CURRENT CIRCULATION IN THE ARCHIPELAGO OF LA MADDALENA

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ABSTRACT

Currents in the Archipelago of La Maddalena are essentially wind-driven and are affected by the local bottom topography. A model is produced to simulate the steady circulation.

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The Archipelago of La Maddalena is formed by several islands separated from the Northen part of Sardinia by a long, 40 m. depth channel (Bucinara) (Fig. 1).

An analysis of seasonally distributed measures of current and wind data from June '76 to June '77 is presented. The data were analysed by means of simple correlation, linear regression and Empirical Orthogonal Function. In such a way the direct dependance of current from local wind in the main channel was demonstrated, with a superposition of a progressive influence of the bottom topography. This can be expressed by the equation of conservation of momentum that, for the studied area can be written:

$$\frac{\partial u}{\partial t} = \frac{\tau_x}{h} - \frac{\tau_b}{h} + \varepsilon$$

where:

$\frac{\partial u}{\partial t}$ = acceleration of the current, $\frac{\tau_x}{h}$ = component of the wind stress, $\frac{\tau_b}{h}$ = bottom friction = ku, ε = error. The value of K (=0.05) was evaluated in order to minimize ε.

A numerical one dimensional model was constructed to simulate the water elevation and velocity during a steady circulation. This is a frequent situation that is reached about 5 hours after the beginning of the wind. The Archipelago was schematized with a network of channels with constant width and depth and the wind stress was different in each channel but constant with time the equations were:

$$\frac{d\eta_i}{dx} = w_i - \tau_b \frac{u_i|u_i|}{g d_i}$$

$$\frac{du_i}{dx} = 0$$

where: $\eta_i(x)$ = sea level elevation in the i-th channel in the point x; wi = wind stress; $\tau_b u_i|u_i|$ = bottom friction; d_i = depth of the i-th channel; $u_i(x)$ = velocity in the i-th channel in the point x.

The model was run for an Eastward wind (Fig.1) and the comparison with observational results is presented in the following table:

MOORING POSITION	ONE-DIMENSIONAL MODEL	OBSERVATIONAL RESULTS
A	19.7	21.9
B	8.4	6.2
C	25.9	21.0
D	25.9	23.0
E	19.5	17.2

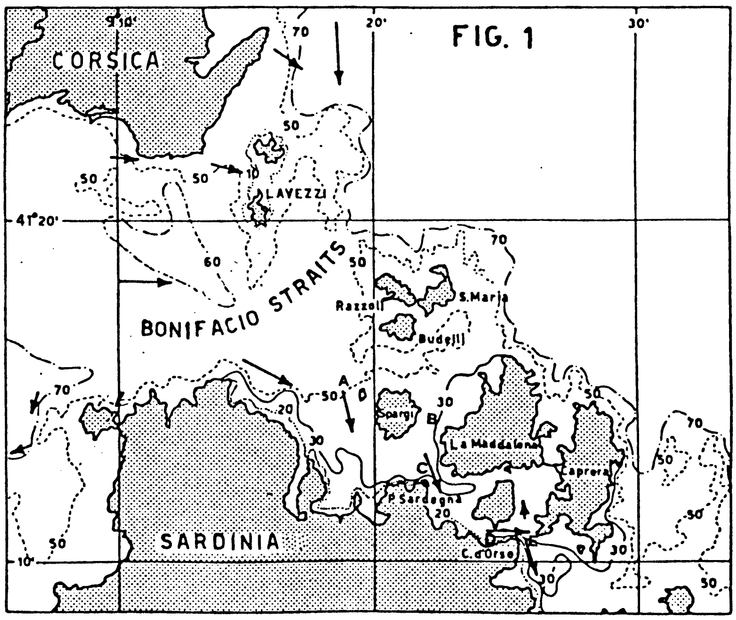

FIG. 1