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Training Program in Coastal oceanography of southern Caspian Sea: Forcing and Structure

Under the auspices of
Partnership for Observation of the Global Oceans (POGO)

in association with
Iranian National Centre for Oceanography
School of Environmental Systems Engineering, The University of Western Australia

Venue: Iranian National Centre for Oceanography, Tehran, Iran

1 – 15 December 2007

Final Report:

The POGO training program on '*Coastal physical oceanography of the Caspian Sea*' was held in Tehran, Islamic Republic of Iran from 1 to 15 December 2007 in collaboration with the Iranian National Centre for Oceanography (INCO). A total of 16 trainees participated with 8 from INCO and 8 from Institutions external to INCO. A list of students is provided as Appendix A

The training consisted of a series of formal lectures in the morning hands on training in the use of MATLAB in the analysis of physical oceanographic data sets obtained by INCO from the southern Caspian Sea. The data were analysed as 5 group projects which covered meteorological, sea level, currents (as 2 groups for RCM and ADCP) and CTD data. The training schedule is given as Appendix B and the trainee groups as Appendix C.

The formal lectures included an Introduction to physical oceanography with an emphasis on continental shelf processes. The lecture schedule is presented on Appendix B. All students received copies of lectures (which were all presented in MS Powerpoint) on a CD as well as all resource material (Matlab programs, Text book on Physical Oceanography by R.W. Stewart in pdf format). A graphical user interface (GUI), developed as part of the Nippon Foundation/POGO project (Sri Lanka, 2006) to analyse sea level data – data sets from the northern Arabian Sea and the Persian Gulf were used to examine storm surges, tidal characteristics and tidal harmonic analysis was also included in the CD. At the conclusion of the training all trainees were given a package containing a CD which included all the data, programs (Matlab routines) used during the training. This ensured that all students had equal access to programs and data for the future.



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WESTERN AUSTRALIA

The Matlab tutorial included the use of SEAWATER package developed by CSIRO Australia to calculate physical properties of sea water, including a tutorial for oceanographers which used Matlab to display temperature, salinity contours as well as the calculation of geostrophic currents from CTD transects.

INCO had collected a series of oceanographic measurements consisting of currents (ADCP and RCM moorings), CTD and meteorological data from the southern Caspian Sea (Figure 1). The study area was located at $36^{\circ} 42'$ and $52^{\circ} 33'$ and covered a band of coastal waters of length 24 km and width 12 km (Figure 1). Babolrood River is located in the east and Port Freidoonkenar is located at the centre of the study area. Within the study region, the continental shelf had a width of ~ 10 km. The depth from shoreline increases gently to 45 m near the shelf break and increases rapidly to 400 m in the next 8 km. The data spanned the period of summer to autumn of 2003. The group projects examined these data sets with the aim of understanding the forcing mechanisms of the coastal circulation. In the absence of any tidal effects (Figure 3), the dominant forcing mechanism is wind and three different forcing 'regimes' were identified: (a) sea breeze regime, where the winds force the currents at the diurnal frequency and in the absence of tides this is the 'regular' background forcing of the currents; (2) direct forcing by wind, where the local winds resulted in strong currents flowing shore parallel from west to east. Here there was a direct correspondence with the local winds and currents; and, (3) remote forcing by wind where strong winds at a remote location generated a continental shelf wave which travelled along the coast from east west. Here, there was a no correspondence with the local winds and currents and the currents exhibited a 'wave' with current reversals: initially currents flowed from east to west and then reversed to the opposite direction. The results of some of the field data analyses are currently being considered for publication in a journal in collaboration with INCO staff.

