A CLIMATOLOGICAL ATMOSPHERIC FORCING DATA SET FOR USE WITH GENERAL CIRCULATION MODELS OF THE MEDITERRANEAN SEA.

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Abstract

A comprehensive climatological atmospheric forcing data set for the Mediterranean Sea area is being presented. This data set is suitable for use in ocean circulation models of the Mediterranean Sea or parts of it. The values of the various heat budget components have been checked against previous studies and the total mean annual heat loss is equal to –7.2 W/m^2, a value very close to the generally accepted one for the Mediterranean Sea.

We present here the procedures followed in order to prepare a climatological atmospheric forcing data set to be used by general circulation models of the Mediterranean Sea. This data set consists of heat fluxes fields and wind stress components on a monthly basis, derived from the ECMWF 1979 – 1993 6-hour re-analysis atmospheric parameters on a regular 1° x 1° grid.

The calculation of climatological wind stress fields is based on the transformation of 6-hour ECMWF wind velocity data to x and y components of wind stress. The drag coefficient is calculated every 6 hours as a function of wind speed and air-sea temperature difference through a polynomial approximation given by [1]. SST data are taken from Reynolds 1° x 1° monthly 1979 – 1993 data base [2] and are linearly interpolated every 6 hours while air temperature data are taken from ECMWF 1979 – 1993 re-analysis data. The air density is calculated as a function of air temperature and relative humidity.

The x and y component of wind stress time series (at 6-hour intervals) are then averaged in time in order to form monthly climatological fields for the Mediterranean region. In

fig.1 we show the wind stress field for a typical winter and summer month. We should mention here that the monthly wind stress fields produced with this particular method from the ECMWF re-analysis wind velocity data, compare very well with the results of [1] for the Mediterranean region.

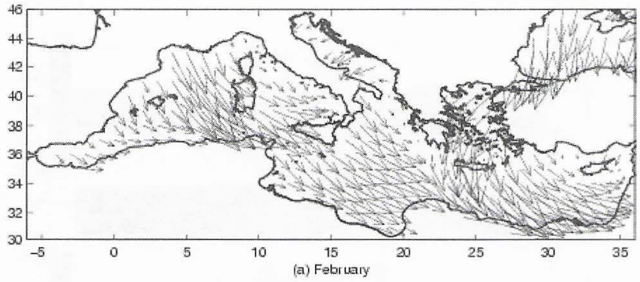

Figure 1 . Wind stress field for a typical winter (upper part) and summer (lower part) month, in the Mediterranean Sea.

The results of the different bulk formulae are summarized in Table I in terms of annual mean values. The formula of May [3] for the longwave radiation combined with Kondo scheme [4] for the calculation of latent and sensible heat flux give a strongly positive (+28.9 W/m2) heat budget for the Mediterranean. If instead we use the Bignami formula [5] for the calculation of longwave radiation the heat budget drops to +17.3 W/m2 (Kondo – Bignami set). Finally, the best set of formulae which gives a negative annual heat budget for the Mediterranean (-7.2 W/m2) is the neutral Budyko scheme [6] for the calculation of latent and sensible heat fluxes along with the Bignami formula for the longwave radiation (Budyko – Bignami set)

Table 1. Annual mean values of heat budget components obtained using various bulk formulae.

Formulae	Q_s (W/m^2)	Q_B (W/m^2)	Q_e (W/m^2)	Q_h (W/m^2)
Reed	201.67			
May		78.76		
Bignami		90.33		
Neutral Budyko			106.18	12.42
Kondo			82.81	11.16

References

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