

UNESCO
Intergovernmental Oceanographic Commission (IOC)
Global Sea Level Observing System (GLOSS)

Technical Survey and Assessment Report
Alexandria (El Iskandariya), Egypt
29th October -2nd November 2006

Survey / report by:
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Disclaimer Note: Whilst every effort is made to be accurate in the report it is submitted with Errors and Omissions Excepted, E&OE.

1. Acknowledgements

With grateful assistance from staff at the National Institute for Oceanography and Fisheries (NIOF), Alexandria with particular appreciation to:

Professor Ahmed El Nemr, Head of the Egyptian National Oceanography Data Centre and OdinaAfrica Focal Point for Egypt.

Ahmed Radwan and Dr Maged Hussain from the Physical Oceanography Department at NIOF.

Professor Ahmed El Gindy, Physical Oceanographer at the Oceanography Department, Faculty of Science, University of Alexandria.

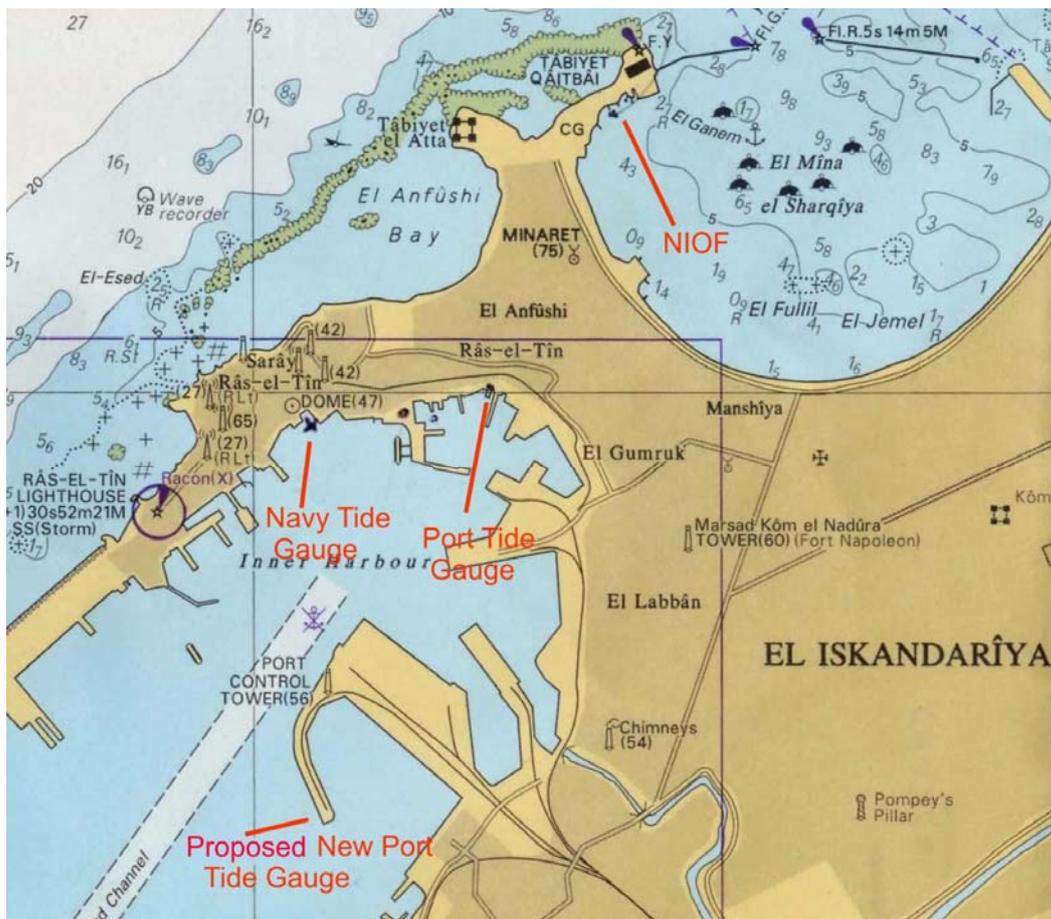


Figure 1. Alexandria (El Iskandariya) Western and Eastern Harbours with tide gauge locations and the location of NIOF. Chart source www.ukho.gov.uk

2. Summary

A technical survey of tide gauge systems in Alexandria, Egypt was carried out from 29th October -2nd November 2006. Alexandria (El Iskandariya) is the Mediterranean Port for Egypt with a large commercial Port at the Western Harbour and adjacent newer Port of Dekheila. The Eastern harbour is used for smaller fishing boats and recreational sailing/motor yachts.

