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Earth observing: Something to watch over us

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An ambitious international project to unite the planet's Earth-observing systems is under way. But getting everyone on board is no easy task, says Naomi Lubick.

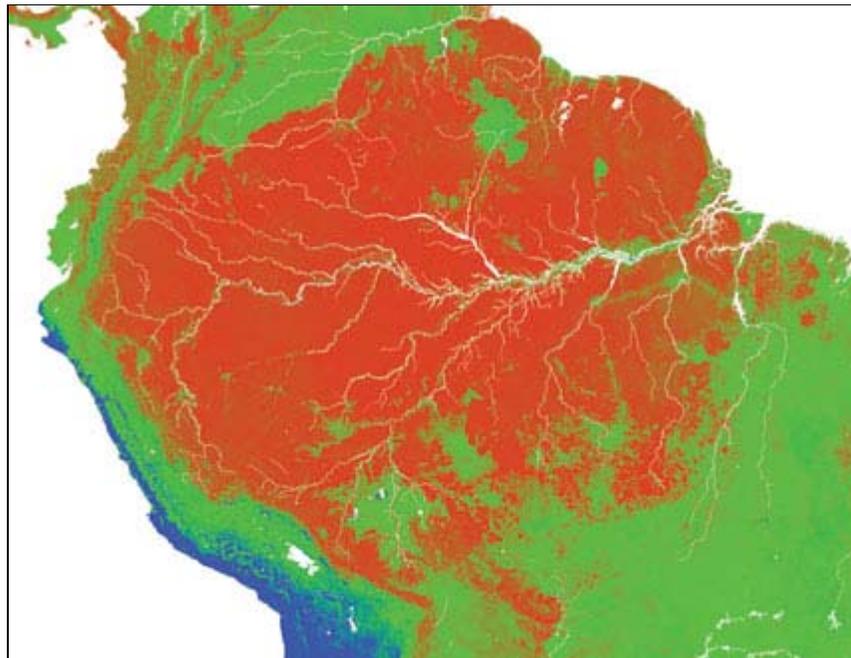
Earth has no shortage of spies — mechanical ones, that is. A range of instruments, including satellites, tide gauges and weather stations, constantly track natural phenomena. But like human spies, these machines rarely speak to each other — hampering the efforts of scientists, politicians and planners to best manage the planet's natural systems.

It took a horrifying natural disaster to put Earth observation in the public consciousness. Soon after the Indian Ocean tsunami killed nearly a quarter of a million people in December 2004, news reports revealed that some of the hydrophones, seismometers and other devices that could have provided a warning were in place — they just weren't linked together in real time to provide an effective alert.

Now plans are afoot for a system to warn of future tsunamis in the Indian Ocean and, with little public fanfare, a much more ambitious scheme is taking shape. The Global Earth Observation System of Systems, or GEOSS, promises global, instantaneous hook-up of satellites, ground-based stations, and oceanographic and atmospheric instruments. Within a decade, if all goes according to plan, scientists from participating countries will share data on a variety of global phenomena — from sea-surface

temperatures, through rainfall totals, to land-use patterns.

GEOSS would link the more than 50 Earth-observing satellites with thousands of oceanographic buoys and terrestrial observing stations. Scientists could combine millions of data sets into one coherent picture, which planners could use to improve people's lives. Using data from anywhere in the world, researchers would be able to predict the long-term agricultural outlook for various regions, track wetlands that are threatened by development, or send alerts when standing water is plentiful enough for the breeding of bumper populations of malaria-bearing mosquitoes.



Plain view: satellite tracking of the state of the Amazon rainforest (red) could become part of a global observation network.

R. SIMMON/NASA EARTH OBSERVATORY

But GEOSS faces many procedural stumbling blocks. It's not clear what kind of information should be shared or by whom. Money remains a major issue in a field where funding for long-term monitoring projects is often slashed. The United States has coughed up most of GEOSS' start-up costs so far — up to US\$750,000 in two years. Now that the programme has moved its headquarters from the United States to Geneva, other governments are starting to contribute money and staff.

Good connections

Scientists and policy-makers had talked about something like GEOSS for decades, but plans only began to crystallize at the 2002 World Summit on Sustainable Development in Johannesburg and at the 2003 G8 summit in Evian, France. Now supporters are busy identifying data gaps, and hope to put new

instruments in place to fill them within the next four years. By 2013, advocates hope to have a complete data-sharing system whose output could help people make better-informed decisions about their lives. One day, GEOSS products could help forest managers track erosion, climatologists follow dust storms, or even anglers find the best spot to cast their line.

