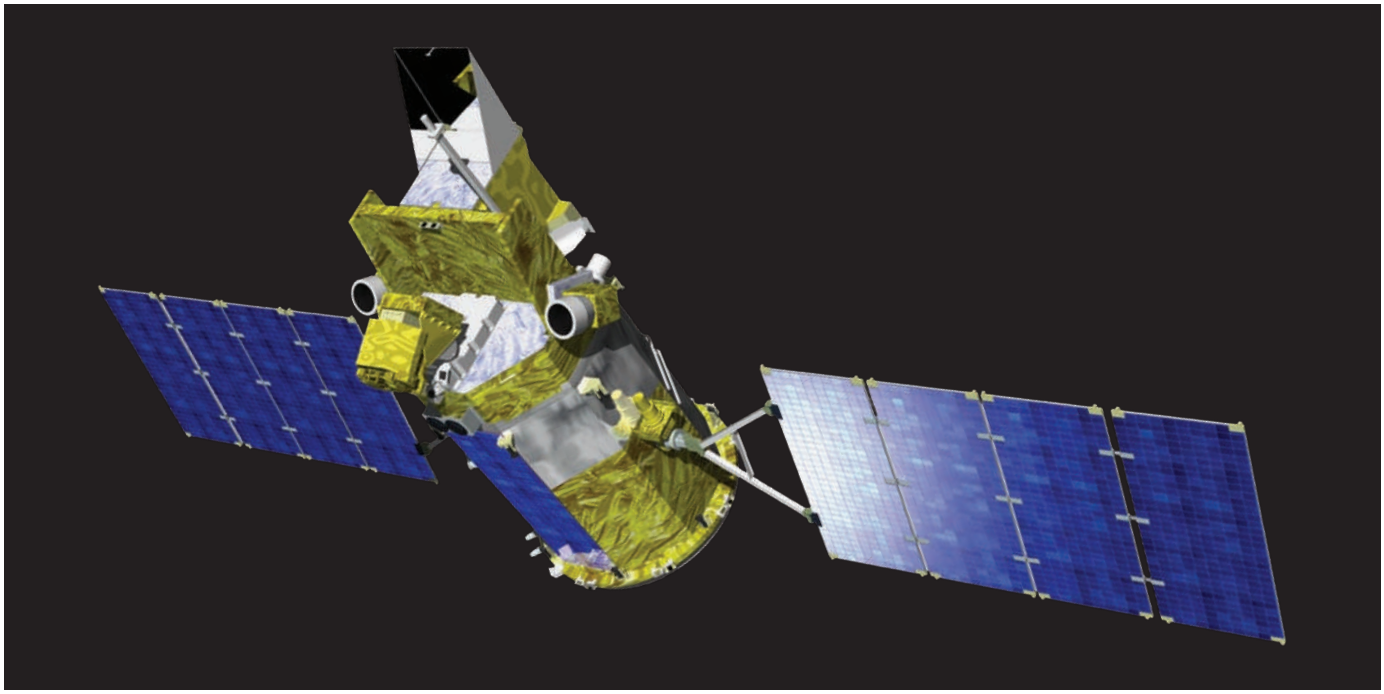


NASA

A specially calibrated monitor aboard NASA's Glory satellite will measure how much radiation the Sun emits.

SOLAR SCIENCE

Probe keeps keen eye on Sun

Glory satellite will make more accurate measurements of solar output.

BY JEFF TOLLEFSON

At some point Greg Kopp just got tired of the questions. Every time the solar physicist showed a plot of the Sun's total radiation output as measured by a succession of satellites since 1978, he had to explain an unexpectedly large offset starting around 2003. That was the year NASA's Solar Radiation and Climate Experiment (SORCE) was launched (see 'Mission control'), carrying a new type of sensor developed by Kopp and his team at the University of Colorado's Laboratory for Atmospheric and Space Physics in Boulder.

Kopp initially thought that there was a problem with the sensor, the Total Irradiance Monitor (TIM), which consistently gave a lower reading than its predecessors. Subsequent analyses now suggest that the sensor's readings offer a truer measure of the Sun's total energy output than others. That accuracy is crucial to understanding the 11-year solar cycle as well as the Sun's small but measurable contribution to global warming. Now, with a second-generation TIM scheduled for launch on 23 February aboard NASA's Glory satellite, Kopp believes he has found a way to avoid a future mismatch in detector readings. "I decided that with Glory I was going to solve this problem once and for all," he says.