The Mediterranean is referred to in Arabic as El Abiad Bahar, the White Sea with Alexandria often referred to as El Iskandariya.

The famous Pharos Lighthouse was situated at the North Western end of the eastern harbour. Near the site of the old lighthouse is Kayet Bay Fort. Immediately next to Kayet Bay Fort is the Alexandria Branch Office of the National Institute for Oceanography and Fisheries (NIOF), with the NIOF Aquarium and the Alexandria University Oceanography Department alongside. The NIOF - Egyptian National Oceanography Data Centre (ENODC) and NIOF Environmental Division are in another building 200m west of the NIOF Alexandria Branch Head Office.

A tide gauge has been in operation in the Commercial Port since approximately 1944 with a newer tide gauge operated by the Egyptian Navy Hydrographic Department since 1990. The Commercial Port is soon to replace their old tide gauge with a newer system. These locations are all in the Western Harbour (Fig.1.).

3. Mission Objectives

The IOC GLOSS mission to Alexandria, Egypt was to establish the following:

1. The status and history of existing tide gauge instrumentation.
2. Location of suitable sites for a new IOC GLOSS-OdinAfrica tide gauge.
3. Location of vertical survey datum benchmarks.
4. Photograph each location and collect relevant material.
5. Establish contact with relevant local staff.
6. Establish if power and telephone links are available on site.
7. Determine if tidal data exists after 1989 from Alexandria, Egypt.

4. Institutions visited

To assess the suitability and need for establishing a IOC / GLOSS sponsored OdinAfrica tide gauge at Alexandria the following institutes were involved with this technical survey;

4.1. National Institute for Oceanography and Fisheries

The National Institute for Oceanography and Fisheries (NIOF) are part of the Ministry of State for Scientific Research and has branch offices in Alexandria, Cairo, Hurghada and Suez City www.niof.sci.eg. With the Egyptian National Oceanography Data Centre (ENODC) at NIOF located at Alexandria <http://www.nodc-egypt.org> NIOF are responsible for promoting sustainable fisheries (marine and freshwater) monitoring marine and aquatic pollution and related research activities. NIOF have extensive laboratories and resources with two 31-metre survey vessels. NIOF have a department concerned with marine geological and geophysical investigations / research related to natural resources and marine seismic activities.

4.1.1. Egyptian National Oceanography Data Centre

The Egyptian National Oceanography Data Centre (ENODC) at NIOF has a modern suite of PC computers networked with ADSL (Broadband), printers and scanners <http://www.nodc-egypt.org>. Professor Ahmed El Nemr, Chemist and OdinAfrica focal point for Egypt is the head of this centre. It is proposed that an OdinAfrica tide gauge could be linked to the data centres ADSL server (approximately 200m from the proposed tide gauge site).

4.1.2. Marine Geology and Geophysical Department

Professor Morad Bacily Awad is head of department and has research interests in seismic tsunami activity in the Mediterranean and Egypt. Dr Amr Z Hamouda a fellow researcher has recently published a paper concerned with modelling of tsunami in the Mediterranean- 'Numerical computations of 1303 tsunamigenic propagation towards Alexandria, Egyptian Coast. Journal of African Earth Sciences 44 (2006) 37-44'. Indicating that in the year 1303, the event that damaged Egypt resulted in a 9m Tsunami wave at Alexandria arriving at around 40 minutes from the earthquake source (just south east of Crete). This work will help promote awareness of the risk of Tsunami in the Mediterranean and Alexandria and the need for a network of Tsunami active tide gauges as part of a Mediterranean Tsunami Warning System.

4.2. University of Alexandria Oceanography Department.

Prof. Mohammed M Dorgham (Fig.2) is the Chair/Head of the Oceanography Department and a Professor in Biological Oceanography and Marine Ecology. Professor Ahmed El Gindy is the Physical Oceanographer and through students / colleagues research papers has documented the physics of the local tides and atmospheric influence in Alexandria and the Eastern Mediterranean. The list of relevant papers is provided in the appendices. The University has relied on tidal data from the Commercial Port of Alexandria and the Egyptian Navy Hydrographic Department.



