My NASA Data - Maps, Graphs, and Data

Earth's Energy Budget

The energy budget diagram on the front shows our best understanding of energy flows into and away from the Earth. It is based on the work of many scientists over more than 100 years, with the most recent measurements from the Clouds and the Earth's Radiant Energy System (CERES; http://ceres.larc.nasa.gov) satellite instrument providing high accuracy data of the radiation components (reflected solar and emitted infrared radiation fluxes). This energy balance determines the climate of the Earth. Our understanding of these energy flows will continue to evolve as scientists obtain a longer and longer record using new and better instrument.
Mini Lesson

CASE STUDY: Surface Effects on Energy Budget - Changes in Central Australia
1. Review the line graph above.
2. How does the Net Radiation at the surface in Central Australia vary from 2000 to 2012?
3. What years does the area experience drought? Does this indicate that the area is a net absorber of energy or a net emitter of energy?
4. What do you think happened in the region in 2010?
5. What does the dashed line mean?

Explanation: While the energy budget averaged over the globe changes little from year-to-year, on a local or regional basis large changes can occur due to changes in the Earth’s surface or atmosphere. For one example, this graph shows the change in net radiation over a region, approximately 2 million km, of Central Australia. The area experienced a multiyear drought from 2002-2009, during which time the region went from being a net absorber to a net emitter of energy, largely due to a change from plant-covered ground to dry soil. Heavy rainfall in 2010 broke the drought, resulting in a large increase in vegetation and soil moisture and a return to net absorption of energy. Similar changes occur on a smaller scale whenever human activities change the surface of the Earth. Loeb et al., IJC, 2016.
Sphere(s)

- Earth as a System

Crosscutting Concepts

- Scale, Proportion, and Quantity
- Systems and System Models

NASA Data Types

- CERES EBAF

Dataset in LAS

- Monthly Flow of Energy into Surface by Longwave Radiation (Watts per square m...)
- Monthly Flow of Energy into Surface by Shortwave Radiation (Watts per square ...)
- Monthly Flow of Energy out of Surface by Longwave Radiation (Watts per square...)

Related Links

- The NASA Earth's Energy Budget Poster
- Energy Budget Detectives
- Data Literacy Cubes Page

Related Lessons

- Earth's Energy Budget-Seasonal Cycles
- Observing Solar Energy

Document Resources

Document Resources

- Earth's Radiation Budget Lithograph

- Our Natural Place In the Big Picture

- Energy Budget Changes Since 1950
Balancing the Energy Budget

The Story of Energy in the Earth System

CO2 Forcing and Response