A Practical Educational Experience in Estuarine and Coastal Fluid Dynamics

W.R. Geyer
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
phone: 508-289-2868 fax: 508-457-2194 e-mail: rgeyer@whoi.edu

Award # N00014-03-10870

LONG-TERM GOALS

To conduct a class that will provide a formative educational experience for a group of graduate students who will likely be among the leaders in coastal and estuarine physical oceanography in the future.

OBJECTIVES

The objectives of this program were:

- to provide the students a strong theoretical background in coastal and estuarine processes;
- to give the students field experience with modern methods of oceanographic measurements;
- to instill a commitment to high-quality research to the next generation of oceanographers.

APPROACH

The Principal Investigator's taught a 5-week intensive Summer School course on estuarine and coastal fluid dynamics, emphasizing the interactions of buoyancy, rough topography, and mixing at the University of Washington Friday Harbor Labs in July-August 2003. The class consisted of graduate students in Physical Oceanography, Civil and Environmental Engineering, and related disciplines.

The class included 15 hours/week of lectures, including core lectures by MacCready and Geyer and guest lectures by Carl Friedrichs, Jan Newton, Rich Pawlowicz, David Jay, Chris Garrett, Harvey Seim, Stephen Monisimth, Jim Lerczak, Steve Lentz, and Jim O'Donnell.

Field work included horizontal dispersion and vertical mixing in a fjord, studies of wind-driven exchange, strait dynamics and mixing, and estuarine dynamics. Observational techniques included acoustic Doppler current profiling (both moored and shipboard), moored temperature and salinity measurements, conventional shipboard hydrography, a dye injection with "tow-yo" fluorometric surveys.

WORK COMPLETED

Lectures covered tidal processes, boundary layers, strait dynamics (including 2-layer hydraulics), estuarine dynamics, and river plumes.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 2003		

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
A Practical Educational Experience in Estuarine and Coastal Fluid Dynamics	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Woods Hole Oceanographic Institution,,Woods Hole,,MA, 02543**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES
The original document contains color images.

14. ABSTRACT
To conduct a class that will provide a formative educational experience for a group of graduate students who will likely be among the leaders in coastal and estuarine physical oceanography in the future.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**		**3**	

Student research projects were all based on the field observations. There were 11 projects, each with approximately 4 pages of text and figures.

RESULTS

The student projects were of varying quality, due in part to the range of experience of the students. Several of the students had only completed one year of graduate study, and so their background was not adequate to produce significant insights about the observations. However the more advanced students came up with significant insights about coastal processes in their projects. For example, Amanda Babson (from University of Washington) applied Stommel and Farmer's (1952) "overmixing" theory to Puget Sound, and found that it varies between the overmixed condition during spring tides and sub-maximal exchange flow during neaps. Jonathan Fram (from Berkeley) did an elegant analysis of the tidal variability of the salinity intrusion in the Snohomish estuary. He showed that although there is a large tidal excursion, the estuarine structure matches the steady-state, theoretical prediction of Chatwin (1976) within a Lagrangian reference frame that moves with the tide.

All of the students found the course to be extremely rewarding, based on the course evaluations and the comments they passed on to their peers and advisors. They particularly liked the opportunity to design and implement their own field projects, and they appreciated the accessibility of the instructors. They felt that there was undue time-pressure in finishing the field work and analysis. They will eventually get used to it.

IMPACT/APPLICATIONS

This course provided a significant stimulus to this cohort of physical oceanographers to pursue observational oceanography. This group will be have new skills and increased confidence in the design and implementation of field studies.

TRANSITIONS

RELATED PROJECTS

REFERENCES

Chatwin, P. C., 1976. Some remarks on the maintenance of the salinity distribution in estuaries. *Estuarine and Coastal Mar. Sci*., 4, 555-566.

Stommel, H., and H. G. Farmer, 1952. Control of salinity in an estuary by a transition. *J. Mar. Res*., 12, 13-20.

PUBLICATIONS

PATENTS

HONORS/AWARDS/PRIZES