

Pensum for course GEOF336 Advanced Chemical Oceanography – spring semester 2017

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Contents of the following 1 book chapter and the following 12 scientific articles will be subject of an oral exam; further students have to write a semester thesis on one specific subject summarising several papers (these will be specified later on) and giving a presentation of the thesis in front of an audience:

Book chapter. Topic: Marine biogeochemistry and climate change

Chapter 10: Carbon cycle, CO₂, and Climate, in Sarmiento, J.L., and N. Gruber, Ocean biogeochemical dynamics, Princeton University Press, 2006, pages 392-453.

Paper 1. Topic: Modelling the ocean carbon cycle and anthropogenic CO₂ uptake

Maier-Reimer, E., and K. Hasselmann, 1987, Transport and storage of CO₂ in the ocean - an inorganic ocean-circulation carbon cycle model, *Climate Dynamics*, 2, 63-90.

Paper2. Topic: Gas exchange ocean-atmosphere

Wanninkhof, R., W. E. Asher, D. T. Ho, C. Sweeney, and W.R. McGillis, 2009, Advances in Quantifying Air-Sea Gas Exchange and Environmental Forcing, *Annu. Rev. Mar. Sci.*, 213–244.

Paper 3. Topic: Tracers of ocean circulation

England, M.H., and E. Maier-Reimer, 2001, Using chemical tracers to assess ocean models, *Reviews of Geophysics*, 39(1), 29-70.

Paper 4. Topic: Global ocean ecosystem modelling

Le Quére, C., et al., 2005, Ecosystem dynamics based on plankton functional types for global ocean biogeochemistry models, *Global Change Biology*, 11, 2016–2040.

Paper 5. Topic: Marine nitrogen cycle

Voss, M., H. W. Bange, J. W. Dippner, J. J. Middelburg, J. P. Montoya, and B. Ward, 2013, The marine nitrogen cycle: recent discoveries, uncertainties and the potential relevance of climate change, *Phil. Trans. R. Soc. B* 368, 1-11.

Paper 6. Topic: Attenuation of organic particle flux in the water column

Martin, J.M., et al., 1987, VERTEX: carbon cycling in the northeast Pacific, *Deep-Sea Research*, Vol. 34. No. 2, pp. 267-285.

Paper 7. Topic: Deoxygenation

Keeling, R.F., A. Körtzinger, and N. Gruber, 2010, Ocean Deoxygenation in a Warming World, *Annu. Rev. Mar. Sci.*, 2, 199–229.

Paper 8. Topic: Marine silicon cycle

Ragueneau, O., et al., 2000, A review of the Si cycle in the modern ocean: recent progress and missing gaps in the application of biogenic opal as a paleoproductivity proxy, *Global and Planetary Change*, 26, 317–365

Paper 9. Topic: Ocean acidification

Orr, J.C., et al., 2005, Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms, *Nature*, 437, 681-686.

Paper 10. Topic: Marine CaCO₃ cycle

Zeebe, R. E., 2012, History of Seawater Carbonate Chemistry, Atmospheric CO₂, and Ocean Acidification, *Annu. Rev. Earth Planet. Sci.*, 40, 141–65.

Paper 11. Topic: Land-ocean coupling

Bauer, J. E., W.-J. Cai, P. A. Raymond, T. S. Bianchi, C. S. Hopkinson, P. A. G. Regnier, 2013, The changing carbon cycle of the coastal ocean, *Nature*, 504, 61-70.

Paper 12: Topic: Glacial CO₂ dynamics

Sigman, D.M., and E. A. Boyle, 2000, Glacial/interglacial variations in atmospheric carbon dioxide, *Nature*, 407, 859-869.