

Mathematical modeling in Earth System Science and Sustainability (EH 6XX)

- Purpose of mathematical modeling and its methodology
- Mathematical representation of earth system
- Equilibrium models: energy and mass balance at earth surface, chemical reactions in weathering processes
- Growth and decay models: Biogeochemical cycles
- Transport process models: Advection and diffusion processes, Energy and mass distribution in soils, Mass transfer on the earth surface
- Distribution of events: Probability distribution of disaster events
- Control of risks in earth system: Optimization models, sustainability models
- Matlab/Python exercises (tutorial and homework)

References

- Waltham D., 1994, Mathematics: a simple tool for geologists, Springer.
- Slingerland R. and Kump L., 2011, Mathematical modelling of Earth's dynamical systems. A Primer, Princeton University Press.
- Yang X., 2008, Mathematical modelling for Earth Sciences, Dunedin Academic Press Ltd.
- Fowler, A., 2011, Mathematical geosciences, Springer.
- Fowler, A. C., 1997, Mathematical models in the Applied Sciences, Cambridge University Press
- Gershenfeld, N., 1998, The Nature of Mathematical Modeling, Cambridge University Press
- Marion, H., 2006, Mathematical modelling in sustainable development, Springer.
- Snyder, R. and Van Wijk, K., 2015. A guided tour of mathematical methods for the physical sciences. Cambridge University Press.