

## MedGLOSS –MEDITERRANEAN AND BLACK SEA REGIONAL SEA LEVEL MONITORING NETWORK: UPDATE OF ACTIVITIES AND PROGRESS

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### 1. Introduction

MedGLOSS, the Mediterranean Network for Systematic Sea-level Monitoring in the Mediterranean and Black Seas acting as Regional subsystem of Global Sea Level Observing System was jointly established in 1997 by the Science Commission of the Mediterranean (CIESM) and by IOC/UNESCO. Following a unanimous decision of the member organizations taken at a coordination meeting held in May 2000, it has been coordinated since then by the MedGLOSS focal center, located at IOLR in Haifa (Rosen & Aarup, 2001).

Initially three major objectives have been defined for MedGLOSS stations: (a) To detect regional long-term relative and absolute sea-level changes trends and acceleration rates, (b) To determine plate tectonic movements in the domain affecting them by the creation of a densified regional long-term sea-level monitoring network in the Mediterranean and Black Seas, and (c) To provide near real time (NRT) sea level data for operational oceanography. In January 2005, following an IOC meeting, an additional fourth objective has been added, to upgrade NRT stations to delivery of true real-time (RT) sea level data for tsunami and other sea level hazards early detection and alert in the Mediterranean and Black sea.

The network was originally been combined of stations providing data for long term monitoring studies in delayed mode (DM) and NRT stations, but all MedGLOSS stations have to measure and provide data according to the international standards defined for GLOSS stations. The minimum data requirements for sea level data were hourly averaged sea-level and atmospheric pressure values. All NRT stations have been requested to have their reference bench marks monitored by GPS, preferably by Continuous GPS stations. Since the NRT stations poses usually low latency sea level data gathering capacity, they became candidates to upgrades to true Real-Time (RT) mode using new software and transmission equipment. Expansion of the MedGLOSS network is continuously promoted for new candidate stations. A MedGLOSS network map of the DM and NRT stations as well of new candidate stations is shown in Figure 1 below.

