

MSL 494: Chemical Coastal Processes

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Class meeting times: TBA
Location: TBA
Office Hours: TBA

Prerequisites: upper-division undergraduate. General Chemistry (i.e. CHEM 105 and CHEM 106) and The Oceans (MSL 111), or permission of instructor.

Course Description

This course investigates chemical processes in the coastal ocean. We will examine chemical interactions at different boundaries, and gain an understanding of how physical and biological processes affect the chemistry of coastal environments. In addition to participation during lectures, students will be evaluated based on four homework assignments, an oral presentation, two midterms and a final.

Learning Objectives

1. Become familiar with chemical processes occurring in coastal/shelf waters.
2. Identify physical and biological controls affecting the distribution and behavior of chemical species.
3. Apply a topic examined during lectures to Alaskan coastal waters

Course Policies and Requirements

Lecture **attendance** and active **participation** in class is expected from all students. Class participation will count for 10% of the final grade.

Email communication will be used to distribute class information, updates and changes.

Four **homework assignments** will be given. Collaboration among students is encouraged. However, each student is expected to submit their own work. Homework assignments will not be accepted after the due date, unless arrangements have been made in advance with the instructor.

Exams. There will be two midterms and one final which are to be completed during the regular class period. The exams will be closed-book, and will require short-essay and diagramed answers. The final exam will be comprehensive with an emphasis on material covered after the second midterm.

Background Readings. There is no required textbook. Reading assignments will come from several books and the primary literature. Chapters from textbooks will be found on eReserves (<http://eres.uaf.edu/eres/default.aspx>) PASSWORD: TBA. Primary literature articles will be obtained from the library (<http://library.uaf.edu/findarticles>). Contact the instructor or a librarian if you need help obtaining articles.

Student Presentations: All students will make an oral presentation that highlights findings from a chosen journal article addressing a chemical process within an Alaskan/Arctic coastal region (topic and reference to be approved by instructor by April 21st).

Paper selection – remember that it has to be a scientific paper addressing a chemical coastal process. For example, the following paper would not be acceptable.

Wagemann, R., E. Trebacz, G. Boila, and W.L. Lockhart. 1998. Methylmercury and total mercury in tissues of arctic marine mammals. *The Science of the Total Environment* **218**:19-31

However, the paper below would be appropriate

Leitch D.R., J. Carrie, D. Lean, R.W. Macdonald, G.A. Stern, and F. Wang. 2007. The delivery of mercury to the Beaufort Sea of the Arctic Ocean by the Mackenzie River. *The Science of the Total Environment* **373**:178-195

Presentations will take place during the last week of lecture (May 3rd and 5th).

Note

This is a stacked 400/600 level course. The material covered will be the same for both versions of the course. Undergraduate level students will be required to answer 4 out of 5 questions for each homework assignment and exam, while graduate students will be required to answer all questions. Undergraduate students will not be required to write a synthesis paper, nor will they be expected to be able to critically evaluate the direction of future coastal/shelf research at the end of the course.

Lack of **academic integrity** including plagiarism is not acceptable and will not be tolerated.

Points and grading scale

	Possible points	% of Total
Attendance and active class participation	50	10
Homework (4 assignments)	100	20
Midterm 1	100	20
Midterm 2	100	20
Presentation	50	10
Final	100	20
Total	500	100

A+ 98-100%

B+ 87-89%

C+ 77-79%

D+ 67-69%

A 93-97%

B 83-86%

C 73-76%

D 63-66%

F < 60%

A- 90-92%

B- 80-82%

C- 70-72%

D- 60-62%

Support and Disability Services

At UAF, the Office of Disability Services (203 WHIT; 474-5655; TTY 474-1827; fydso@uaf.edu) ensures that students with physical or learning disabilities have equal access to the campus and course materials. If you have specialized needs, please contact this office or the instructor to make arrangements.

Lecture Schedule (Subject to change)

Week	Date	Lecture Topic	Assignment	Reading
1	1/20	Introductions, overview, logistics		
2	1/25	Coastal zone classification review		Open University Ch. 5-8
	1/27	Chemical composition and mixing		
3	2/1	Residence time and input variability		Eyre, 1998
	2/3	Floculation processes	hmw1 Due	Boyle et al., 1974; Sholkovitz, 1976
4	2/8	Organic speciation of trace metals	hmk1 returned	van den Berg, 2000; Buck et al., 2005
	2/10	The roll of Suspended particles		Turner and Millward, 2002
5	2/15	Photochemical Processes		Sulzberger, 2000
	2/17	Photochemical Processes (cont.)	hmw2 Due	Moran & Zepp, 2002
6	2/22	Midterm 1	hmk2 returned (2/21, office)	
	2/24	Carbonate system; Coastal Acidification	Midterm 1 returned	Emerson & Hedges Ch.4
7	3/1	Coastal Acidification (cont.)		Borges & Gypens, 2010
	3/3	Dissolved Oxygen; hypoxia/anoxia		Grantham et al., 2004
8	3/8	Interactions at sediment/water interface	hmw3 Due	Presley and Trefry 1980; Libes Ch.12
	3/10	Sedimentary transformation of organic matter		Artemyev Ch. 4
SPRING BREAK				
9	3/22	Sedimentary transformation of trace metals	hmw3 returned	
	3/24	The role of bacteria		
10	3/29	The influence of sea ice		Melnikov Ch. 3
	3/31	Midterm 2		
11	4/5	Isotopes as tracers	Topic Due. Midterm 2 returned	Libes Ch. 5
	4/7	Isotopes as tracers (cont.)	hmw4 Due	Swarzenski et al., 2000
12	4/12	Upwelling, fronts and eddies review	Outline/References Due	
	4/14	Controls on coastal productivity	hmw4 returned	Alongi Ch 7
13	4/19	Controls on coastal productivity (cont.)		Hutchins et al., 1998
	4/21	Interdisciplinary coastal research		Oceanography, 21(4): 90-107,
14	4/26	Coastal Observing Systems	Paper Due	
	4/28	Future challenges and coastal management		Valiela Ch 14
15	5/3	Student Presentations		
	5/5	Student Presentations	Papers Returned	
16		Final Exam		