The students who participated in the course had varied backgrounds. All students had formal training (including PhD's) in related fields such as marine structures, coastal engineering and hydraulics but not in coastal physical oceanography. However, all the participants had a very good command of English and were experienced in the use of Matlab. For all of the students this was the first time that they had participated in a training program which covered theoretical, field data collection and data analysis and presentation in coastal physical oceanography. The feedback from the students was that the training was immensely beneficial to them as (1) the theory explained quite a few phenomena which they had observed but lacked the knowledge to explain; and, (2) data analysis techniques using Matlab provided skills in data processing and presentation. In summary, the students were exposed a range of skills and experiences which will help with their own work.

Finally, I would like to acknowledge the support of POGO through Dr Shubha Sathyendranath and the excellent organisation of the training program venue and associated facilities by the INCO staff.

C Pattiaratchi

POGO Visiting Professor to Iran 2007.

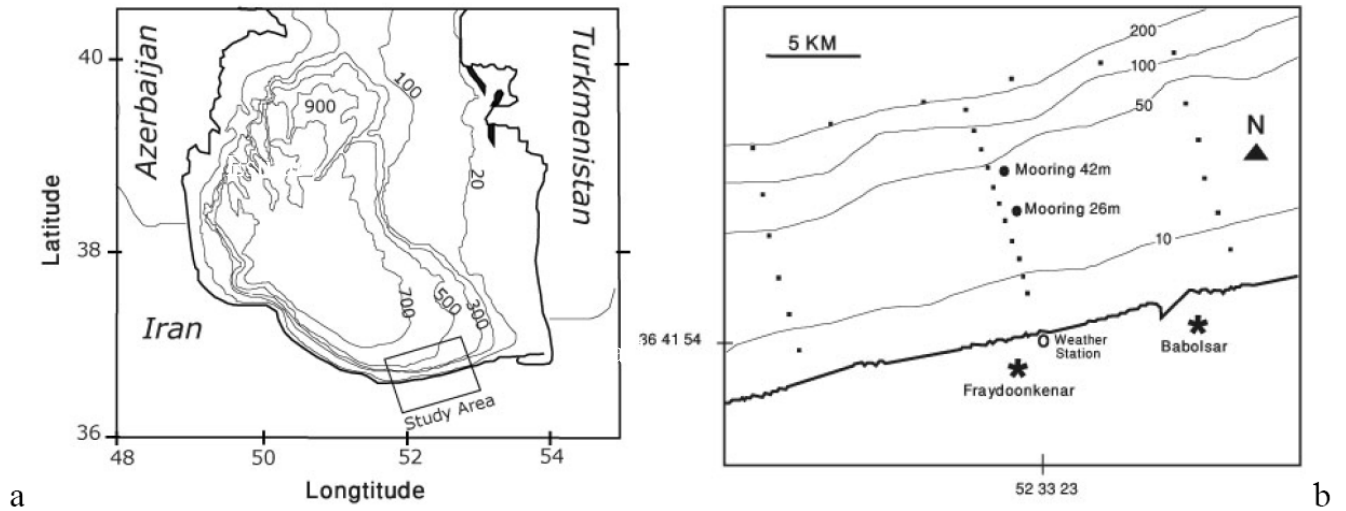


Figure 1- Location of (a) study region in the southern Caspian Sea; and (b) CTD sampling stations moorings and meteorological station

