

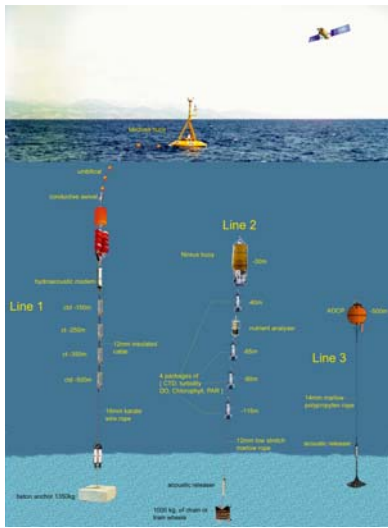
The Mediterranean Moored Multi-sensor Array (M3A): System Upgrade and Extension

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A prototype multi-sensor buoy system able to deliver real time physical and biochemical observations at open ocean sites has been developed and operated in the south Aegean Sea (E1-M3A site) for the needs of the Mediterranean Forecasting System during the EU/FP4 MFSP project. The system architecture integrates sensors for optical and chemical measurements in the upper 100m of the ocean (dissolved oxygen, chlorophyll-a, PAR, nitrate) and physical measurements (temperature, salinity, turbidity, current speed and direction) down to 500m. During the ongoing MFSTEP (FP5) project the M3A system has been upgraded and expanded in two more sites: the south Adriatic Sea (E2-M3A) and the Ligurian Sea (W1-M3A). The three systems currently operate for the needs of MFSTEP, starting on September 2005 they will also contribute to the observing component of the MERSEA (FP6) project.



The E1-M3A system of the south Aegean Sea



Overall design: Sensors hosted by three independent mooring lines: central line-1 hosting deep (150-500m) sensors and surface buoy; line-2 hosting physical and biochemical sensors at 40-100m depths; line-3 hosting an upward looking ADCP at 500m

Position (X Lat , Y Lon): 35o 39.676' N, 24o 59.132' E

Depth: 1030m

Measurements in the water column								
	40	65	90	115	150	250	350	500
Temperature	•	•	•	•	•	•	•	•
Salinity	•	•	•	•	•	•	•	•
Light Attenuation	•	•	•	•	•	•	•	•
Dissolved Oxygen	•	•	•	•	•	•	•	•
Chlorophyll-a	•	•	•	•	•	•	•	•
PAR	•	•	•	•	•	•	•	•
Nutrients (Nitrate)	•	•	•	•	•	•	•	•
Current speed/direction	0-500 m profile							
Measurements at air-sea interface								
Air Temperature	Relative Humidity	Atmospheric Pressure	Wind speed and direction	Wave parameters				

Data transmission: Line1: Inductive modem; line2-line1: hydroacoustic modems; Satellite communication: IRIDIUM

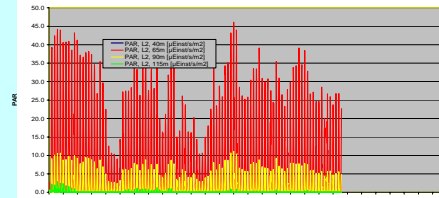
Basic Instrumentation: CTD:SBE-37 (line 1, 150-500m), SBE-16 (line2, 40-100m); Nutrient Analyzer: WS-OCEAN NAS2EN; ADCP: RDI 75kHz; Acoustic modems: Linquest UWM300



The E1-M3A system provides data from the south Aegean Sea since 21 July 2004 (photo from deployment by R/V Aegeao)



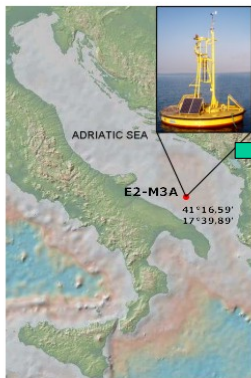
Photosynthetically Active Radiation (PAR), $\mu\text{Einsteins}/\text{sec}/\text{m}^2$



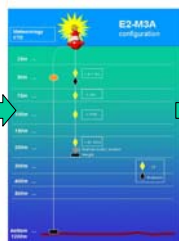
Example of E1-M3A time-series: PAR data at different depths

The E2-M3A system of the south Adriatic Sea

SCIENTIFIC PAYLOAD

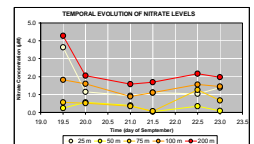


DESIGN

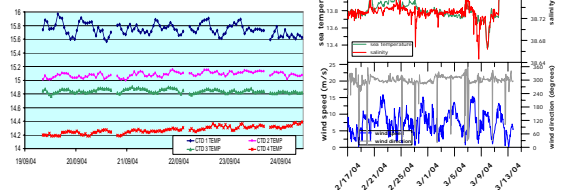


E2-M3A is based on the Italian buoy BOMA -project supported by a national initiative

Mooring chain		Surface measurements
Depth	Instruments	<ul style="list-style-type: none"> Meteo measurements CT at surface level
50m	C, T, D, Chl	
75 m	C, T, Chl	
100 m	C, T, PAR	
200 m	C, T, D, O2	Sampling system <ul style="list-style-type: none"> ✓ multiparametric probe ✓ nutrient analyser



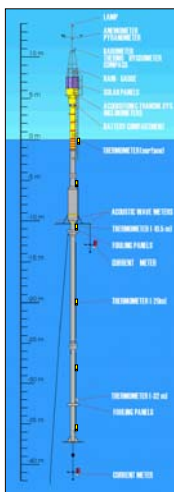
SOME RESULTS...



The buoy is located in the center of the Southern Adriatic Gyre, the deep water formation site

An innovative pumping system connected with a nutrient sensor in the buoy hull allows the automatic sampling at several depths

The W1-M3A system of the Ligurian Sea



- Position: 009° 09.80' E 43° 47.40' N
- Spar buoy (about 50 meters long and 11 tons weight, with a small laboratory on its top) moored in the Ligurian Sea on a 1370 meter deep water and at about 37 nm far from the coast.
- The buoy, the unique spar buoy in the Mediterranean, is a stable measuring platform for collecting meteorological and surface data in the ocean.

- Equipped by a set of meteorological and oceanographic sensors whose measurements are collected each hour by the on-board acquisition system.
- Data are transmitted in near real-time to the station ashore by a Globalstar phone link.

Time series of sea temperature at 5 depths (0.5, 12.0, 20.0, 28.5, 36.5 m), wind speed, air temperature and relative humidity from February 1st, 2000 up to December 31st, 2003.

