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Other Information:
MFSTEP WEB SITE
http://www.bo.ingv.it/mfstep

The Monthly Bulletin is available in WP8 Section:
http://www.bo.ingv.it/mfstep/WP8/monthly

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The Mediterranean Sea is a semi-enclosed basin with deep ocean areas and narrow continental shelves. Exceptions to this rule are given by the extended shelf areas of the Adriatic Sea and the Tunisian plateau. The Gibraltar Strait balances the water and heat losses at the air-sea interface of the basin, maintaining a long term steady state equilibrium. The complex morphological structure of the basin and its exchanges with the Atlantic Ocean make the Mediterranean Sea circulation particularly unsteady and variable, from the deep ocean areas to the shelves. The large amplitude natural variability of the basin circulation couples with man-induced changes in the Mediterranean regions. Anthropogenic effects are evident, especially on the hydrological cycle of the basin and particularly on runoff. Thus the coastal areas cannot be managed without a nowcasting/forecasting system that will allow the continuous assessment of system evolution. Such a system is at the base of the most urgent societal concerns for the protection and sustainable exploitation of resources in the open ocean and coastal regions of the Mediterranean Sea.

Since September 1998, the Mediterranean Forecasting System (MFS) program (Pinardi and Flemming, 1998) has begun to implement the backbone of a future fully integrated forecasting system of the Mediterranean Sea. The first Project to implement elements of the MFS program was the Mediterranean Forecasting System Pilot Project (MFSPP) that lasted from September 1998 until June 2001 (Pinardi et al., 2003). The second Project is ADRICOSM (www.ingv.it/adricosm) financed by the the Italian Ministry for the Environment and Territory, Department for Environmental Research and Development which supported the MFS forecasting activities between 2001 and 2004. The third Project is the Mediterranean Forecasting System Toward Environmental Predictions (MFSTEP) which begun in March 2003 and will end in 2006 (www.bo.ingv.it/mfstep).

MFS is composed by four observing networks: 1) the near real time satellite data analysis and dissemination network; 2) the Voluntary Observing Ship (VOS), vertical profiling network; 3) the Mediterranean Moored Multidisciplinary Array (M3A) observing network and 4) the autonomous drifting and profiling network.

Numerical forecasting is performed using an Ocean General Circulation Model (OGCM) that was implemented in the Mediterranean basin at 1/16 x 1/16 degrees resolution and 72 vertical levels. Atmospheric forcing data are given by analyses and forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF). Ten days forecasts are produced once a week using an asynchronous coupling with atmospheric forecasts. Every week an analysis is computed assimilating SST, SLA along the tracks, VOS-XBT data and ARGO floats data.

Several subregional forecasting systems at 3km of resolution are nested within the MFS: the Alermo Forecasting System for the Aegean Levantine area (http://pelagos.oc.phys.uoa.gr/mfstep/bulletin/), the North West Mediterranean Model (NWMED) (http://www.noveltis.net/mfstep-wp9), the Sicily Channel Regional Model (SCRM) (http://www.imc-it.org/progetti/mfstep/Forecast/bulletin.html), and the Adriatic Regional Model (http://www.bo.ingv.it/adricosm/bulletin.html).

Every week the MFS forecast is published on the Web site of MFSTEP (www.bo.ingv.it/mfstep).

NEW
Since May 2005, the basin scale forecast switched from SYS1 to SYS2 and since August 2005 from SYS2 to SYS2a.
For further information on the new system see the web site: http://www.bo.ingv.it/mfstep/WP8/data_ass_opa.htm
THE ANALYSES USED TO COMPUTE THE BULLETIN FIELDS ARE FROM THE MFS SYS2a.
1. **THE OBSERVING SYSTEM DATA FOR THIS MONTH**

1.1. VOS-XBT

Red lines represent the Voluntary Observing Ship’s tracks where XBT data were collected during August. Nominal sampling distance is 12 nm. along track.

![Data vos–xbt for this month](image1)

1.2. SEA LEVEL ANOMALY DATA FROM AVAILABLE SATELLITES

The model assimilates Sea Level Anomaly (SLA) data from two satellites: JASON1 which has a repeat time of 10 days and GFO that has a repeat time of 17 days. The following figure represents the satellite data assimilated by the model during August.

![Assimilated data this month: JASON1 and GFO SLA (m)](image2)
1.3. SEA SURFACE TEMPERATURE (SST) FROM SATELLITES

This figure shows the monthly mean SST field computed from satellite data.

The situation for August is characterised by the general gradient between the Western and the Eastern Mediterranean.

The lowest values are present in the Western Basin and in particular over the Gulf of Lions (about 20°C) and the Alboran Sea. All the Eastern Basin is characterised by higher values: from the Sicily Strait eastward, the values increase reaching their maximum over the Levantine Basin, along the Southern Coasts of Turkey.

In the Eastern Mediterranean there is an exception: all the Eastern Aegean Sea and a very small area south-western of Crete, in fact, show lower values than the rest of the western sub Mediterranean area.

