Modeling Early Earth Climate with GEEBITT (Instructor's Notes)

In-class Exercise and Homework

Author

Cindy Shellito
Earth Sciences Program, University of Northern Colorado
Email: Lucinda.shellito@unco.edu

Background Knowledge and Skills

Students should be somewhat familiar with current understanding of the early evolution of the atmosphere, the role of greenhouse gases in the 'Faint-Young Sun' Paradox, and evidence for Proterozoic glaciation. Students should also have had an introduction to concepts in atmospheric radiation: relationship between emitted radiation and temperature (qualitative understanding of Stefan-Boltzmann Law), black-body temperature, shortwave vs. longwave radiation, albedo, and the role of greenhouse gases in absorbing longwave radiation. It is also helpful if students have some understanding of the roles of models (of varying levels of complexity) in climate research.

Tips for Running the Activity

I set aside 5-10 minutes at the beginning of the class period to introduce GEEBITT – I project the spreadsheet at the front of the room, and walk students through each worksheet, and remind them of the goals of this activity. Students require a full 50 minute class period to complete the activity. Typically, I have students work in pairs or groups of three.

If class time is short, the class may be divided into three groups, with each group focusing on a different time period (Modern, Archean, Neoproterozoic). At the end of the class, each group must share their results and insights with the class as a whole.

Assigned Reading (Prior to Activity)

Kasting, J. When Methane Made Climate. Scientific American, July 2004, p. 78-85.
Hoffman, P. and D. Schrag. Snowball Earth. Scientific American, January 2000, p. 68-75.