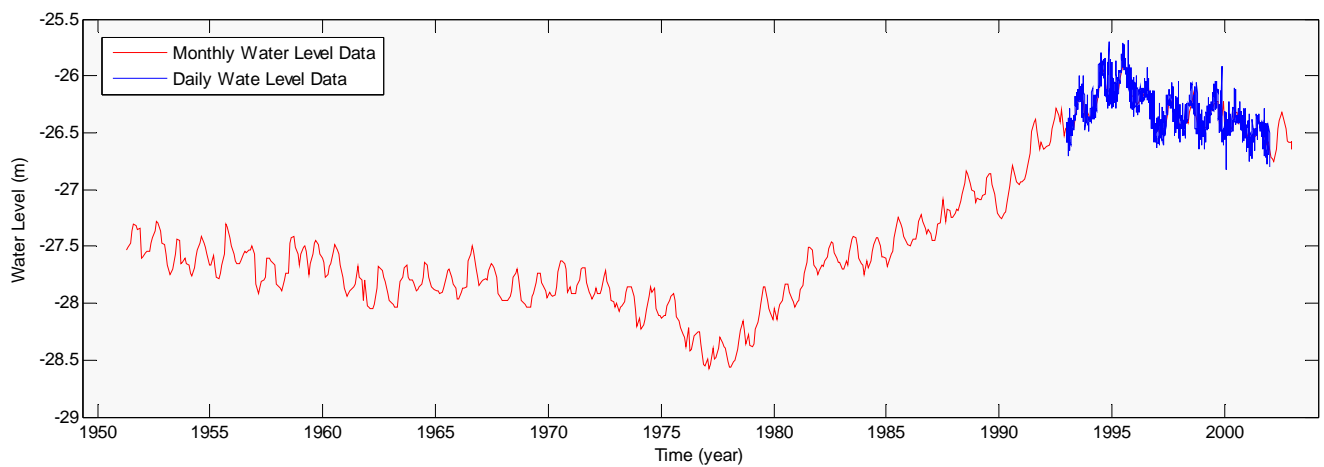


Figure 2 - Time series water levels in the southern Caspian Sea showing the longer-term changes in the mean sea level.

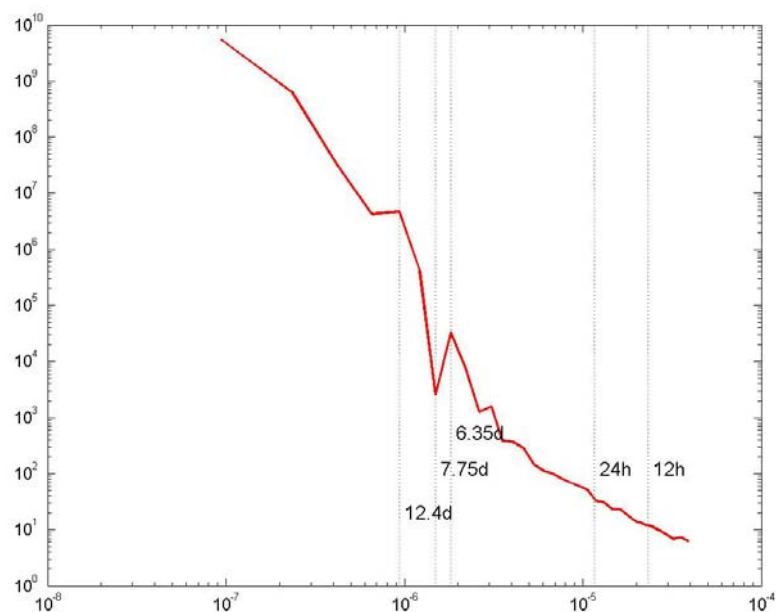


Figure 3 – Power spectrum of the sea level record (sampling interval = 3hours) showing the absence of energy in the tidal band but substantial energy in the ‘weather’ band.