Fig.2. University Professors (L-R): Hassan Awad, Ahmed El Nemr (NIOF), Ahmed El Gindy, Mohammed M Dorgham and Abdel-Fattah El Sayed.



Fig.3. University of Alexandria, Oceanography Department (undergoing major renovations) adjacent to NIOF.

4.3. Egyptian Navy Hydrographic Department.

Commodore Ehab El Bannan is the Hydrographer of the Egyptian Navy and Director of the Egyptian Navy Hydrographic Department (ENHD). They are responsible for the production of navigation charts for Egyptian territorial waters in the Mediterranean, Red Sea. ENHD works closely with the International Hydrographic Organisation (IHO) and the International Maritime Organisation (IMO). They have a department of Oceanography and Meteorology and operate tide gauges in the Red Sea and Mediterranean.

5. History of Alexandria Sea level measurements

At present there are two operational tide gauges in the Western Harbour of Alexandria (Figure 1).

The Hughes mechanical / float tide gauge maintained by the Commercial Port of Alexandria - Marine Survey Department part of the Port Engineering Department, has been in operation since 1944 and is still in daily use.

This tide gauge is documented in the data holdings for PSMSL www.pol.ac.uk/psmsl and referred to as station code 330/071, where PSMSL have hourly data and monthly means from 1944-1989.

This tide gauge has provided the existing data for Alexandria, which has been extensively analysed by researchers in the University. Particularly by Professor Ahmed El Gindy and Professor Dr Zinab Abdel Aziz Moursy - now at NIOF (Phd Thesis, 1989, Meteorological Aspects of Storm Surges at Alexandria Coastal Waters, Alexandria University), refer to appendices.

Data for this tide gauge from 1944-1989 was provide to PSMSL by Dr Omran E. Frihy of the Coastal Research Institute, Alexandria. This data was monthly means of Mean Sea Level (MSL). No recent contact has been established with Dr. Omran E. Frihy or the Coastal Research Institute during this GLOSS survey. Hourly observations (1944-1989) were provided by a student from Alexandria who was on a research assignment with POL / PSMSL in the late 1980's.

The Port of Alexandria - Marine Survey Department is to install a new tide gauge and meteorology system in the Western Harbour (Fig.1.) in late 2006 - no details of the system is presently available. This will be documented in a follow up report.

There was mention in 2000, from a Dr Gomaa Dawod of the Survey Research Institute / National Water Research Centre from Giza (near Cairo) that they had plans to install a pressure tide gauge in Alexandria. However this has not been confirmed during this GLOSS survey or renewed contact established with the Survey Research Institute / National Water Research Centre since 2002.

A more recent pressure tide gauge operated by the Egyptian Navy was installed in 1990. The tide gauge is an Aanderraa pressure transducer system replacing an older Interocean pressure transducer tide gauge. Details of this system and data will be available in a future report.

6. Existing gauges in Alexandria

6.1. Port Tide Gauge

At the Commercial Port in the Western Harbour, a Hughes (London) mechanical / float tide gauge (Fig.2) is still in daily operation and is maintained by the Port Marine Survey Department which is under the authority of the Port Engineering Department. The head of this Port Marine Survey Department is Engineer Zaghlol. Tabulated data sheets for each month with half-hourly observations exist from 1982 to 2006.

This is the same tide gauge inspected by Alan Browell in 1987 (UNESCO IOC Technical Survey) This is a large format (0.5m) clockwork drum chart recorder with a float / stilling well. The float is linked to the chart recorder by a metal tape with holes and toothed pulley. This gauge was installed in around 1944.



Fig.2. Port Tide Gauge installed in 1944. Manufactured by Hughes, London.



Fig.3. Adjacent tide staff and stilling well used to calibrate the tide gauge.

