Characteristics of the response of the current field in the Kastela Bay to the atmospheric forcing

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Kastela Bay is a small semienclosed basin with total area of 61 km^2 and average depth of 23 m. The bay communicates with the adjacent sea through a relatively wide (1.8 km) and deep mouth (mean depth about 40 m). The principal freshwater source is Jadro River with relatively small discharge (yearly mean about 10 $m^3 s^{-1}$).

Seven current measurement experiments of approximately two month duration were made in the Kastela Bay from 1980 to 1990. Current measurement stations were placed in the center and in the mouth of the bay where water exchange with the adjacent sea takes place. In each experiment meaurements were made simultaneously at more then one station and several depths. This made possible the determination of vertical and horizontal distribution of current field. Measurements in various seasons allows us to detect intra-seasonal differences in the current field.

Current meter data were analyzed together with appropriate hourly wind and atmospheric pressure data recorded at the meteorological station in the vicinity in order to study the effects of the atmospheric synoptical disturbances on the current field and water exchange with the adjacent sea. Currents and wind stress vectors were decomposed into the east-west and north-south components. All these time series were then low-pass filtered with 24m214 filter (THOMPSON, 1983) to reject tidal and other high frequency motions. Besides of the detailed analyses of low-pass filtered time series, correlation coefficients between north and east components of wind stress and currents were computed for periods with wind speed greater than 5 m/s in order to study the momentum balance (WINANT, 1980). Basic statistical characteristics (mean, standard deviations) were also computed. Correlation coefficients between current components and atmospheric pressure were computed for entire time series. Using linear interpolation for the current profiles, water transports and renewal times were obtained for stations in the mouth of the bay. Schemas of water transports were given for strong wind events.

The most obvious characteristic of all time series is strong variability on a weekly time scale.

Current meter data in the mouth of the bay show well defined two-layer structure for the periods with strong wind events, with surface current in phase with wind, while in deeper layers the phase-lag between wind and currents is 180 (GACIC, 1982; GACIC *et al.*, 1987). Correlation coefficients between currents and wind stress components, as well as average vectors give frictional momentum balance. Great negative correlation coefficients between the current components show polarization of the currents in the mouth in the east-west direction during the strong wind events. Correlation coefficients between east component of currents in the surface layer and atmospheric pressure show incoming flow during the periods with low pressure and outcoming flow during the periods with high pressure. The motions in the lower layers are in the opposite directions. Low pressure is often connected with scirocco (SE) wind, that also drives incoming flow in the surface layer and high pressure is connected with bora (NE) wind that drives outflow in the surface layer (ZORE-ARMANDA, 1980). When the scirocco (bora) wind stops the pressure starts to raise (fall) and opposite circulation in the mouth is established. Deviations from these typical synoptical situations were also observed.

Magnitudes of currents and correlation coefficients between currents and wind stress and currents and atmospheric pressure were smaller for the stations in the center of the basin. The correlation coefficients between wind stress and current components, as well as average current vectors reveal Ekman momentum balance with Ekman transport in the surface layer and compensatory transport in deeper layers.

Calculations of the water transports and renewal times show that the wind is effective mechanism for water exchange in the bay. Water renewal times are of order of two days during the strong wind events.

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