New spacecraft could help break the climate debate gridlock

January 11 2011, By Irene Klotz

Glory is a low Earth orbit scientific research satellite designed to collect data on the properties of aerosols, including black carbon, in the Earth's atmosphere and climate system, and to collect data on solar irradiance for the long-term effects on the Earth climate record. Credit: NASA.gov

A new robotic probe is headed to the launch pad, aiming for a spot aboard what is called the A-train -- a fleet of Earth-orbiting spacecraft keeping tabs on the planet's changing climate.

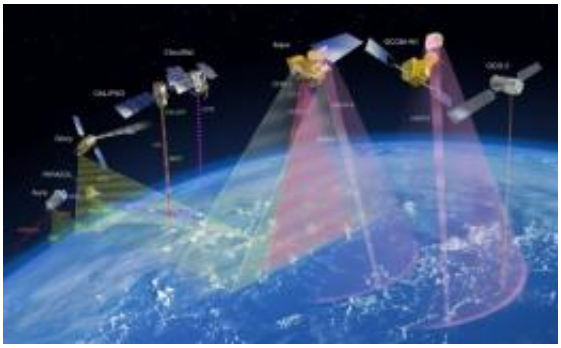
The problem seems simple enough: Take the total amount of energy coming to Earth from the sun, subtract what gets reflected back or re-radiated from particles in the atmosphere and see what you have left. If more energy is coming in than going out, it's getting hotter.

The next bit is more complicated: Figure out what fraction of these

atmospheric particles stems from natural phenomena, such as wind-blown dust and volcanic eruptions, and what is coming from things we can control -- our industrial processes, business pursuits and recreational past-times.

NASA hopes to tackle the problem in one fell swoop with a spacecraft named Glory. Part-solar monitor, part-atmospheric probe, Glory is to join the quartet of Earth-orbiting satellites known as the Afternoon Constellation -- nicknamed the A-train -- which fly over the equator at roughly 1:30 p.m. local time every day so scientists can collect data from a variety of instruments tracking the same bit of real estate virtually simultaneously. That information is fed into computer models used to monitor and forecast climate change.

"As we're starting to set climate policy based on the inputs that are driving climate change, we need to be able to distinguish how much of climate change is stuff that we can control and how much is purely natural," said solar physicist Greg Kopp, with the Laboratory for Atmospheric and Space Physics at the University of Colorado in Boulder.



The Afternoon Train, or "A-Train", for short, is a constellation of satellites that travel one behind the other, along the same track, as they orbit Earth. Four satellites currently fly in the A-Train - Aqua, CloudSat, CALIPSO, and Aura. Glory, GCOM-W1, and OCO-2 are scheduled to join the configuration in 2011,

2012, and 2013, respectively. (Courtesy NASA.gov) Credit: NASA.gov

From a perch 438 miles above the planet, Glory will inventory atmospheric aerosols -- both naturally occurring and human-induced -- so scientists can determine each type's relative influence on global climate. The instrument used to do this, called the Aerosol Polarimetry Sensor works by looking at the angles of the light waves bouncing off particles in the atmosphere. The patterns serve as fingerprints of a molecule's chemistry.

"The aerosols come in all shapes and sizes and chemical compositions," said Glory project scientist Michael Mishchenko, with the NASA Goddard Institute for Space Studies at Columbia University in N.Y. "We can get a fairly good idea of the chemical composition and, thereby, of the origin of the particles -- is it a natural particle, or a manmade particle? The existing instruments can't do that."

Aerosols, which are basically everything that is suspended in the atmosphere besides clouds, can interact with sunlight directly by absorbing it or reflecting it back into space, both of which affect how much heat is in the atmosphere. Aerosols also have an indirect impact on climate by changing the properties of clouds, including how reflective they are and how much rain they produce.

Mishchenko suspects that the impact on the climate from aerosols is almost as significant in magnitude as the impact from greenhouse gases, but there is not yet enough information for an accurate assessment.

"The aerosols are a very important component of the climate system and the most unknown component of the climate system," Mishchenko said. "They represent one of a few climate components which are directly

affected by human activities."

Opposite Glory's aerosol probe is a device to measure energy coming in from the sun, called the Total Irradiance Monitor or TIM. TIM will collect data about sunlight fluctuations across the entire electromagnetic spectrum, from X-rays to far infrared light, information that scientists want to better understand the ebb and flow of energy to and from Earth.

"We need to be able to detect whether there's imbalance and we need to attribute this balance to specific causes," Mishchenko said.

Glory, which was built by Orbital Sciences Corp., is due to arrive at Vandenberg Air Force Base in California on Jan. 10 and be launched on Feb. 23. The launch comes two years after the botched flight of NASA's Orbiting Carbon Observatory, another key climate-monitoring spacecraft that the agency plans to replace and fly in 2013.

Provided by Inside Science News Service