The Port Marine Survey Department changes the data sheets daily and tabulates the data in hand written Arabic numerals. Calibration is made with a nearby tide staff in a protected stilling well chamber outside the tide gauge cabin (Fig.3). The tide gauge stilling well is linked to the open seawater by a submerged pipe, which dampens any surface / wind wave oscillations except the harbour seiche. No information was available on the relationship between the tide staff and nearby benchmark. This will be resolved with the Port Marine Survey Department Staff and Egyptian Navy Hydrographic Department in the near future with a follow up report.

6.2. Egyptian Navy Hydrographic Department Tide Gauge Network

A tide gauge operated by the Egyptian Navy Hydrographic Department (ENHD) was installed at the Western Harbour of Alexandria, in 1990. The tide gauge (Fig.1.) is an Aanderra pressure transducer system replacing an older InterOcean pressure transducer tide gauge. Details of this system and data will be available in a future report.

A brief meeting with the ENHD established that they maintain a comprehensive network of tide gauges in the Red Sea and Mediterranean. Further details and data will be available to GLOSS / OdinAfrica in the future as a follow up report after formal links between the ENHD and IOC/GLOSS have been established.

6.3. Proposed New Commercial Port Tide Gauge

The Port Marine Survey Department part of the Engineering Department of Alexandria Commercial Port are to install a new tide gauge/meteorology station in the Western Harbour in late 2006. No details are presently available. The proposed location is indicated in Figure 1. This system is to replace the old Port tide gauge installed in 1944.

7. Bench marks and datums

A survey benchmark (BM) is located next to the old 1944 Hughes Commercial Port Tide Gauge in the Western Harbour.

In 1986 a new benchmark was established in the Port by a US company involved with a Sewage Discharge Project this has subsequently been used by the Navy for a tide gauge reference level and is near the newer Navy tide gauge.

It is necessary to link these BenchMarks with the proposed OdinAfrica tide gauge in the Eastern Harbour at NIOF providing a common reference datum. The Navy has offered assistance with this work and the services of the Institute of Land Survey. NIOF do not presently have an automatic 1st order survey level for this levelling which would need to be carried out on a regular basis to check on Benchmarks.

The distance from the Port Tide Gauge / BM to the proposed tide gauge site at NIOF is 1500 metres so a closed level loop of 3km will be required.

In 2002, Dr Gomaa Dawod from the Coastal Research Institute / National Water Research Centre, provided details of the local datums to PSMSL/GLOSS. Where Mean Sea Level (MSL) was determined from 1898-1906, which corresponded with the tidal staff reading of 33.8cm. This MSL is called Survey Dept Zero Level Datum or '1906' Datum.

The information from this visit indicate the 'Zero Level' height above Chart Datum is 34cm and Chart Datum is defined as equivalent to Mean Low Water Springs (MLWS) as determined from 1938-2006.

This implies that the difference between MSL and MLWS is 33.8cm (34cm)? This needs to be checked with the Institute of Land Survey and the Egyptian Navy Hydrographic Department.

Details of the exact locations and vertical levels of these benchmarks are presently not available and will need to be documented by NIOF with assistance from the Navy, the Institute of Land Survey and the Port Marine Survey Department as a follow up report for GLOSS/OdinAfrica. This should be considered as a priority before any new OdinAfrica installation.

7.1. Port Tide gauge calibrations.

The Port calibrates (daily) the Hughes 1944 tide gauge paper trace to the tide staff reading on the adjacent tide staff in the protected stilling well nearby (Figs.2, 3). There is an adjacent tide gauge Benchmark (BM), which NIOF and the ENHD are to document and photograph for GLOSS. *No details where available during the visit by the NIOF staff.*

With reference to Figure 3, the water level at the time of the photograph was near to 60cm on the tide staff at 1.20pm local time (GMT+2) on Wednesday November 1st 2006. The top of the staff is 125cm (in Arabic numerals) and the graduations appear to be every 2cm.

8. Tides and seiches

The Western Harbour of Alexandria Port exhibits a seiche (surface oscillation) with a period of around 60 minutes, this is common in Mediterranean Ports. El-Gindy A.A.H. (1986) has documented this seiche event in the Western Harbour. This seiche can be clearly seen on the tidal trace of the Port Tide Gauge, Fig.2. It is highly likely that a seiche exists in the semi enclosed Eastern Harbour but no research is available at present and could be a topic for investigation by the University, EHND and NIOF.

