

The corona's total thermal energy, estimated to be 2×10^{23} joules, is also much less than typical for solar minima.

The Sun and Nearby Stars

SphinX measurements of the Sun's recent X-ray output are showing it to be the dimmest X-ray star in its immediate stellar neighborhood. SphinX X-ray spectra can be extrapolated to the spectral range of the X-ray instrument on Germany's Röntgensatellit (ROSAT) that observed nearby stars, many of which have coronae just like the Sun's. Using stellar luminosities from the ROSAT All-Sky Survey (RASS) [Schmitt *et al.*, 1995], it was found that the Sun's X-ray luminosity, averaging 1.3×10^{18} watts between February and October 2009, was less than the X-ray luminosity of all stars within 23 light years of the Sun, and was 100 times less than that of Alpha Centauri A, widely considered to be the Sun's "twin star" from the point of view of its optical output.

SphinX estimates of the Sun's X-ray luminosity in the ROSAT X-ray energy range are in fact some 50 times less than those during the previous solar minimum, when the Sun would have been considered quite normal in its X-ray output compared with nearby stars.

The Sun has experienced a truly unusual episode in humanity's observational history. Its X-ray output over the previous minimum was remarkably low, lower than at any time in the past 50 years, since the space age began. Activity is at last picking up in this new year—as a result, the deepest minimum in recent times may be over. Nonetheless, SphinX measurements of the X-ray emission are unique in that they recorded the unprecedentedly low levels of X-ray activity, helping scientists to better understand extremes in the natural variability of the Sun.

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NEWS

U.S. Geological Survey Would Fare Well in Proposed Federal Budget

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The U.S. Geological Survey (USGS) is among the U.S. federal science agencies that would see significant funding increases if Congress approves the Obama administration's proposed budget for fiscal year (FY) 2011. The FY 2011 budget request would provide USGS with \$1.13 billion, an increase of \$21.6 million, or 1.9%, above the FY 2010 enacted level.

"In a time of budget austerity, to have the budget for a science agency like the USGS actually be at a level above 2010—and 2010 was a pretty good budget year for the USGS—is indeed a very good sign," USGS director Marcia McNutt said at a 1 February budget briefing. "What we are seeing in the USGS budget is the reflection from both the president and the secretary [of the Department of the Interior, of which USGS is part] of their commitment that the problems that the nation is facing right now are problems to which science can help us find an answer," she said.

McNutt indicated the proposed budget would provide particularly strong support for USGS science programs—energy, climate, water, and hazards—that are aligned with the agency's science strategy. "It shows how coming up with a strong science plan, a strong science strategy, and sticking to it, did us well," she said.

Within the proposed budget, the Geographic Research, Investigations, and

Remote Sensing account would increase to \$153.4 million, up 5.4% from \$145.6 million. The Land Remote Sensing proposed budget of \$75.9 million would allow the agency to continue operations and maintenance for Landsat 5 and 7. In addition, a program increase of \$13.4 million would fund ground system requirements for the Landsat Data Continuity Mission. Landsat 8 is scheduled to launch in 2012.

Funding for the National Geospatial Program would drop to \$65.9 million from \$70.7 million. Most of that cut would come from a \$3.5 million decrease in funding for the National Map partnerships, which would receive \$10.4 million compared with \$13.9 million in FY 2010. McNutt said the agency looks forward to rebuilding the program again in the future.

The Geologic Hazards, Resources, and Processes account would receive an overall slight increase to \$253.8 million from \$249.1 million. The budget for geologic hazard assessments would bump up modestly to \$92.9 million from \$92.8 million, with funding for volcano hazards assessments targeted to rise a bit to \$25.2 million, up from \$24.4 million. Funding would dip for earthquake and landslide hazards assessments, the Global Seismographic Network, and geomagnetism research.

Geologic Landscape and Coastal Assessments funding would increase to \$77.6 million from \$74.4 million. Included is \$4 million for coastal and marine spatial planning

to increase the availability of geospatial data, among other goals. The budget for mineral resources assessments would dip slightly to \$52.5 million from \$53.8 million, while funding for energy resources assessments would increase moderately to \$30.8 million from \$28.2 million.

The Water Resources Investigations account would decrease to \$228.8 million from \$232.3 million. Funding for hydrologic networks and analysis would increase, with decreases for other line items, including the Groundwater Resources Program, the National Water-Quality Assessment Program, and the Toxic Substances Hydrology Program.

Funding for biological research would dip from \$204.9 million to \$201.3 million. The budget for the agency's Enterprise Information account, which includes support for computers and information systems, would drop to \$41.5 million from \$46 million. Funding for USGS science support would increase 11.8% to \$77.4 million from \$69.2 million.

The proposed USGS budget also requests funding for some initiatives from the secretary of the interior, including \$11 million in additional funding for climate change adaptation, primarily to expand the Department of the Interior's climate science centers. Funding for the agency's Global Change account overall would jump a whopping 23.9% to \$72.1 million, up from \$58.2 million. The New Energy Frontier initiative would receive \$3 million in new funding to study the impact of wind energy options on ecosystems and wildlife populations. The budget also would include funding for the agency to begin an assessment of the availability and use of water resources in the United States through the WaterSMART (Sustain and Manage America's Resources for Tomorrow) program. In addition, \$3.6 million would be slated for the Treasured Landscapes initiative to implement the

Chesapeake Bay Protection and Restoration presidential executive order.

