Spring 2-1-2004

GEOL 585.01: Surface-water Groundwater Interaction- A Multi-Disciplinary Approach

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Geol 585-01

Spring 2004

Surface-water Groundwater Interaction: A Multi-Disciplinary Approach

Woessner
Tues.-Thur. 10-11, Three required field trips
Dr. Woessner's speaking and meeting schedule this semester will require rescheduling class meetings to a two-hour evening meeting occasionally. A weeks notice will be given for any changes in the course meeting schedule.
Text: Readings on Electronic Reserve

Course Objectives:
To explore the tools and methods used to study groundwater and surface water interaction in lakes, wetlands, and streams. Become familiar with the classic and modern literature on surface water groundwater interaction.

Specific Requirements
1. Read and prepare all assigned papers and prepare a 5 to 10 min. class presentation and participate in paper discussions.
2. Attend three ½ to 1 day field trips. Tentative Schedule is set in the course outline. However, weather considerations will require some adjustments.
3. Attend 2 or more invited speaker presentations
4. Complete well-cited 10 page term paper Due May .

Assessment:
1. Satisfactory active class participation by being prepared to present summaries of each article and active participation in discussions. Papers for the class meeting will be assigned and then students will randomly be chosen to present summaries and lead discussions (only three unprepared will be accepted then final grade will be decrease by 10 % for all additional unprepared. B, 80% is a passing grade for this course)
2. Satisfactory completion of quizzes if given (80% grade)
3. Satisfactory participation in scheduled field trips (attend all or prepare a 5 page paper on the research areas covered by the trip)
4. Completion of a 10 page term paper on one area of surface water- groundwater quantification or characterization: Physical Methods, Geochemical Methods, Biological Methods

Tools

Week of January 26
Intro, Course Assignments, Groundwater Basics, Water Balance

Students will be assigned parts of the Winter paper to facilitate discussion. Overheads of figures will be provided. Students are expected to prepare summary notes on each paper

that will allow them to present an organized 5 to 10 min presentation to the class and hit the important points. We will then discuss the subject as a class.

Weeks of Feb. 2, Feb. 9, Feb. 16

Note: No class on Thursday, February 5. Dr. Woessner will be speaking and attending the Montana America Fisheries Meeting in Whitefish, MT. This meeting has very interesting subject material about streams and restoration, especially on Wednesday, February 4. You might want to attend, registration is $25 for graduate students, undergraduates are free, see http://www.fisheries.org/AFSmontana/2004%20MCAFS%20Meeting%20Agenda.htm

Winter, T.C., 1981, Uncertainties in Estimating the Water Balance of Lakes, Water Resources Bull. 17(1), 82-115.

Precipitation p.85-88_____ Evaporation p.88-95_____

Stream Flow p. 95-98_____ Overland flow p. 98-101_____

Groundwater 101-106_____ Lake volume 106-108 _____

Implications 108-110_____ Conclusions110 Bill

Lee, D. R and J. A. Cherry, 1978. A field exercise on groundwater flow using seepage meters and mini-piezometers. Journal of Geological Education, 27, 6-10_____

Shaw, R. D. and E. E. Prepas, 1989. Anomalous, short-term influx of water into seepage meters. Limmol. Oceanogr., 34(7), pp. 1343-1351._____

Paulsen, R. J., Smith, C. R., ORourke, D., and Wong, Teng-Fong, 2001. Development and evaluation of an ultrasonic ground water seepage meter. Ground Water, vol. 39, no. 6, pp. 904 -911._____

Murdoch, L. C. and S. E. Kelly, 2003. Factors affecting the performance of conventional seepage meters. WRR 39(6), 1163, doi:10.1029/2002Wroo1347,2003, SWC 2-1-2-10.

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Hannula, S. R., K. J. Esposito, J. A. Chermak, D. D.Runnells, D.C. Keith and L. E. Hall, 2003. Estimating ground water discharge by hydrograph separation. Ground Water, 41(3), p. 368-375._____

Landon, M. K., D L Rus, and F. E. Harvey, 2002, Comparison of instream methods for measuring hydraulic conductivity in sandy streambeds. Ground Water 39(6), p. 870-885.