The mean spring tidal range of the eastern Mediterranean is of less than 0.5m amplitude and it is likely that there is little significant tidal variation between the eastern and western harbours.

9. Existing data availability

POL PSMSL www.pol.ac.uk/psmsl has hourly data with monthly means from 1944-1989 for Alexandria (PSMSL code 330/071).

Refer to: http://www.pol.ac.uk/psmsl/psmsl_individual_stations.html.

The University of Alexandria, Oceanography Department has tidal records from the Port Tide Gauge on typed sheets but not all in digital format and would require some effort to enter into a computer data file. Professor El Gindy has these typed data sheets/digital files up to 2005. It is not clear how much data is already in digital format or only paper sheets.

With permission from the Egyptian Navy Hydrographic Department (ENHD) it may be possible to access their tide gauge digital tidal data from 1990 to present date in hourly data or monthly means to establish a continuous unbroken record from 1944 to present data.

10. Use of sea level data

Tidal data is of great importance to present understanding of sea level rise and global warming. The Global Sea Level Observing System (GLOSS) promotes the development of global sea level monitoring with the use of tide gauges and related training, publications and workshops. GLOSS helps to promote data sets to be available in near real time for the purposes of calibration of satellite altimetry, ocean circulation models and a service to the various governments' hydrographic services for maritime safety and navigation. OdinAfrica forms a regional network of such tide gauges and promotes the observation, analysis and archive of marine science data and information. The Mediterranean has active seismic regions and a history of Tsunami. Tide gauge data with near real time systems can form part of Tsunami warning systems and modelling of Tsunami.

11. An OdinAfrica/GLOSS sponsored tide gauge in Alexandria

GLOSS through the OdinAfrica program are promoting the use of tide gauge systems that provide near real time data access using satellite communications with digital data recording capability and new radar/pressure water level sensors. This improves reliability and minimises maintenance.

To avoid potential access problems into the Western Harbour Commercial Port it has been recommended by NIOF and the University Oceanography Department that a new OdinAfrica/GLOSS tide gauge be installed on the sea wall at NIOF head office in the inner Eastern Harbour at Moharem Bey (Fig.1).

The site is very secure with no public access with a suitable vertical concrete wall (Fig.4) with adequate water depth (1.6m). The offices of NIOF and the University Oceanography Department overlook this location (Fig.5).

Electrical power is available and an ADSL/Broadband link is possible to the NIOF/ENODC data centre (200 metres away). The tide gauge data logger cabinet can be next to the tide gauge sensors or installed inside/outside the NIOF meeting room (Fig.5) requiring a signal cable run of 31m to the tide gauge.



Fig.4. Sea wall in front of NIOF Head Office with the suitable tide gauge location. (L-R) Ahmed Radwan, Tarek El Gezary, Dr Maged Hussain, Prof. Ahmed El Nemr.



Fig.5. View of NIOF from the adjacent University Building with the sea front location proposed for the OdinAfrica Tide Gauge. Separate NIOF meeting room at end of grass lawn-proposed site for data logger/solar panel.

12. Automated Weather Station Upgrade

The automatic weather station on the roof of the University Oceanography Department provides wind speed, direction and air pressure/temperature and is useful as a teaching aid for the University and provides real time data for harbour Seiche research (Figs.6, 7). An upgrade to this old system is an option and has been requested by the University Department of Oceanography, as funds are limited for new equipment. The present system is a Babuc/ABC system from Lsi-Lastem from Milan in Italy <http://www.lsi-lastem.it>

However, local and regional weather station data can be obtained from both the European Centre for Medium-Range Weather Forecasts www.ecmwf.int and the National Weather Service – National Centers for Environmental Prediction www.ncep.noaa.gov These sources have access to meteorological station observations from Borg El Arab airport 60km west of Alexandria. However a local real time system for maritime observations would prove useful and assist with local research / teaching.

A new system can be stand alone or interfaced into the tide gauge data logger with data available via satellite / Internet. The replacement weather station could be on the roof of the University building which would only be 100 metres from the proposed tide gauge site at NIOF or on the top of the NIOF office (approximately 30 metres from the proposed tide gauge site).



Fig.6. University Automatic Weather Station
Note: Building renovations in progress.