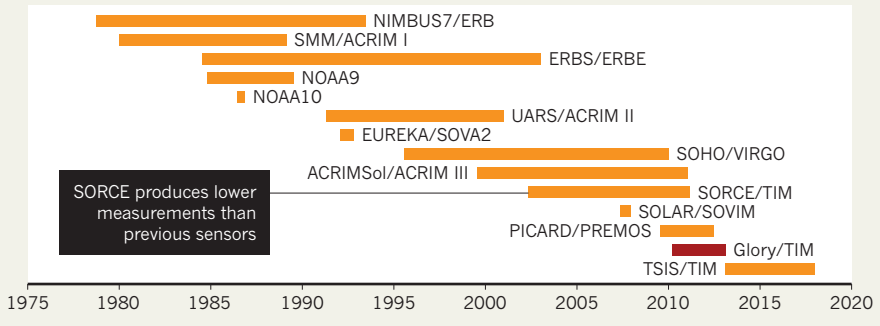
Kopp's solution was to design a facility that can exquisitely calibrate sensors such as TIM before they launch. The facility includes a variable power laser that acts as a light source and a cryogenically cooled radiometer that is almost immune to temperature fluctuations, all inside a space-like vacuum. By calibrating the detector to the radiometer's readings, Kopp hopes to eliminate almost all ambiguity in Glory's measurements of solar radiation, expected to be three times more precise than those from SORCE.

He has also used the facility to analyse a replica of the SORCE sensor and validate that satellite's readings. On the basis of those and other measurements, Kopp and Judith Lean of the Naval Research Laboratory in Washington DC, calculate that during the 2008 solar minimum, the Sun emitted about 0.34% less energy than previously estimated (G. Kopp and J. L. Lean *Geophys. Res. Lett.* **38,** L01706; 2011). That is not enough to affect estimates of human influence on climate, but it is important for solar physicists. "This is a fundamental ▶

NATURE.COM
For more on the launch of the Glory satellite, see:
go.nature.com/mcbind

MISSION CONTROL

A series of missions have measured the Sun's energy output continuously since 1978. With the launch of Glory and future satellites, physicists hope to continue the series with even greater accuracy.



quantity that has been pursued for more than 100 years," Lean says.

The design of TIM explains its consistently lower readings. Other sensors typically use a two-stage aperture to gather incoming light. Kopp and Lean suggest that this can allow light to bounce around within the device and contribute to an overestimate of incoming energy. In Kopp's TIM, 99.99% of the solar radiation that enters the aperture disappears down a long tube before getting trapped in a chamber full of what he describes as miniature broccoli heads made of a nickel–phosphorus alloy. The device then measures the amount of heat the sensor derives from the incoming radiation.

Solar physicists hope that the increased precision and confidence built into the current generation of irradiance sensors will compensate for any future lapse in monitoring. Yet continuity remains a high priority. NASA's goal is to get some overlap between Glory and SORCE, which lost one of the reaction wheels used to aim the instrument in September 2008 and has been running on a back-up system ever since. "Overlap among measurements is essential because absolute accuracy is not guaranteed," says Kevin Trenberth, a senior climate scientist at the National Center for Atmospheric Research in Boulder.

Preliminary data from PREMOS, a Swiss-built sensor launched in June 2010 on the French PICARD satellite, seem to align well with the SORCE readings. PREMOS was also calibrated against Kopp's cryogenic radiometer, which bolstered confidence in its initial readings, says principal investigator Werner Schmutz at the World Radiation Center in Davos. "Without this confirmation, we probably would have hesitated with our new value," Schmutz adds.

Researchers are counting on another University of Colorado detector to pick up monitoring duties in 2014. While improvements in calibration mean that researchers can probably tolerate a gap in the record and still compare past and future data with reasonable confidence, Kopp says, such a contingency would be a last resort. The truest test of Kopp's ground-based calibrator will come when Glory begins reporting data later this spring. Kopp says he's not losing any sleep. "I'm really expecting good agreement," he says with a smile. ■ SEE EDITORIAL P.444

NEUROIMAGING

Alzheimer's-disease probe nears approval

Imaging technique could help to resolve questions about brain plaques associated with the condition.

