

Geog 295: What makes the Critical Zone critical?

Instructors: Bodo Bookhagen and Oliver Chadwick

Location: 4th Floor Conference Room, Ellison Hall

Time: Wednesday, 3:30 to 6 PM (we will provide refreshments)

The critical zone reaches from the top of the vegetation canopy through the vadose zone. It links disciplines as disparate as ecosystem ecology, geomorphology, biogeochemistry, soil science and hydrology. It has been defined by the National Research Council and the National Science Foundation in order to foster Earth surface research that explicitly crosses disciplinary boundaries. The actual process of developing a Critical Zone Observatory (CZO) as they are called is a work in progress. There are six sites operating at this point and another call for proposals has been released recently.

We propose a graduate seminar class that evaluates the conceptual beginnings of the Critical Zone, research emanating from CZOs and research from elsewhere that reach toward the ideal of crossing Earth surface process disciplinary boundaries. We will focus primarily on empirical and modeling papers that attempt to link hillslope hydrology, geomorphology and weathering processes into an integrated understanding of how the Critical Zone functions.

The class will require students to read material each week and to act as a presenter once or several times during the class. Bookhagen, Chadwick, and Postdoc Jeannie Dixon will guide the class based on their hands on experiences developing the Critical Zone concepts, and conducting research in that realm. The reading listed below are designed to progress from general research need statements from the National Research Council to overview papers from existing CZOs to specific research efforts being conducted at CZOs and elsewhere.

Reading list

1	Oct. 03	<u>NRC (2010): <i>Landscapes on the Edge – New Horizons for Research on Earth’s Surface</i></u> (Chapters 1, 2 and 3) and <u>NRC (2012): <i>New Research Opportunities in the Earth Sciences</i></u> (Chapters 2 and 3)
2	Oct. 10 Ann Tan <u>ann.jw.tan@gmail.com</u>	<u>Chorover, J. et al: <i>How Water, Carbon, and Energy Drive Critical Zone Evolution: The Jemez-Santa Catalina Critical Zone Observatory, Vadose Zone J.</i>, 10:884-899</u> and <u>Brantley, S.L., et al. (2011): <i>Twelve testable</i></u>

		<i>hypotheses on the geobiology of weathering</i>, Geobiology 9(2): 140-165, doi: 10.1111/j.1472-466902010.00264.x and <i>Fisher, M. (2012): Investigating the earth's critical zone</i>, CSA News.
3	Oct. 17 Aron Bufe bufe@umail.ucsb.edu	<i>Riebe, C., Kirchner, J.W., Finkel, R.C. (2004): Erosional and climatic effects on long-term chemical weathering rates in granitic landscapes spanning diverse climate regimes</i>, EPSL, 224, 547-562.
4	Oct. 24 Sam Prentice sep@umail.ucsb.edu <i>BB will not be on campus</i>	<i>Rasmussen, C. et al. (2011): Strong climate and tectonic control on plagioclase weathering in granitic terrain</i>, EPSL, 301, 521-530.
5	Oct. 31 David Wampler dfw@email.arizona.edu <i>BB and OC will not be on campus</i>	<i>Ferrier, K., Kirchner, J.W., Finkel, R.C. (2011): Estimating millennial-scale rates of dust incorporation into eroding hillslope regolith using cosmogenic nuclides and immobile weathering tracers</i>, JGR Earth Surface, 116, F03022.
6	Nov. 07 Yang Lin (Ferrier et al) ylin@umail.ucsb.edu Kyongho Son (Nicótina et al.) kson@bren.ucsb.edu <i>BB will not be on campus</i>	<i>Ferrier, K., Kirchner, J.W., Finkel, R.C. (2012): Weak influences of climate and mineral supply rates on chemical erosion rates: Measurements along two altitudinal transects in the Idaho Batholith</i>, JGR Earth Surface, 117, F02026. <i>Nicótina et al. (2011): Hydrologic controls on equilibrium soil depths</i>, WRR, 47, W04517.
7	Nov. 14 John Potapenko potapenko@geog.ucsb.edu	<i>Hurst, M.D. et al. (2012): Using hilltop curvature to derive the spatial distribution of erosion rates</i>, JGR Earth Surface, 117, F02017.
8	Nov. 21 Sadie Iverson sadie.iverson@lifesci.ucsb.edu	<i>Maher, K. (2011): The role of fluid residence time and topographic scales in determining chemical fluxes from landscapes</i>, EPSL, 312, 48-58.

9	Nov. 28 Becky Streit rebeccastreit@umail.ucsb.edu <i>OC will not be on campus</i>	Ma, L. et al. (2010): Regolith production rates calculated with uranium-series isotopes at Susquehanna/Shale Hills Critical Zone Observatory, EPSL, 297, 211-225.
10	Dec. 5	No class – AGU conference