THE ROLE OF OPTICAL PROPERTIES FOR THE DYNAMICS AT THE OPEN SEA STATION STONCICA

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Abstract
Trend of decrease of transparency at the open sea station Stoncica motivated us to include different optical water conditions in the numerical simulations. Different optical types used, resulted in changed vertical thermal structures, and the differences, after few days of integration were higher for the simulation of summer than for winter conditions.

Key words: numerical model, Adriatic Sea, optical water types

Introduction

The hypothesis that optical conditions of the heat transfer may have significant dynamical effect has been tested here through the two numerical experiments run for the set of optical water types, according to the classification of Jerlov (1). The used water types were those present in the earlier period at the Stoncica station (Middle Adriatic Sea), and the type prevailing recently (2).

Numerical hydrodynamic model

Here the Princeton Ocean Model (POM) (3), three-dimensional primitive equation nonlinear model, with the complete thermodynamics, was used. The thermodynamic properties of the sea were simulated during two episodes of the bora wind: the first one 5th August 1972 and the second one the 13th March 1973. The equations, which capture the model physics, are the traditional equations for conservation of mass, momentum, temperature and salt, coupled with the equation of state (4). Oceanographic model was forced with the spatially variable wind stress (5) and the heat fluxes. Heat fluxes were calculated using bulk formulae according to Large (6) with the atmospheric parameters (wind, air temperature and humidity) obtained by measurements above the sea at the Stoncica station and instantaneous SST calculated by the oceanographic model.

The incoming short-wave radiation at the air-sea interface was calculated according to Haurwitz (7), assuming sun altitude was a function of hour angle s, geographic latitude j and declination d. In the model equations, short-wave radiation attenuation with depth was introduced through coefficients for each respective water types (I, IB, III) according to Paulson and Simpson (8). Model domain was Adriatic shelf with the horizontal resolution of 10 km. In the vertical direction 16 sigma layers were chosen.

Results and discussion

Results of the numerical experiments were shown in Figure 1.

The sea surface temperature time series at the model node, that corresponds to Stoncica station, show regular diurnal variations. During both bora episodes stronger heating in the surface layer was obtained in the optical type III. It is also obvious that during summer, temperature in the surface layer in the optical type III shows stronger deviation from temperature in other two optical types, for the same atmospheric conditions.

The reason for that could be lower wind speed during summer bora episode, which resulted in the reduced vertical mixing and therefore lower vertical heat transport. Summer pycnocline also prevents vertical heat transport which caused increased sea surface temperature.

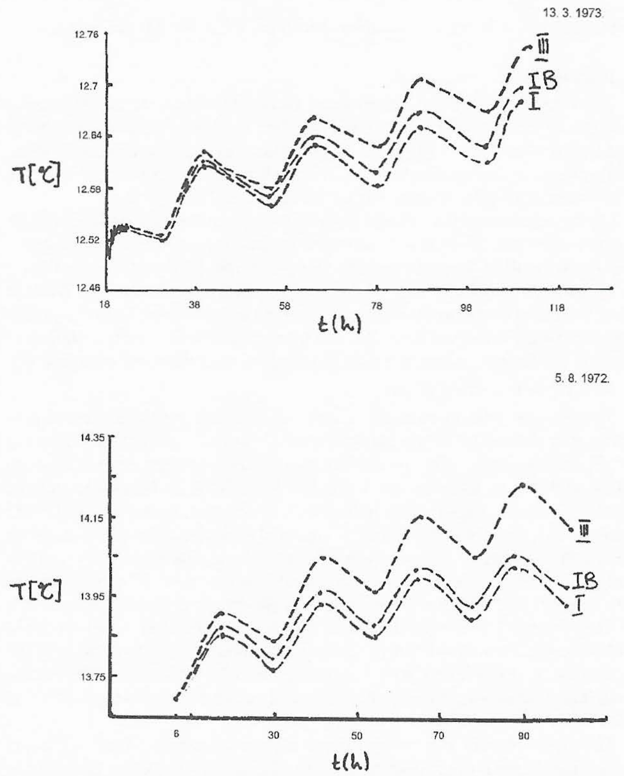

Figure 1. Temperature course with integration time for optical water types I, II and III in the surface layer.

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