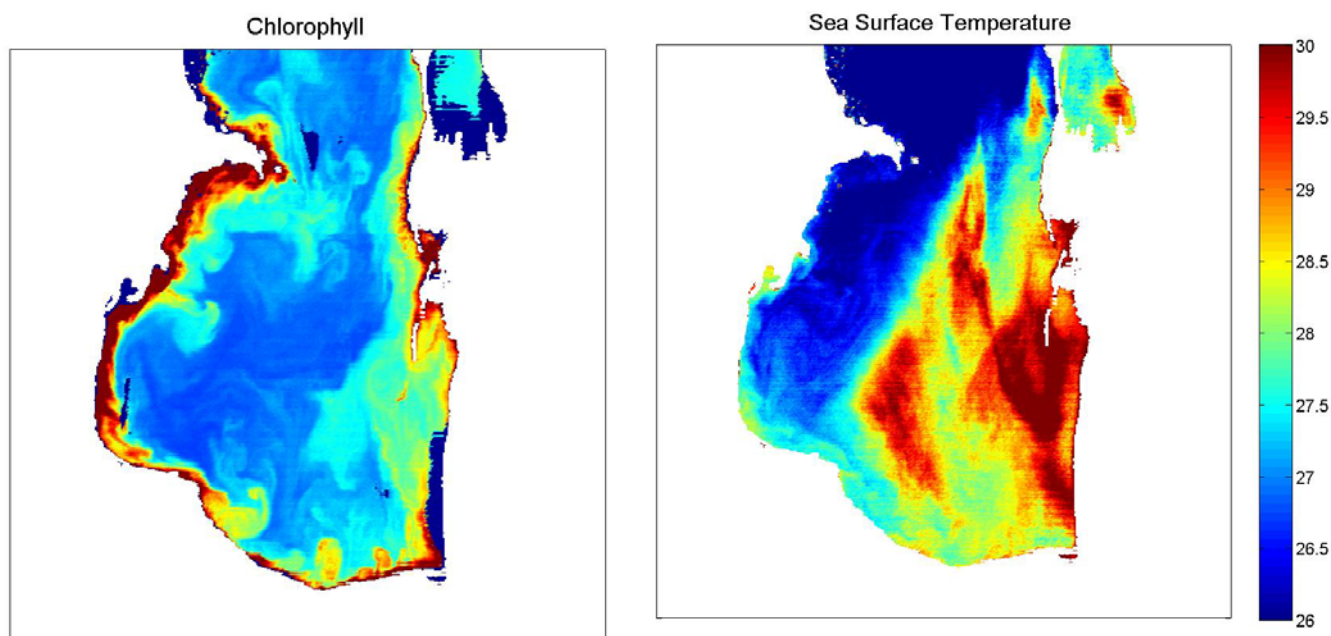


Figure 4 – MODIS images of Chlorophyll a and sea surface temperature obtained on 9 August 2003 coinciding with the period of data collection