Texts

Alongi, D.M. (1998) *Coastal Ecosystem Processes*. CRC Press, Boca Raton, FL, 419 pp.

Artemyev, V.E. (1996) *Geochemistry of Organic Matter in River-Sea Systems*. Kluwer Academic Publishers, Dordrecht, 190 pp.

Emerson, S. and Hedges, J. (2008) *Chemical Oceanography and the Marine Carbon Cycle*. Cambridge University Press, Cambridge, 453 pp.

Libes, S.M. (1992) *An introduction to Marine Biogeochemistry*. John Wiley & Sons, Inc., New York, 734 pp.

- Melnikov, I.A. (1997) *The Arctic Sea Ice Ecosystem*. Gordon and Breach Science Publishers, Amsterdam, 204 pp.
- The Open University (1997) *Waves, Tides and Shallow-Water Processes*. Butterworth-Heinemann, Oxford, 187 pp.
- Valiela, I. (2006) *Global Coastal Change*. Blackwell Publishing, Malden, MA, 368 pp.

Articles

- Borges, A. V. and N. Gypens. 2010. Carbonate chemistry in the coastal zone responds more strongly to eutrophication than to ocean acidification. *Limnology and Oceanography*, **55**(1): 346–353
- Boyle, E.A., R. Collier, A.T. Dengler, J.M. Edmond, A.C. Ng, and R.F. Stallard. 1974. On the chemical mass-balance in estuaries. *Geochimica et Cosmochimica Acta*, **38**: 1719-1728.
- Buck, K.N., J.R.M. Ross, and K.W. Bruland. 2007. A Review of total dissolved copper and its chemical speciation in San Francisco Bay, California. *Environmental Research* **105**: 5-19
- Eyre, B. 1998. Transport, Retention and Transformation of Material in Australian Estuaries. *Estuaries* 21(4A): 540-551
- Grantham, B.A., F. Chan, K. J. Nielsen, D. S. Fox, J. A. Barth, A. Huyer, J. Lubchenco, and B. A. Menge. 2004. Upwelling-driven nearshore hypoxia signals ecosystem and oceanographic changes in the northeast Pacific. *Nature*, **429**: 749-753.
- Hutchins, D.A., G. R. DiTullio, Y. Zhang and K. W. Bruland. 1998. An iron limitation mosaic in the California upwelling regime. *Limnology and Oceanography*, **43**(6): 1037-1054
- Moran, M.A. and R.G. Zepp. 2002. Role of Photoreactions in the Formation of Biologically Labile Compounds from Dissolved Organic Matter. *Limnology and Oceanography*, **42**(6): 1307-1316
- Presley, B.J., and J.H. Trefry. 1980. Sediment-water interactions and the geochemistry of interstitial waters.
- Salisbury J., M. Green, C. Hunt and J. Campbell. 2008. Coastal acidification by rivers: A new threat to shellfish? *Eos, Transactions, American Geophysical Union* **89**(50):513
- Sholkovitz, E.R. 1976. Flocculation of dissolved and inorganic matter during the mixing of river water and sea water. *Geochimica et Cosmochimica Acta*, **40**: 831-845.
- Sulzberger, B. 2000. Photooxidation of Dissolved Organic Matter; Role for Carbon Bioavailability and for the Penetration Depth of Solar UV-Radiation. In: Gianguzza, A., Pelizzetti, E., and Sammartano, S. (eds.), *Chemical Processes in Marine Environments*. Springer, Berlin, pp.75-90.
- Swarzenski, P.W., Corbett, D.R., Smoak, J.M., and McKee, B. 2000. The use of U-Th series radionuclides and transient tracers in Oceanography: An overview. In: Hester, R.E., and Harrison, R.M. (eds.), *Chemistry in the Marine Environment*. Royal Society of Chemistry, Cambridge, 98 pp.
- Turner, A. and G. E. Millward. 2002. Suspended Particles: Their Role in Estuarine Biogeochemical Cycles. *Estuarine, Coastal and Shelf Science*, **55**: 857–883
- Van den Berg, C.M.G. 2000. Organic Complexation of Metals in Seawater. In: Gianguzza, A., Pelizzetti, E., and Sammartano, S. (eds.), *Chemical Processes in Marine Environments*. Springer, Berlin, pp.189-200.