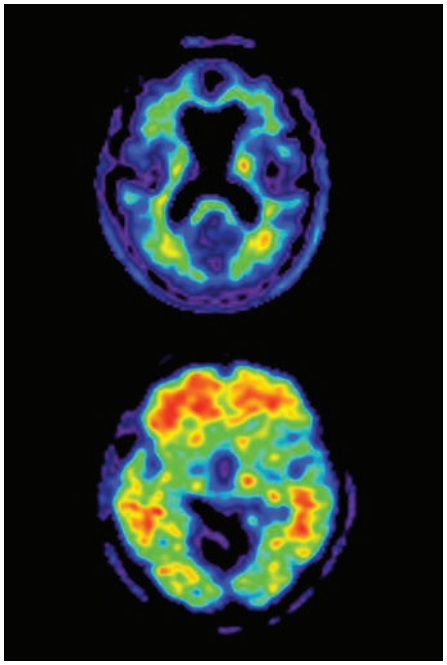
BY HEIDI LEDFORD

An imaging agent that reveals a signature of Alzheimer's disease in the brain — given conditional support last week by advisers to the US Food and Drug Administration (FDA) — is likely to be more valuable to scientists than to patients.

The agent, called florbetapir (Amyvid), enables physicians to determine whether Alzheimer's disease is the cause of a patient's dementia. In the future, it may also help them to catch the disease before obvious symptoms appear, a hope that has sparked fresh debate about the value of early diagnosis for a devastating, untreatable disease. The panel of advisers — whose guidance is usually, but not always, followed by the FDA — also stated that the test should not be given final approval until its developers demonstrate that clinicians can uniformly interpret its results.

"The importance of the decision is probably bigger for research in the near future than it is for clinical practice," says William Thies, the chief medical and scientific officer of the Alzheimer's Association based in Chicago, Illinois, a nonprofit organization that funds research on Alzheimer's disease.

Physicians diagnose Alzheimer's disease only after memory loss interferes with daily activities. By then, "there's so much irreversible damage that it might be too late to hope for an effective treatment", says Gil Rabinovici, a neurologist at the University of California, San Francisco. Definitive confirmation comes from autopsy, with the presence of characteristic lesions in the brain caused by clumps of the peptide amyloid-β. These amyloid plaques are hypothesized to be the cause of the memory loss.



Florbetapir reveals amyloid plaque build-up (red) in the brain of someone with Alzheimer's disease (bottom), which is absent in a healthy brain (top).

ELI LILLY/AVID RADIOPHARMACEUTICALS

Some researchers already use a reagent called Pittsburgh Compound B to image amyloid plaques in people suspected to have Alzheimer's disease. The compound binds to the plaques, and its radioactivity can be detected using positron emission tomography. But the reagent is labelled with carbon-11: with a half-life of just 20 minutes, its use is limited to the handful of facilities that have an on-site cyclotron to prepare it.

In contrast, florbetapir is labelled with fluorine-18, which has a half-life of nearly two hours. That would be long enough to allow the compound's manufacturer, Eli Lilly, based in Indianapolis, Indiana, to send labelled florbetapir directly to users without losing too much of the reagent to radioactive decay. The likely result: more and bigger studies of the relationship between amyloid and disease, says Thies.

A study published last week was crucial to the advisory panel's decision. It confirmed that brain scans of living patients given florbetapir correlate with amyloid plaques found at autopsy after they died (C. M. Clark *et al. J. Am. Med. Assoc.* **305,** 275–283; 2011). The Alzheimer's Disease Neuroimaging Initiative, a project to improve clinical trials of candidate therapies for Alzheimer's disease, has already incorporated florbetapir in its studies of hundreds of people suspected to have the condition. And Rabinovici hopes to test whether the reagent can distinguish between Alzheimer's disease and frontotemporal dementia, which causes many of the same symptoms and is often misdiagnosed.

Florbetapir could help to resolve one of the fundamental disputes about Alzheimer's disease: whether amyloid plaques kill brain tissue or are a side effect of the disease process. "Critics always tell me 'well we don't know yet if the amyloid hypothesis is true'," says William Jagust, a neuroscientist at the University of California, Berkeley. "But this compound will finally allow us to examine just how important amyloid is." ■