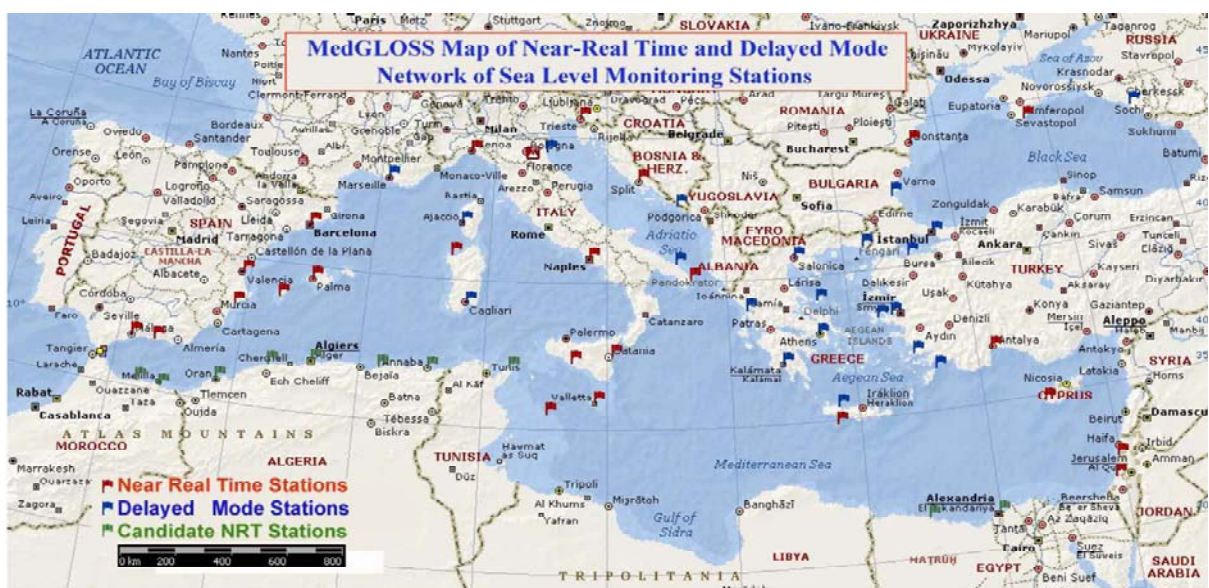


Figure 1 – Map of MedGLOSS stations

## 2. Major activities

The MedGLOSS focal center has been serving as the host for the MedGLOSS web server, has been providing technical, scientific and financial assistance to MedGLOSS member sea level stations as well as to membership candidate organizations in the Mediterranean and Black sea, including assistance in installation of new equipment, professional consulting in the selection of equipment, sensors calibration and new software data acquisition, processing and quality control tools. Since 2002 MedGLOSS started cooperating with ESEAS. During 2002-2005 the MedGLOSS jointly with ESEAS prepared the ESEAS-Research Infrastructures research proposal submission and then its successive project performance for the European Commission, while MedGLOSS focal center lead the work package on the upgrade of the sea level network by modernizing existing sea level stations and collocation with CGPS. The MedGLOSS focal center has been developing various data gathering, quality control and data transmission software, which have provided free to the sea level community, as well as an interface for easy Windows based tide analysis and forecasting named TIDE TASKS FOR WIDOWS (TT4W) using the DOS based TASK 2000 tide analysis software developed by scientists at POL/NERC in UK. The TT4W has been widely used ever since, including for the training in tidal analysis at the IODE training center in Ostende, Belgium for ODIN AFRICA program. The TT4W has been running under the MS OFFICE EXCELL 2003 version enabling analysis of hourly time series of sea level data.

We are glad to announce that recently the MedGLOSS focal center at IOLR completed the development of a new version of the software, TT4W version 2, which enables analysis of sea level data gathered at constant intervals of up to 1 minute. The software operates under the MS OFFICE EXCELL 2007, and will shortly be available at the MedGLOSS web site for downloading by eligible users.

Since 2005, when MedGLOSS has been invited by the IOC then established Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS) to cooperate in the upgrading of its sea level monitoring stations to provide low latency data for early tsunami detection and warning activities (see map of pilot TWS stations in Figure 2), the MedGLOSS focal center was devoted in that new challenge. The challenge was due to the need to upgrade the data acquisition

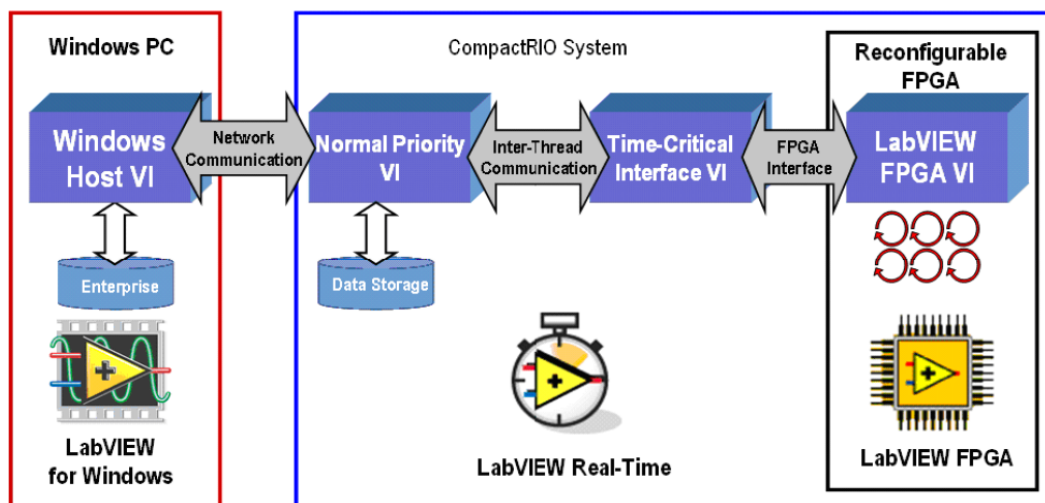


**Figure 2 – Map of pilot TWS**

and dissemination which was running under the DOS environment, to the WINDOWS environment in order to enable fast data communication via Internet, preserving at the same time real time clock

data acquisition activities (normally not satisfactory under WINDOWS). Upon solution of the technical problems involved, following investigation of various alternatives and the approval of the upgrade plans by CIESM Director General Prof. Frederic Briand, together with a generous financial support by CIESM since 2008 as well as by IOLR, the MedGLOSS focal center has recently completed the purchase and integration of adequate additional equipment for the upgrade of the MedGLOSS sea level stations in Portomaso (Malta), Paphos (Cyprus), Constanta (Romania) and Kaciveli (Ukraine). Additional MedGLOSS stations operated by IOLR at Hadera and Ashdod (Israel) will be also upgraded with IOLR funding.

