Explaining Earth’s Energy Budget: CERES-Based NASA Resources for K-12 Education and Public Outreach

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Introduction
Among atmospheric scientists, the importance of the Earth radiation budget concept is well understood. Papers have addressed the topic for over 100 years, and the large Clouds and the Earth’s Radiant Energy System (CERES) science team (among others), with its multiple on-orbit instruments, is working hard to quantify the details of its various parts (i.e., Loeb et al., 2009).

In education, Earth’s energy budget is a concept that generally appears in middle school and Earth science curricula, but its treatment in textbooks leaves much to be desired. Students and the public hold many misconceptions, and very few people have an appreciation for the importance of this energy balance to the conditions on Earth. More importantly, few have a correct mental model that allows them to make predictions and understand the effect of changes such as increasing greenhouse gas concentrations (Libarkin et al, 2013).

As an outreach element of the core CERES team at NASA Langley, a multi-disciplinary group of scientists, educators, graphic artists, writers, and web developers has been developing and refining graphics and resources to explain the Earth’s Energy budget over the last few decades. Resources have developed through an iterative process involving ongoing use in front of a variety of audiences, including students and teachers from 3rd to 12th grade as well as public audiences.

Accompanying Materials
Accompanying this diagram is a series of explanatory panels that can be used in a ‘create your own’ classroom poster.

Revised diagram
After years of experience using this diagram in talks for students, we also developed an Energy Budget “story” – a series of powerpoint slides that build up the diagram one piece at a time and allow students to “follow the energy” as the diagram comes together. We have found this to be an effective way to engage students with this rather complex diagram, and we continue to update and enhance the slide set based on questions and comments from our audiences.

Telling the Story

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Related Resources
Related resources for exploring the energy budget in the K-12 classroom are available as part of the MY NASA DATA project.

http://mynasadata.larc.nasa.gov

Website
http://science-edu.larc.nasa.gov/energy_budget/

References

www.nasa.gov

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