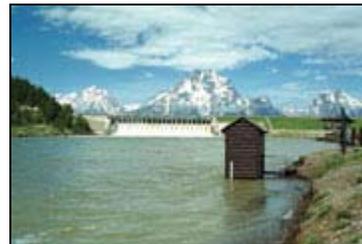
On some levels, scientists already share their observations of Earth. Researchers have long swapped information from remote sensing satellites such as the US Landsat series and the European Space Agency's ERS satellites. GEOSS is a natural extension of this. Most scientists agree that the billions of dollars that already flow into Earth observing are not always spent most effectively. Data sets overlap dramatically for some observations, such as meteorological satellite recordings, but are sorely lacking in others, such as hydrophone measurements that could warn of tsunamis. And earlier international efforts to coordinate observations, such as the Global Ocean Observing System and the Global Climate Observing System, suffer from funding shortages.

Global vision

Yet since the Johannesburg summit, high-level political backing for GEOSS has coalesced relatively quickly. In 2003, ministers from 33 countries and representatives of the European Union (EU) attended the first global Earth Observation Summit in Washington DC. Interest swelled and by February this year, 58 governments had signed a cooperative agreement in Brussels. Such international attention could keep the pressure on individual governments to stay with GEOSS, says Don Hinsman, director of the space programme at the World Meteorological Organization (WMO) in Geneva. "That type of visibility will only ensure continued support," he says.

But some countries are hesitant to climb on board. For instance, Tanzania's government has yet to consider joining. Mohammed Mhita, director-general of the Tanzania Meteorological Agency, and other supporters are working out how to encourage the financial investment for computing power and high-speed telecommunications needed to take full advantage of GEOSS. They are also discussing which organization should take the lead on national efforts. And in Saudi

Arabia, some scientists have spoken of difficulties in getting data from their own country's sources. Secretive governments may not want to share their data but "it becomes harder to hold out in an interconnected world" says Joanne Gabrynowicz, a US delegate to several recent GEOSS meetings and the director of the National Remote Sensing and Space Law Center of the



Under GEOSS, data would be shared from streamflow gauges such as this one on Snake River in Wyoming.

K. M. NOLAN/USGS

University of Mississippi.

Other nations may feel they could lose their self-sufficiency if they share too much, says John Zillman, president of the Australian Academy of Technological Sciences and Engineering, and former president of the WMO. Under GEOSS, he notes, a researcher could sit in the United States and produce forecasts for regions thousands of miles away. "How is the national meteorological survey of Nigeria going to feel?" he asks. "Are they going to be happy to see their data flowing freely, while you in the United States perform their forecasts? That's the dilemma."

Such issues are also a concern for emerging world powers. India, which has a strong telecommunications and scientific infrastructure, has been reluctant to share data from its network of seismometers. Because the information is considered vital to national security, the government prevents it from being sent out in real time — a serious potential problem for the fledgling Indian Ocean tsunami warning system. Some data are held indefinitely as they may pertain to nuclear testing. And economic considerations also come into play: satellite images and other kinds of high-resolution data are sometimes reserved for sale.

In many cases, GEOSS might allow countries to keep sensitive data to themselves, while sharing information that could benefit other countries. "We look at GEOSS to contribute, but we also look at it to benefit us in areas where we don't have missions," says Mukund Rao, a geologist at the Indian Space Research Organisation and president of the Global Spatial Data Infrastructure Association. For instance, India has no ocean observations that track sea-surface height and temperature and so might be interested in acquiring them through GEOSS.

But even the most dedicated countries, such as the United States, cannot guarantee their long-term support. Several US Earth-observing projects — such as the collection of national measurements of streamflow by the US Geological Survey — are losing funding. And the US government only recently made plans to launch the successor to the Landsat 7 remote sensing satellite. Now, there may be a potential gap of several years before the next-generation Landsat is launched.

GEOSS' birth pangs might be lessened, say observers, if the programme models itself on the WMO. With 187 member countries and territories, most with their own meteorological division, the body has had great success in sharing databases. It took years for countries to make sure their data were in the correct format for sharing, and to figure out how to get the information to each other, says Zillman — but they did it in the end. GEOSS is already taking its first steps in this direction: at a meeting in May, participants agreed in principle to accept carefully worded language on how to retain control over data while pledging to share them.

“ However it ends up

For now, GEOSS is housed at the

being structured, GEOSS has the potential to reshape the face of Earth observing. ”

WMO's offices in Geneva, under an independent coordinating secretariat. Some observers think GEOSS should be moved under the auspices of the United Nations (UN), whereas others

wonder if it should remain an independent organization, much like the Intergovernmental Panel on Climate Change.

"There are arguments for both," says Vice Admiral Conrad Lautenbacher, head of the US National Oceanic and Atmospheric Administration and a driving force behind GEOSS. In its current independent state, GEOSS "doesn't have the huge bureaucracy, procedures and baggage that you have as a formal UN organization" Lautenbacher says. Instead, the relatively informal coalition allows parties to talk to each other in a non-threatening forum. On the other hand, although the UN infrastructure may be unwieldy, the UN provides a venue where countries are used to dealing with each other, which might be important for building trust, says Zillman.

However it ends up being structured, GEOSS has the potential to reshape the face of Earth observing supporters say. If the early momentum can be sustained, the spies will start sharing crucial observations. Earth science will benefit from the silence being broken.