1.4. MEDARGO

The following figure shows the MFSTEP Argo float positions during August. For further information about Argo floats see the web site: http://www.ifremer.fr/coriolis/cdc/zoneDataSelection/cdcMFSTEPDataSelections.asp

1.5. GLIDERS

A new technology is now at a prototype development stage which has the potential to bring tremendous benefit to an observing system for a basin with scales like the Mediterranean. These are autonomous gliders, which can "fly" underwater on slightly inclined paths, using only their buoyancy for propagation. A typical dive/ascent to 1000 m depth moves the glider horizontally by around 4 km at horizontal speed of about 40 cm/s. During these casts, the glider can measure temperature and salinity. Data are telemetered via satellite in real-time while the glider is at surface. The glider steers itself autonomously, but can also be controlled remotely to change its mission programming or to command it back to the base. The tracks represented in the following figure are those from September until now.

For further information about Glider see the web site: http://www.ifremer.fr/coriolis/cdc/zoneDataSelection/
THE ATMOSPHERIC FLUXES

2.1 HEAT FLUX

**MONTHLY MEAN of NET HEAT FLUX (MFS Analyses) [W/m²]**

The first atmospheric forcing we consider is the **net downward heat flux [W/m²]** that is negative when Mediterranean looses heat. During August positive or close to zero values are present over almost all the basin with a range between 0 and 200 W/m². The highest values characterise the Alboran Sea, the southern coasts of Sicily and Sardinia, the Gulf of Lions and, in general, all the northern coasts of the Eastern basin.

**MONTHLY MEAN ANOMALY of NET HEAT FLUX (MFS-NCEP) [W/m²]**

The analysis of the net heat flux anomalies is done comparing the monthly mean of August 2005 with the climatology from NCEP/NCAR reanalyses recomputed for our system. The anomalies are both positive and negative, in particular: Western Mediterranean shows negative values almost everywhere while the Eastern part of the basin is characterised by wide areas of positive values reaching 60-70 W/m².

The figure beside shows the comparison between the monthly basin mean of the total heat flux calculated by the MFS System (for July is 71.25 W/m²) and the basin mean of the total heat flux from the NCEP/NCAR Reanalysis(70 W/m²). The difference is about 5 W/m² and this means that during August 2005 the heat gained by Mediterranean is higher than the climatology.
2.2 WIND STRESS

The August 2005 monthly mean of the wind stress [N/m²] is shown in the first figure below. In the Eastern Mediterranean sector we can see an high intensity Etesian signal touching the Northern Coasts of Africa and the Eastern Ionian area while in the Western part of the Mediterranean a strong Mistral signal involves the Gulf of Lions, goes trough the Sardinia Channel and makes feel its influence until the Sicily Strait.

Comparing MFS monthly mean wind stress with the NCEP/NCAR climatology we can recognise positive amplitude anomalies generally all over the Mediterranean with the highest values over the Gulf of Lions and the Aegean Sea.
2. **WHAT HAS HAPPENED THIS MONTH?**

In this section we use the analyses from the MFS System:

The figure beside shows the MFS **Sea Surface Temperature (SST) [°C]** monthly mean. This field presents the lowest values over the Gulf of Lions, the Alboran Sea, the southern coasts of Sicily and the Eastern Aegean Sea.

The second figure shows the difference between SST monthly mean and the Medatlas climatology (THE MEDAR GROUP MEDATLAS 2002). The anomalies are positive over almost all the Eastern basin, except over the Adriatic Sea. They present their maximum values along the Greek and Turkish coasts. The situation for the Western Mediterranean is different: both positive and negative values are present, the first over the Alboran and the Tyrrenian Seas and the others over the Gulf of Lions and through the Sicily Channel.

The third figure shows the difference between MFS monthly mean and SST monthly mean computed from satellite data. This difference is around -0.5/-1 °C over all the Mediterranean. All the Southern coasts of the basin are instead characterised by positive values of 0.5-1 °C.
The figure below illustrates the monthly mean of the **salinity** field [psu] and shows the general gradient between the Eastern and the Western Mediterranean of about 3 psu.

![Monthly Mean of Salinity](image1)

Analysing the anomalies, we can see negative values almost everywhere except in the **Northern Adriatic, the Gulf of Lions** and the **Northern Aegean Sea**: this means that during August 2005 in most areas the salinity has decreased at the surface with respect to the climatology except in the major run-off areas of the Mediterranean.

![Monthly Mean Anomaly of Salinity](image2)
The figure above represents the **magnitude of the surface currents** calculated from MFS analyses.

As we can see the amplitude is largest in the Alboran Sea where the current forms the first gyre, immediately eastward of Gibraltar.

We decided to focus our attention on the **Alboran Sea**.

The Atlantic Waters enter in the Mediterranean and form an high intensity cyclonic Gyre.

The Gibraltar-Atlantic Current flows eastward with a current intensity of about 60 cm/sec.

The Algerian Basin is characterised by several anticyclonic eddies and meanders.

Along the northern coasts we can recognise the Liguro-Provencal-Catalan Current (LPC) flowing westward and branching near Marseille.

Along the Western Sardinia Coasts there is a very intense southward current that is normally not present.

The figures below (Robinson et al., 1992, Pinardi et al., 2004, Millot et Taupier, 2005) show the Mediterranean Sea Circulation structures for reference.
THE MEDITERRANEAN SEA CIRCULATION SCHEMATIC

(from Pinardi et al., 2004)

(from Millot et Taupier-Letage, 2005)

(from Robinson et al., 1992)
3. **BIBLIOGRAPHY**


