate resolution in the ocean SST (the model has 1°/4 horizontal resolution) to give realistic heat budgets at the air-sea interface. Our work also shows the existence of high heat anomalies during the summers 1987-1988, due to very high air temperature in summer expecially in the Eastern Mediterranean basin. Sensible and latent heat fluxes show 2 to 3 standard deviations anomalies in this region and time of the year. During the winter 1981 we show very anomalous wind amplitudes associated also to an exceptionally strong Mistral event and very strong wind stress over the Ionian basin.

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