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LaBaugh, J. W., T. C. Winter and D. O. Rosenberry, P. F. Schuster, M. M. Reddy and G. A. Aiken, 1997. Hydrological and chemical estimates of the water balance of a closed-basin lake in north central Minnesota. WRR, 33(12), pp. 2799-2812.

Burnett, B., J. Chanton, J. Christoff, E. Kontar, S. Knpa, M. Lambert, W. Moore, D.O'Rourke, R. Paulsen, C. Smith, L. Smith and M. Toniguchi, 2002. Assessing methodologies for measuring gorundwtaer discharge to the ocean. EOS, Transactions, AGU, 83(11), p.117-123.

Week of Feb. 23

Focus on Lake Systems

All students are responsible for all papers at all times. Overheads of figures will be provided. Students are expected make a 5 to 10 min presentation and hit the important points when called upon.

McBride, M. S. and H. O. Pfannkuch, 1975. The distribution of seepage within lakebeds. Jour. Research USGS, 3(5), pp. 505-512.

Lee, D. R., J. A. Cherry and J. F. Pickens, 1980. Groundwater transport of a salt tracer through a sandy lakebed. Limnol. Oceanogr. 25(1), pp. 45-61.

Anderson, M. P. and J. A. Munter, 1981. Seasonal reversals of groundwater flow around lakes and the relevance to stagnation points and lake budgets. WRR, 17(4), pp. 1139-1150

Winter, T. C., 1978. Numerical simulation of steady state three-dimensional groundwater flow near lakes. WRR, 14(2), pp. 245-254.

Week of March 1

Cornett, R. J., B. A Risto and D. R. Lee, 1989. Measuring groundwater transport through lake sediments by advection and diffusion. WRR, 25(8), pp. 1815-1823.

Stauffer, R. E., 1985. Use of solute tracers released by weathering to estimate groundwater inflow to seepage lakes. ES&T, 19, pp. 405-411.

Woessner, W. W. and C. Brick, 1992. The role of groundwater in sustaining shoreline spawning kokanee salmon, Flathead Lake, Montana. First International Conference on Ground Water Ecology, USEPA and AWRA, pp. 257-266.

Rosenberry, D. O., 2000. Unsaturated-zone wedge beneath a large, natural lake. Water Resources Research, Vol. 36, no. 12, pp. 3401-3409.

Hagerthey, S. E. and W. C. Kerfoot, 1992. Groundwater influences on the littoral communities of lakes. First International Conference on Ground Water Ecology, USEPA and AWRA, pp. 165-177.

Week of March 8

Focus of Wetlands

Mitsch, W. J and J. G. Gosselink, 1993. Wetlands. 2nd ed. Van Nostrand Reinhold, N.Y. Chapter 2. Definitions of Wetlands.

Mitsch, W. J and J. G. Gosselink, 1993. Wetlands. 2nd ed. Van Nostrand Reinhold, N.Y. Chapter 3. Wetland types and Wetland Resources of North America Pages 30-53

Mitsch, W. J and J. G. Gosselink, 1993. Wetlands. 2nd ed. Van Nostrand Reinhold, N.Y. Chapter 3. Wetland types and Wetland Resources of North America Pages 53-67

Mitsch, W. J and J. G. Gosselink, 1993. Wetlands. 2nd ed. Van Nostrand Reinhold, N.Y. Chapter 4. Hydrology of Wetlands.67-90

Week of March 15

Mitsch, W. J and J. G. Gosselink, 1993. Wetlands. 2nd ed. Van Nostrand Reinhold, N.Y. Chapter 4. Hydrology of Wetlands.90-113

LaBaugh, J. W., 1986. Wetland ecosystem studies from a hydrologic perspective. Water Res. Bull., 22(1), p. 1-10.

Stevenson, R. J. and F. R. Hauer, 2002. Integrating hydrogeomorphic and index of biotic integrity approaches for environmental assessment of wetlands. J. N. Am. Benthol. Soc, 21(3): p. 502-513.

Meyboom, P., 1967. Mass-transfer studies to determine the groundwater regime of permanent lakes in hummocky moraine of western Canada. Journ. of Hydrology, 5, pp. 117-142.