"We wish there were only increases and no program decreases, but 'they made us do it,'" McNutt joked, referring to administration officials. "But we recognize that in these tough times, we really have to do our part to meet the president's goals. The programs that were cut we recognize are valuable programs, but nevertheless we had to have

priorities. Everything is important," McNutt said, adding, with a nod to the radio program *A Prairie Home Companion*, "Coming from Minnesota, where all the children are above average, there is no program that we felt was not worthwhile."

Future issues of *Eos* will detail the Obama administration's federal budget request for FY 2011 for other geophysics-related agencies, including the National

Oceanic and Atmospheric Administration and the National Science Foundation. For more information, visit <http://www.whitehouse.gov/omb/> and individual federal agency Web sites. For details on the NASA and Department of Energy proposed budgets for FY 2011, see *Eos*, 91(7), 16 February 2010.

—RANDY SHOWSTACK, Staff Writer

FORUM

Advocating for the Use of Informatics in the Earth and Space Sciences

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Earth and space scientists are engaged in integrating knowledge stemming from different disciplines about the constituent parts of the complex Sun-Earth system with the objective of understanding its properties as a whole system. Earth and space system analysis is a real challenge for scientists as well as for information technology (IT) experts. The scope and complexity of Earth and space system investigations demand the formation of distributed, multidisciplinary, collaborative teams [Foster and Kesselman, 2006]. The growing area of geoscience informatics is concerned with providing integrated access to a range of advanced information and processing resources for the environment.

There is an irreversible trend away from data-centric architectures and toward service-oriented architectures (SOA) and systems. Data-centric architectures consider interactions and interoperability at the data level, sharing common data models, while service-oriented architectures allow interoperability among information systems at the enterprise level, sharing common functional interfaces. In the Internet era, there is a clear demand to discover and access geosciences resources using Internet technologies. This can be achieved by enabling spatial data infrastructures (SDI) to "understand" and serve valuable and useful geosciences resources [European Parliament, 2007]. There has been increasing interest in the application of information systems in Earth and space sciences, as indicated by substantial investment across all disciplines by science agencies such as the U.S. National Science Foundation (<http://www.nsf.gov>) and the European Commission Research and Development Framework programs (http://ec.europa.eu/research/fp7/index_en.cfm). Considerable intellectual innovation is occurring due to data, information, and knowledge sharing across traditional disciplinary boundaries [Baker et al., 2008].

Scientific unions in the United States and Europe are recognizing that the field of informatics in the Earth and space sciences has grown rapidly in the past decade to the point where expanding the scope of existing international forums is warranted: AGU has established

an Earth and Space Science Informatics (ESSI) focus group and the European Geosciences Union (EGU) created an ESSI scientific division in 2008. These ESSI groups collaborate closely in promoting common sessions and coordinating actions to advocate for the use of informatics in the Earth and space sciences.

EGU's ESSI Division Scope

Advanced digital infrastructures (e.g., cyberinfrastructures, known in Europe as e-infrastructure) are needed to support the formation and operation of an Earth and

space systems science community that is based on multidisciplinary knowledge integration. EGU's ESSI division has been conceived as a European forum to support multidisciplinary information sharing and interoperability. Its activities promote the presentation and discussion of Earth sciences digital infrastructure development from a scientific perspective to complement and integrate the technological perspective. EGU's ESSI division aims to facilitate the integration of information systems from different geoscience disciplines, addressing the heterogeneity that characterizes

the disciplines' data and metadata models, protocols, interfaces, semantics, and embedded knowledge.

The ESSI division also serves as a virtual intellectual commons for the international geosciences community for discussing and sharing ideas and knowledge on advanced technologies that are of interest to the geospatial science community. Figure 1 depicts the ESSI context framework.

The ESSI division supports Earth and space scientists to leverage the recent revolution in IT and consequent information infrastructures by adopting the information modeling approach and implementing model-driven architectures, SOA, and semistructured data model and encodings.

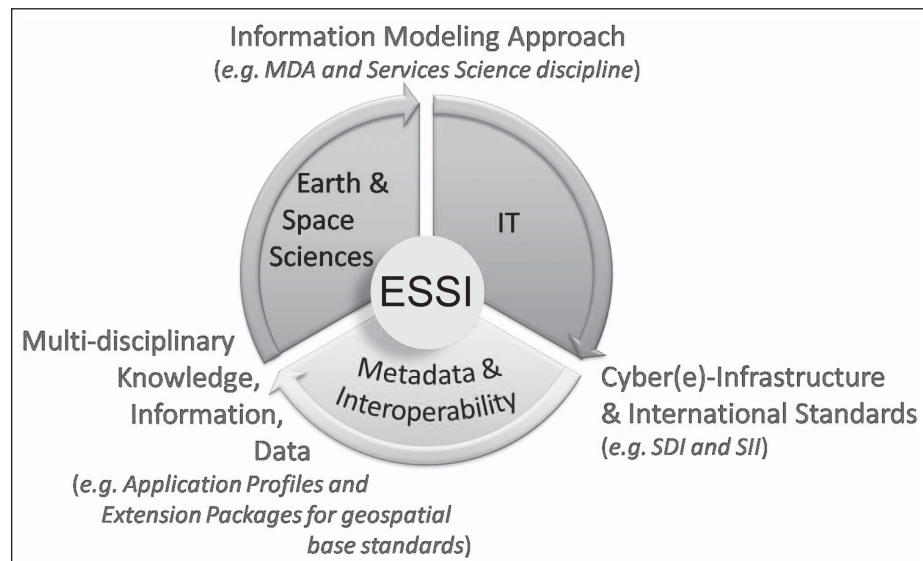


Fig. 1. European Geosciences Union (EGU) Earth and Space Science Informatics (ESSI) context framework.