

**OCN/GG 638: Earth System Science and Global Change**

Fall 2015

MSB 305. We, Thu 1:30-2:45 pm  
(Room and time flexible if necessary)**Instructor:**

Richard E. Zeebe

**Description:**

This graduate course presents a global view of the planet, including its origin and building blocks, the components of the climate system, biogeochemical cycles, and an analysis of natural and human-induced environmental change. Starting with the formation of the solar system and ending with anthropogenic greenhouse gases and 21st-century climate change, the course provides a survey of key aspects of Earth System functioning. The chemical history of the ocean-atmosphere-sediment system is examined. Critical tools for understanding the global carbon cycle such as seawater carbonate chemistry and isotope fractionation are introduced. The fundamental components of Earth's climate system are investigated, while most recent developments in our understanding of past, present, and future climate change are also highlighted. Effects of anthropogenic carbon dioxide emissions on present and future climate, as well as on ocean chemistry (ocean acidification) are discussed.

**Grading:**

Final paper and oral presentation in class. Topics to be announced.

**Readings:**

"The Earth System" (3rd Edition). Kump, L. R., Kasting, J. F., and Crane, R. G. Prentice Hall, 2009.

"Our Changing Planet: An Introduction to Earth System Science and Global Environmental Change" (4th Edition). Mackenzie, F. T., Prentice Hall, 2010.

"CO<sub>2</sub> in Seawater: Equilibrium, Kinetics, Isotopes". Zeebe, R. E. and D. A. Wolf-Gladrow. *Elsevier Oceanography Series*, 65, pp. 346, Amsterdam, 2001.

"How to Build a Habitable Planet". Broecker, W. S. Eldigio Press, Lamont-Doherty Geological Observatory, Palisades, New York, pp. 291, 1998.

"The Atmosphere and Ocean: A Physical Introduction". (2nd Edition), Wells, N., Wiley and Sons, pp. 404, New York, 1997.

"A Compendium of Geochemistry: from Solar Nebula to the Human

Brain". Li, Y.-H., Princeton University Press, pp. 475, 2000.

"Climate Change 2007: Climate Change 2007: The Physical Science Basis". IPCC, Solomon, S. et al. (Eds.), Cambridge University Press, Cambridge, 2007. www.ipcc.ch

"Tracers in the Sea". Broecker, W.S. and T.-H.Peng, Eldigio Press, Lamont-Doherty Geological Observatory, Palisades, New York, pp. 690, 1982.

+ "Paper(s) of the week" (recent Nature/Science articles).

**Tentative Schedule:**

1. Solar System
2. Isotopes
3. Earth's History (Deep Time)  

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4. Climate System
5. Greenhouse Effect and Gases
6. Seawater Carbonate Chemistry
7. Long-Term Carbon Cycle  

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8. Proxy Archives
9. Past Climate Events
10. Anthropogenic Greenhouse Gases
11. Ocean Acidification
12. Present and Future Climate Change