Rosenberry, D. O. and T. C. Winter, 1997. Dynamics of water-table fluctuations in an upland between tow prairie-pothole wetlands in North Dakota. J. of Hydrology, 9, p. 266-289.

Week of March 22

Koerselman, W., 1989. Groundwater and surface water hydrology of a small groundwater-fed fen. Wetlands Ecology and Management, 1(1), p. 31-43.

Loftus, W. F., R. A. Johnson and G. H. Anderson, 1992. Ecological impacts of the reduction of groundwater levels in short-hyrperiod marshes of the Everglades. First Intern. Conf. On Ground Water Ecology, USEPA and AWRA Proceedings, April, p. 199-208.

Hensel, B. R. and M. V. Miller, 1991. Effects of wetlands creation on groundwater flow. J. of Hydrology, 126, p. 293-314.

Wilsnack, M. M., Welter, D. E., Montoya, A. M., Restrepo, J. I. and Obeysekera, J., 2001. Simulating glow in regional wetlands with the MODFLOW flow wetlands package. Journal of the American Water Resources Association, Vol. 37, no. 3, pp. 655-674.

Mitsch, W. J and J. G. Gosselink, 1993. Wetlands. 2nd ed. Van Nostrand Reinhold, N.Y. 17. Wetland Creation and Restoration.p. 577-598

Week of March 29 Spring Break, no class

Week of April 5

Field Trip Friday April 9, 12 noon to 5 pm Frenchtown Pond

Mitsch, W. J and J. G. Gosselink, 1993. Wetlands. 2nd ed. Van Nostrand Reinhold, N.Y. Wetland Creation and Restoration.p. 598-615

Galatowitsch, S. M., A. G van der Valk and R. A. Budelsky, 1998. Decision-making for prairie wetland restorations. Great Plains Research, 8, p. 137-155.

LaBaugh, J. W., T. C. Winter, G. A Swanson, D. O. Rosenberry, R. D. Nelson and N. H. Euliss, Jr., 1996. Changes in atmospheric circulation patterns affect midcontinent wetlands sensitive to climate. Limnol. Oceanogr., 41(5), p. 864-870.

Week of April 12

Focus on Streams

Sharp, J. M. , 1988, Alluvial aquifers along major rivers, in Bac, W., Rosenshein, J. S. and Seaber, P. R., eds. Hydrogeology: Boulder, CO, GSA, The Geology of North America, O-2 : 273-282.

Hayashi, M. and Rosenberry, D. O., 2002. Effects of groundwater exchange on the hydrology and ecology of surface water. Ground Water, Vol. 40, no. 3, pp. 309-316.

Woessner, W. W., 2000. Stream and fluvial plain ground-water interactions: re-scaling hydrogeologic thought. Ground Water.

Velett, H. M., Hakenkamp, C. C., and Boulton, A. J., 1993, Perspectives on the hyporheic zone: integrating hydrology and biology, introduction.. J. N. Am. Benthol. Soc. 12: 40-43.

Triska, F.J., V.C. Kennedy, R.J. Avanzino, G.W. Zellweger, and K.E. Bencala, 1989. Retention and transport of nutrients in a third-order stream in northwestern California: Hyporheic Processes. Ecology, 70(6): 1893-1905.

Field Trip Bandy Ranch or Swan Valley Saturday April 17.

Week of April 19

Alexander, M. and D. Caissie, 2003, Variability and comparision of hyporheic water temperatures and seepage fluxes in a small atlantic salmon stream. Ground Water 41(1): p. 72-82.

Dahm, C. N., Grimm, N. B., Marmonier, P., Valett, H. M., and Vervier, P., 1998, Nutrient dynamics at the interface between surface waters and groundwaters. Freshwater Biology, 40: 427-451.

Cardenas, M.B. and V. A. Zlotnik, 2003, Three-dimensional model of modern channel bend deposits. WRR 39(6), 141, doi:10.1029/2002WR0011383.2003; SHB1-1SHB 1-12.

Hoehn, E. and von Gunten, H. R., 1989, Radon in groundwater: a tool to assess infiltration from surface waters to aqufiers. RRR, 25(8): 1795-1803.

