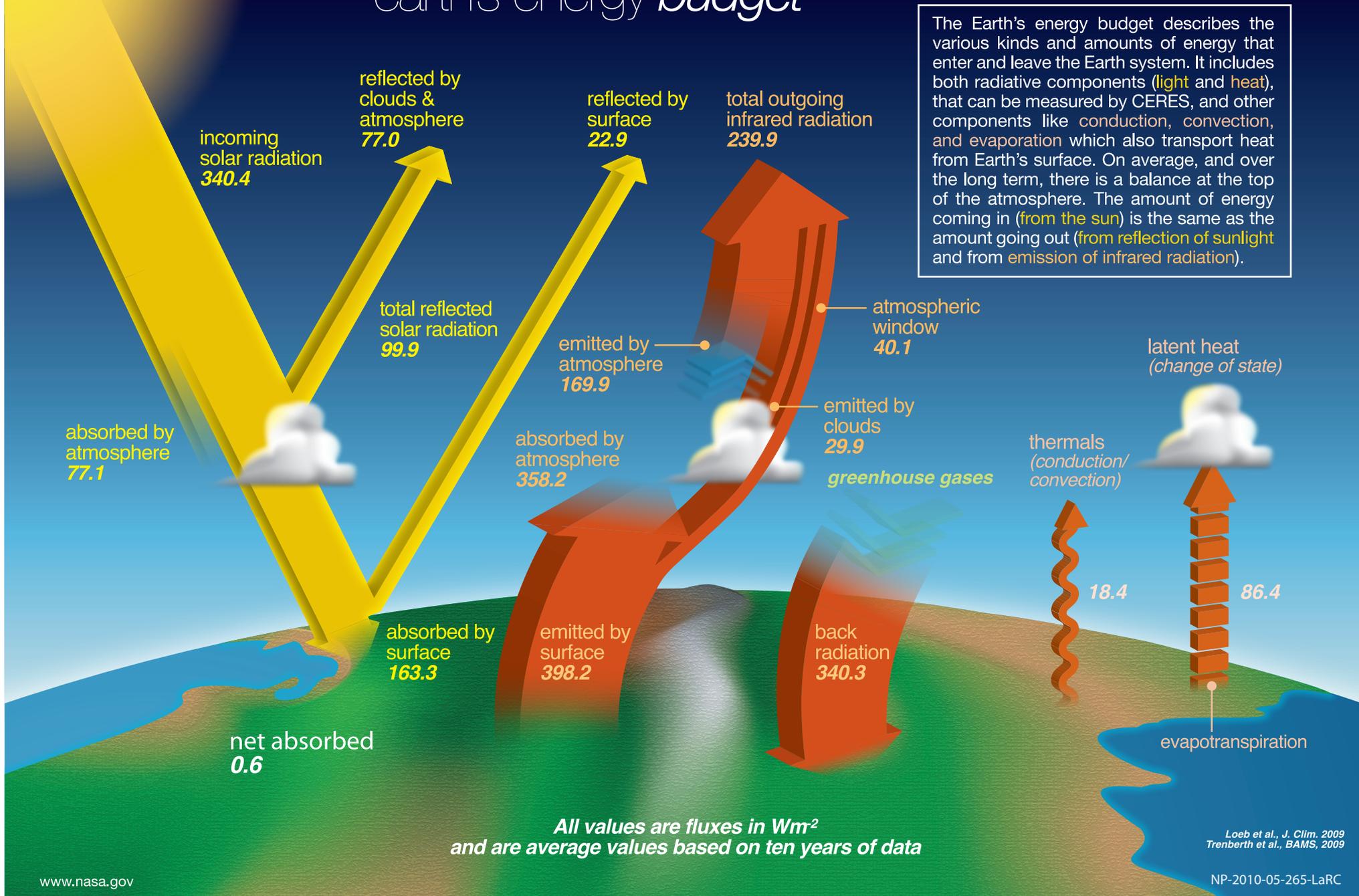




earth's energy *budget*

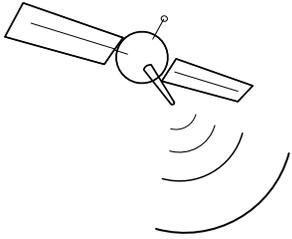
The Earth's energy budget describes the various kinds and amounts of energy that enter and leave the Earth system. It includes both radiative components (**light** and **heat**), that can be measured by CERES, and other components like conduction, convection, and evaporation which also transport heat from Earth's surface. On average, and over the long term, there is a balance at the top of the atmosphere. The amount of energy coming in (**from the sun**) is the same as the amount going out (**from reflection of sunlight** and from emission of infrared radiation).



All values are fluxes in Wm^2
and are average values based on ten years of data

Loeb et al., J. Clim. 2009
Trenberth et al., BAMS, 2009

The 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://science.larc.nasa.gov/ceres/>) 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 instruments (<http://clarreo.larc.nasa.gov/>).

Did you know?

Units:

Energy fluxes are measured as Watts per square meter.

Watt: a standard unit of power.

Joule: a standard unit of energy

1 Watt = 1 Joule / sec



National Science Education Standards - <http://www.nap.edu/html/nse/>

Content Standard D: Earth and Space Science: Energy in the earth system

Content Standard F: Science in Personal and Social Perspectives: Science and technology in local, national, and global challenges

National Council of Teachers of Mathematics Standards (grades 9-12) – <http://standards.nctm.org/>

Number and Operations: Understand numbers, ways of representing numbers...

Measurement: Understand measurable attributes of objects and the units, systems, ...

Data Analysis and Probability: Develop and evaluate inferences and predictions ...

Connections: Recognize and apply mathematics in contexts outside of mathematics.

Representation: Use representations to model and interpret physical...

AAAS Benchmarks (grades 9-12) - <http://www.project2061.org/publications/bsl/online/>

The Physical Setting: Weather and Climate

Transfer of thermal energy between the atmosphere and the land or ... 4B/H2

Greenhouse gases in the atmosphere... 4B/H4

Climatic conditions result from ... 4B/H5

The earth's climates have changed in the past, are currently changing, and are expected to change in the future... 4B/H6

Climate Literacy Framework Principles - <http://climateliteracynow.org/>

Principle 3: The Sun is the primary source of energy for the climate system.

Principle 4: Earth's weather and climate systems are the result of complex interactions.

Principle 6: Evidence indicates human activities re impacting the climate

Standards

You can find more information, resources, and activities on this concept at:

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

Additional information sections available on the reverse side of the large poster