Fig.7. Weather Station sensors

13. Conclusions and Recommendations

The Commercial Port of Alexandria are to install a new tide gauge / meteorology system in the Western Harbour. No information is presently available on the specifications or exact location other than that indicated in Figure.1. This may provide adequate tidal data for GLOSS/OdinAfrica and future research by NIOF and the University. However it is very unlikely that data will be available in near real time via satellite or telephone modem as with other OdinAfrica ongoing installations.

As an alternative it has been recommended that an OdinAfrica tide gauge be installed in the Eastern Harbour next to the NIOF head Office. This recommendation was approved by NIOF, The University and the Egyptian Navy Hydrographic Department. Furthermore Alan Browell in 1987 (UNESCO IOC Technical Survey) provided the same recommendation.

Access to the Commercial Port / Navy tide gauges in the Western Harbour is restricted and would cause delays during installation, routine maintenance or inspections / calibrations of an OdinAfrica tide gauge hence the preferred location in the Eastern Harbour.

The location at NIOF (Eastern Harbour) has a suitable concrete sea wall, electrical power and telephone /ADSL options. The data logger can be installed inside/outside the NIOF meeting room with the satellite antenna/solar panels on the roof. The location is very secure and not exposed to storm waves as it is on the southern facing side of the inner shore of the Eastern Harbour.

The University and NIOF are keen to support the proposal of an OdinAfrica tide gauge and the President of NIOF Professor Soliman Hamad Abdel Rahman is happy to provide all necessary assistance. The Egyptian Navy Hydrographic Department indicated that although they have a tide gauge in the Western harbour they are more than happy to provide assistance to GLOSS/OdinAfrica and NIOF. The University indicated they would benefit from an additional source of tidal data, which would help student research work.

Dr Maged Hussain and Ahmed Radwan both with the Oceanography Department at NIOF (Alexandria) are ideal candidates who could be responsible for the OdinAfrica tide gauge. They both have oceanographic equipment technical and computing experience. Ahmed Radwan is presently completing a Phd thesis related to meteorological influence on tidal variations in the Suez Canal/Red Sea. Dr Maged Hussain has specialised in remote sensing and coastal zone management.

The option to upgrade / replace the existing Automatic Weather Station at the University needs to be considered. This could be either a stand alone system independent from the tide gauge system or integrated with the tide gauge data logger and data satellite transmissions.

Tidal data after 1989 could be obtained from the Commercial Port Tide Gauge installed in 1944 presently in the form of paper charts and tabulated half-hourly data sheets (available for 1982-2006).

The University has tidal data from the Commercial Port Tide Gauge up to 2005 on paper data sheets and some in digital format and would provide data for the period from 1989 to 2005/6.

Both of these of data sets would require some effort to enter into digital form.

Alternatively the ENHD could provide digital data from their tide gauge from 1989/1990 to present date, however this will require formal correspondence from IOC / GLOSS to the Hydrographer of the Egyptian Navy, Commodore Ehab El-Bannan of the Egyptian Navy Hydrographic Department (ENHD).

14. Suggested Actions for IOC / GLOSS

1. Establish closer links with the Egyptian Navy Hydrographic Department (ENHD) to promote GLOSS and OdinAfrica in collaboration with NIOF and the University of Alexandria. This will help with access to digital tidal data from the ENHD and any assistance needed with establishing an OdinAfrica tide gauge at Alexandria.
2. Source existing tidal data from the Commercial Port Marine Survey Department and the University of Alexandria Department of Oceanography.
3. Determine details/history and locations of Benchmarks next to tide gauges in Western Harbour and establish new benchmarks around the area for the proposed OdinAfrica tide gauge as necessary. The ENHD along with the Commercial Port Marine Survey Department and the Institute of Land Survey will need to be contacted by NIOF /GLOSS.
4. Determine details of proposed Commercial Port Tide Gauge and suitability for GLOSS/OdinAfrica.

APPENDICES.