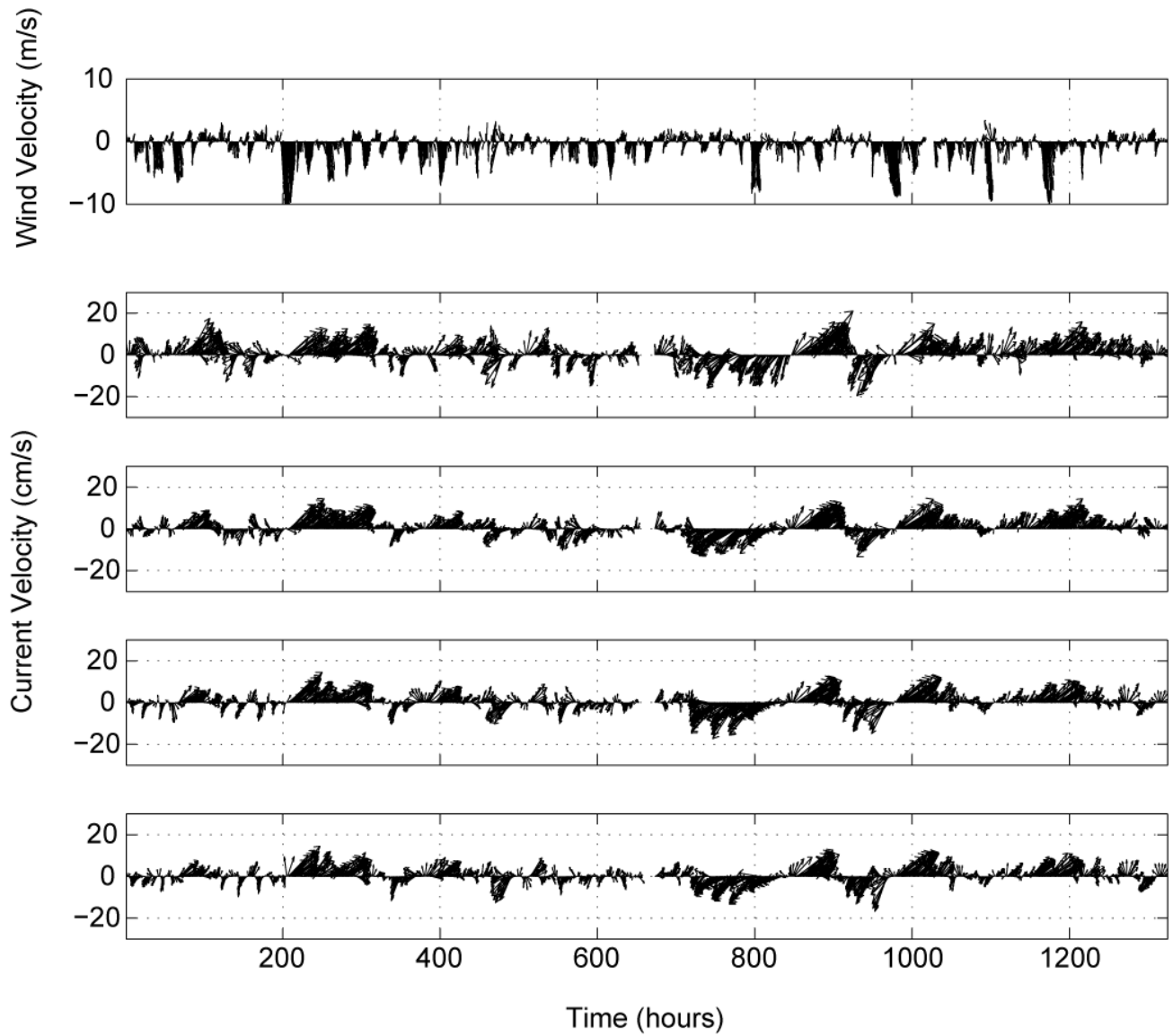


Figure 5 – Time series of winds and currents at different levels (measured by ADCP). The currents are ‘event’ driven – some of the events are related to local wind events whilst others are generated by remote influences.

APPENDIX A: Student List for POGO Training programme – Iran (2007)

Participants of the Workshop on: “Coastal Oceanography in the Southern Caspian Sea, Forcing and Structure”

No	Name/ Surname	Organization	Field of Study	Email
1	Dr. Mahmood Reza Akbarpour Jannat	Iranian National Center for Oceanography	Coastal Civil Engineering	akbarpour@inco.ac.ir mahmood_akbarpour@yahoo.com
2	Dr. Aliasghar Golshani	Iranian National Center for Oceanography	Coastal Engineering	agolshani@hotmail.com
3	Dr. Peyman Eghtesadi-Araghi	Iranian National Center for Oceanography	Chemical Oceanography	peghtesadi@gmail.com
4	Mr. Peygham Ghaffari	Iranian National Center for Oceanography	Physical Oceanography	ghaffari@inco.ac.ir
5	Mr. Siamak Jamshidi	Iranian National Center for Oceanography	Physical Oceanography	jamshidi@inco.ac.ir
6	Mr. Majid Noranian Isfahani	Iranian National Center for Oceanography	Physical Oceanography	m_isfahani@inco.ac.ir
7	Mr. Saeed Sanjani	Iranian National Center for Oceanography (Chabahar Research Station)	Physical Oceanography	saeed_sanjani@inco.ac.ir
8	Mr. Kaveh Pourkiani	Iranian National Center for Oceanography (Bandar Abbas Research Station)	Physical Oceanography	kpourkiani@yahoo.com