Von Gunten, H. R., Karahenbohl, U., Kuslys, M., Giovanoli, R., Hoehn, E., and Keil, R., 1991, Seasonal Biogeochemical cycles in riverborn groundwater. Geochemica et Cosmochemica Acta., 55: 3597-3609.

Field Trip Jocko River, Saturday April 24

Week of April 26

Stanford, J. A., 1998, Rivers in the landscape: introduction to the special issue on riparian and groundwater ecology. Freshwater Biology, 40: 402-406.

Wroblicky, G. J. and Campana, M. E., 1998, Seasonal variation in surface-subsurface water exchange and lateral hyporheic area of two streams. WRR, 43(3): 317-328.

Valett, H. M., Fisher, S. G. and Stanley, E. H., 1990, Physical and chemical characteristics of the hyporheic zone of a Sonoran Desert stream. J. N. Am. Benthol. Soc., 9(3): 201-215.

Savant, S. A., Reible, D. D., and Thibodeau, L. J., 1987, Convective transport within stable river sediments, WRR 23(9): 1763-1768.

Week of May 3

Term Paper due May 4

Hendricks, S.P. and D.S.White, 1991, Physicochemical patterns within a hyporheic zone of a northern Michigan river, with comments on surface water patterns. Can. J. Fish. Aquat. Sci., 48: 1645-1654.

Hensen, E. A., 1975, Some effects of groundwater on brown trout redds. Trans. Amer. Fish. Society, 104(1): 100-110.

Hope, S. J and Peterson, R. A., 1996, Pore water chromium concentration at 100-H reactor area adjacent to fall chinook salmon spawning habitat of the Hanford Reach, Columbia River. Prepared for the USDE, Office of Environmental Restoration and Water Management, Bechtel Hanford, Inc., Richland, WA.

Bencala, K.E. and R.A. Walters, 1983. Simulation of solute transport in a mountain pool-and-riffle stream: a transient storage model. Water Res. Research 19(3): 718-724
Harvey, J.W. and K.E Bencala., 1993. The effect of streambed topography on surface-subsurface water exchange in mountain catchments. Water Res. Research, 29 (1): 89-98.

Ward, J. V., Bretschko, G. Brunke, M., Danielopol, D., Gilbert, J., Gonser, T., and Hildrew, A. G., 1998, The boundaries of river systems: the metazoan perspective. Freshwater Biology, 40: 531-569.

Pusch, M., Fiebig, D., Brettar, I, Eisenmann,k H., Ellis, B. K., Kaplan, L. A., Lock, M. A., Naegeli, M. W. , and Traunspurger, W., 1998, The role of micro-organisms in the ecological connectivity of running waters. Freshwater Biology, 40: 453-495.

Bencala, K. E., 1993, A perspective on stream-catchment connections. N. Am Benthol. Soc., 12(1): 44-47.

Puckett, L. J. Cowdery, T. K., P. B. McMahon, L. H. Tornes, and J. D. Stoner, 2002. Using chemical, hydrologic and age dating analysis to delineate redox processes and flow paths in the riparian zone of a glacial outwash aquifer-stream system. WRR 38(8) 10.1019/2001WR000396, 2002, 9-19-20

Stanford, J. W. and Ward, J. V., 1993, An ecosystem perspective on alluvial rivers: connectivity and the hyporheic corridor. N. Am Benthol. Soc., 12(1): 48-60.

Plamer, M. A., 1993, Experimentation in the hyporheic zone: challenges and prospectus. N. Am Benthol. Soc., 12(1): 84-93.

Meyer, J. L., 1997. Stream health: incorporating the human dimension to advance stream ecology. J. N. Am. Benthol. Soc., 16 (2): 439-447.

Final Class Meeting during Exam Week Friday May 12, 8-10.

Additional 2 speakers will be scheduled for either in class or for noon talks in the department, Geol 304.

Possible presentations by:

Bonnie Ellis, Bio Station, Flathead Lake
Jack Stanford, UM Biological Station
O9
Johnnie Moore, River-GW Geochemistry
Andy Shelton, Fisheries Biologist
Jack Donahue, Geography
Fishery Biologist, MT fish wildlife and Parks
Skip Roquist, Lolo Forest Hydrologist
Don Pots, Forest Hydrologist
Land and Water Consulting, Stream Reclamation