The upgrade to RT data monitoring and transmission of the sea level stations required both addition of new equipment and new software. The new software is named MedGLOSS RT and was developed under National Instruments LABVIEW software environment for data acquisition under WINDOWS operating system (XP Professional), to gather real time meteo-marine data (sea level and atmospheric pressure, wind speed, wind direction, sea water temperature, sea waves and clock updates using GPS or atomic clock) using real time clock data gathering capabilities, processing and transmission of the data every 1 minute as 6minutes averaged sea level data every 1 hour to Internet by FTP via Internet protocols (I.P.) The software package acquires data from 3 sensors (providing data via RS-232 serial transmission) which operate under WINDOWS operating system (XP Professional) on an *Intel Core 2 Duo P8400 (2.26GHz-1066MHz/3Mb)* processor laptop computer, e.g. *Dell Latitude E5500-V (SATA 7200RPM 200GB, DELL Wlan 1397 (802.11 b/g) DC, SDRAM DDR2 800MHz 2GB)*. The sea level data are acquired from a sea level sensor (Paroscientific Digiquartz® Intelligent Depth Sensor type 8CDP having Intelligent Electronics with RS-232 Bi-Directional Interface allowing user selectable parameters including resolution, update rate, engineering units, sampling commands etc.) at a rate of 20 Hz using a National Instruments CompactRIO Controller and Chassis Integrated System and LabVIEW FPGA Module 8.6. The MedGLOSS RT Monitor.exe software presents data from the sensors, saves the data on the local hard drive of the PC and in addition transmits it to user defined FTP locations. The NI CompactRIO system has an integrated hardware architecture that combines an embedded real-time processor and a user-programmable FPGA (Field Programmable Gate Array) chip within a single chassis. The cRIO application uses three separate processors as shown in Figure 3 – a windows PC, a real time OS (Operating System) controller, and an FPGA.



**Figure 3 Application architecture**

The RT host and the Windows PC communicate over the Ethernet (LAN – IEEE 802.3). The actual start of RT data transmission is expected to start in July 2009, after a training workshop on the operation of the upgrade equipment and software is held for the stations operators. In addition to the RT stations upgrade, an additional software package is presently being developed also with CIESM financial support, for quick in situ detection of various sea level based hazards and alert via the Internet, along the concepts presented by the author at the workshop held at the GLOSS X GE meeting. The software development is estimated to be completed and operational in fall 2009.

The MedGLOSS focal center at IOLR in coordination with CIESM and IOC/UNESCO and with MedGLOSS network member organizations carried out additional activities dedicated to the following main issues:

- Participation in International Activities related to coordination of sea level measurement, analysis, early tsunami warning with GLOSS, ESEAS, PSMSL, GCOS/WMO, CLIVAR and integration in larger observational activities such as MOON, GMES, GEOSS and ICG/NEAMTWS.
- Provision of sea level data to SEPRISE (Sustained Efficient Production of Required Information and Services within Europe) demonstrator for operational oceanographic services at Pan-European level, coordinated by EuroGOOS. The provision was carried out until July 2007, when the SEPRISE project demonstrator, coordinated by IFREMER ended.
- MedGLOSS coordinator participated in the 34<sup>th</sup> CIESM International Research Workshop, entitled "Towards an Integrated Mediterranean Marine Observatory" and at the European Sea Level Service Governing Board and workshop in May, 2008 at IOC headquarters in Paris.
- Operation and improvement activities of the MedGLOSS Internet web site (Internet address: <http://medgloss.ocean.org.il/>) included:
  - a. Improvement of security, data backup and capacity of the web site. MedGLOSS data base is currently being also upgraded to better cope with the large load of data and visits
  - b. Provision of technical and software information and/or assistance to the MedGLOSS near real time sea level stations in Malta, Cyprus, Constantza and Kacively and also to potential candidates for upgrading sea level stations in Tunisia, Egypt, Turkey, Greece (e.g. Univ. of Istanbul, Univ. of Crete, Nat. Observatory of Athens, etc.).

### **3. Future planned or contemplated activities:**

- a. Addition of existing and to be upgraded stations to NRT sea level network, in particular on the Southern coasts of the Mediterranean, provision of support for maintenance and operation of the existing stations and further development of the QC and data management capabilities of the MedGLOSS focal center.
- b. Continuation of discussions with MOON to determine best ways and terms of cooperation, and continued cooperation with ESEAS, whereas MedGLOSS plays also the linking role between the European stations network and the non-European Mediterranean and Black sea stations.
- c. Continuation of providing support to MedGLOSS members in the maintenance of the sea level stations and software as well as possible assistance for installation of new stations.
- d. Participation in the activities of the ICG/NEAMTWS for the implementation of the RT observing and warning system.
- e. Workshop for capacity building and coordination of sea level stations upgrading and networking in the Mediterranean and Black seas, including tsunami and other hazards detection and data dissemination. This meeting should also strengthen the commitment of MedGLOSS present and future members by the preparation of a members MOU agreement defining policies for data gathering, transfer, use and dissemination.
- f. Potential participation or cooperation with the HyMex project.
- g. Development of a new versions of Tide Tasks for Windows working in other languages than English (Spanish, French, Portuguese, Arabic), if funds become available.
- h. Seeking for funding to enable the above mentioned activities.

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