Annex 1. UNESCO Publications

Report on Tide Gauge Stations in Egypt and the Sudan, Alan Browell, 1987, UNESCO Contract 240-609-7. PDF file available at <http://www.pol.ac.uk/psmsl/training/gloss.pub.html>

Annex 2. National Institute for Oceanography and Fisheries

NIOF website <http://www.niof.sci.eg>

ENODC-NIOF <http://www.nodc-egypt.org>

Annex 3. Alexandria / Dekheila Ports

www.mts.gov.eg

www.emdb.gov.eg

www.alexportic.net

www.apa.gov.eg

Annex 4. NIOF Publications

Hamouda A.Z. 2006. Numerical computations of 1303 tsunamigenic propagation towards Alexandria, Egyptian Coast. Journal of African Earth Sciences 44 (2006) 37-44.

Annex 5. University of Alexandria Research Papers / Thesis

Hamed A.A. and El-Gindy A.A.H. (1988). Storm surges generated by winter cyclones at Alexandria Egypt. International Symposium on variational methods in geosciences, 14-17 October, 1985, at Oklahoma University. International Hyd. Rev Jan. 1988.

El-Gindy A.A.H. (1986). Investigation of the high frequency oscillations of the sea level in the Western Harbour of Alexandria, Egypt. Bull. Instit. Ocean. & Fish. A.R.E. **12**, pp127-134.

El-Gindy A.A.H. and Eid F. (1990). Long term variations of monthly mean sea level and its relation to atmospheric pressure in the Mediterranean Sea. Int.Hyd. Rev., Jan. 1990, LXVII (1), pp. 147-159

El-Gindy A.A.H., Sharaf El-Din S.H. and Z.Moursy (1992). Forecasting of the storm surge in winter at Alexandria (Egypt). Accepted for publication, Faculty of science Bulletin, Qatar University, pp. 239-244.

Sharaf El-Din S.H., El-Gindy A.A.H. and Moursy Z. (1992). Statistical Analysis and Distribution Models of surge random data at Alexandria (Egypt).Proceedings of the third International Conference on " Environmental protection is a must", Alexandria University, 13-15 April 1992, pp. 57-75.

El-Gindy A.A.H., Sharaf El-Din S.H. and Moursy Z. (1993). The surge variability and its relation to meteorological conditions at Alexandria, Egypt. The XXXII nd congress and plenary assembly of the CIESM, Greece., Proceedings of the third International Conference on " Environmental protection is a must", Alexandria University, 13-15 April,1992, pp. 41-56.

El- Gindy A.A.H and Moursy Z. (1996) Sea level changes, tide and surges at Borollus and Ras El- Barr along the Mediterranean coast of Egypt. Proc. of the International Workshop on MED & Black Sea ICZM, November 2-5, 1996, Sarigerme. Turkey, E. Ozhan (Editor), PP. 343- 355.

Emirate Professor Dr Zinab Abdel Aziz Moursy at NIOF, Alexandria
(Phd Thesis, 1989. Meteorological aspects of Storm Surges at Alexandria Coastal Waters, Alexandria University).

Annex 6. For Reference: Standard and Secondary Ports

With reference to the United Kingdom Hydrographic Office www.ukho.gov.uk Admiralty Tide Tables, for the Mediterranean Sea; all the Ports are referenced to the tide at Gibraltar as the Standard Port and

as such are all referred to as Secondary Ports. The convention adopted by UKHO is to give time and height differences of the spring/ neap tide, i.e. MLWS, MHWS, etc.

Annex 7. Contacts

1. National Institute for Oceanography and Fisheries (NIOF)

Address: Kayet Bay, El Anfoushy, Alexandria, Egypt, <http://www.niof.sci.eg>

NIOF Senior Staff

Professor Soliman Hamad Abdel Rahman: President.

Prof. Mohammed Attia Shridah: Vice President

Dr Mohammed Shata: Director of Alexandria Branch: (Oceanographer / Marine Geologist).

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3. Egyptian Navy Hydrographic Department ENHD

Commodore Ehab El-Bannan.
Hydrographer of the Egyptian Navy
Director of the Egyptian Navy Hydrographic Department ENHD
Ras El Tin, Alexandria.

4. Commercial Port

Western Harbour, Alexandria.
Port Marine Survey Department - Head of Department is Engineer Zaghlol.
Notes: Contact NIOF for address details.
The Port Marine Survey Department is part of the Port Engineering Department.

5. Institutes / people previously involved with GLOSS / PSMSL

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