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9	Mr. Ali Khosh kholgh	Tehran University (Student) Iranian National Center for Oceanography	Hydraulic Structures	khosh@uc.ac.ir
10	Mr. Rohollah Amirabadi	Tehran University (Student), Iranian National Center for Oceanography	Marine Structures	amirabadi82@gmail.com
11	Dr. Seyed Ali Azarmsa	Tarbiat Modares University	Coastal Engineering	sazarmsa@gmail.com
12	Mr. Daryoush Mansouri	Tarbiat Modares University	Marine engineering- Ship Structure	dariusshm127@yahoo.com
13	Miss Tayebah Sadat Tajalli Bakhsh	Faculty of Natural Resources and Marine Sciences- Tarbiat Modares University (Student)	Physical Oceanography	tajallibakhsh@yahoo.com
14	Mr. Mohammad Reza Khalilabadi	Hydrophysics Research Center	Physical Oceanography	khalilabadi@hotmail.com
15	Mr. Mostafa Nazarali	Pooya Tarh Pars consulting engineering company	Marine Structures	mostafa.nazarali@gmail.com
16	Dr. Amir Houshang Nezamivand Chegini	Guilan University	Hydraulic Structures	ahnchegini@yahoo.co.uk



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APPENDIX B: TIMETABLE – Lectures

Date	0900-1015	1045-1200	1330-1500	1530-1700
2 December	Introduction	Instrumentation	Time Series Analysis	Equations of motion
3 December	Currents without friction (Inertial and Geostrophic)	Currents with friction, upwelling, Ekman dynamics	Atmospheric circulation	Physical properties of sea water
4 December	Storm surges	Continental shelf waves	Matlab tutorial on sea level data analysis	
5 December	TS Diagrams and water masses	Ocean Oscillations (ENSO, NAO, IO di-pole etc)	Group projects	
6 December	Continental Shelf processes : vertical mixing and fronts	Group projects	Group projects	
9 December	Water Level variability from Seiches to Centuries	Group projects	Group projects	
10 December	Tsunamis	Group projects	Group projects	
11 December	Continental Shelf processes off Western Australia	Group projects	Group projects	
12 December	Air-Sea Fluxes	Group projects	Group projects	
13 December	New Instrumentation techniques (HF Radar, ARGO, Ocean Gliders)	Marine Acoustics	Group projects	
15 December	Group projects: Presentations	Group projects: Presentations	Closing ceremony, Award of Certificates	

APPENDIX C: List of Group Projects

Participants of the Workshop on: “Coastal Oceanography in the Southern Caspian Sea, Forcing and Structure”

	Name/ Surname	Field of Study	Group
1	Dr. Mahmood Reza Akbarpoor Jannat	Coastal Civil Engineering	CTD Data
2	Dr. Ali Asghar Golshani	Coastal Engineering	CTD Data
3	Mr. Saeid Sanjani	Physical Oceanography	CTD Data
4	Roohollah Amirabadi	Marine Structures	
5	Tayebe Sadat Tajali Bakhsh	Physical Oceanography	CTD Data
6	Dr. Seyyed Ali Azarmsa	Coastal Engineering	Water level
7	Mohammadreza Khalil Abadi	Physical Oceanography	Water level
8	Mostafa Nazar Ali	Marine Structures	Water level
9	Dr. Amir Hushang Nezamivand Chegini	Hydraulic Structures	ADCP Data
10	Dariush Mansoory	Marine engineering- Ship Structure	ADCP Data
11	Kaveh Poorkiani	Physical Oceanography	ADCP Data
12	Siamak Jamshidi	Physical Oceanography	ADCP Data
13	Peygham Ghaffari Nuran	Physical Oceanography	Weather Data
14	Majid Nooranian Esfehani	Physical Oceanography	RCM
15	Dr. Peyman Eghtesadi	Chemical Oceanography	CTD Data
16	Ali Khosh kholgh	Hydraulic Structures	RCM