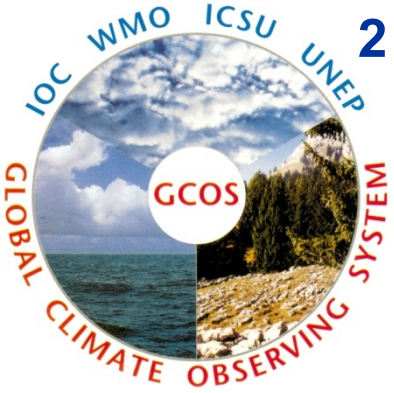
Global Climate Observing System (GCOS)
GCOS Upper-Air Reference Network (GRUAN) –
The GCOS Steering Committee Perspective & the U.S. GCOS Program Perspective

Howard Diamond, US GCOS Program Manager on behalf of
Carolin Richter, Director - GCOS Secretariat

2nd GRUAN Implementation-Coordination Meeting (ICM-2)
2 -4 March 2010, Payerne, Switzerland



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WMO UNESCO IOC UNEP ICSU International Council for Science

Global Climate Observing System

Mission: To ensure that the data required to meet the needs of users for climate information are obtained and made available for:

- **Climate system monitoring, climate change detection and attribution;**
- **Research, modelling and prediction of the climate system;**
- **Assessing impacts, vulnerability & adaptation;**
- **Application to sustainable economic development.**

Global, long-term, high-quality, sustainable.

Structure of GCOS

- GCOS is sponsored by
  - World Meteorological Organization (WMO),
  - United Nations Environment Programme (UNEP),
  - Intergovernmental Oceanographic Commission (IOC),
  - International Council for Science (ICSU)

  and has strong links with FAO GTOS

- GCOS secretariat was established to advise and report to its sponsors and the UNFCCC

- The “Global Climate Observing System” consists of the climate-relevant components of existing atmospheric, oceanic and terrestrial observing systems and their enhancement to meet user needs for climate observations

Governance of GCOS

- Steering Committee of scientific and operational experts.
- Steering Committee Chairman and Director with a small secretariat - total 3 regular staff
- Three domain science panels
  - Atmospheric Observation Panel for Climate (AOPC) - sponsored by WCRP and GCOS
  - Ocean Observation Panel for Climate (OOPC) - sponsored by GOOS, WCRP, and GCOS
  - Terrestrial Observation Panel for Climate (TOPC) - sponsored by GTOS, WCRP, and GCOS
- GCOS National Coordinators and Committees

Strategy of GCOS

- Planning and advising on implementing Climate Observing Systems to "Climate" standards
- Based on advice from scientific panels and working with relevant technical bodies.
- Engaging Intergovernmental International and National Bodies
  - UNFCCC / COP / SBSTA
  - Intergovernmental bodies of GCOS Sponsors
  - GEOSS
  - CEOS
- Resource Mobilisation ("GCOS Cooperation Mechanism")
  - Multi-governmental Voluntary Donor Fund

Essential Climate Variables (ECVs)*

Domain	Essential Climate Variables	
Atmospheric (over land, sea and ice)	**Surface[1]:**	Air temperature, Wind speed and direction, Water vapour, Pressure, Precipitation, Surface radiation budget.
	Upper-air:	Temperature, Wind speed and direction, Water vapour, Cloud properties, Earth radiation budget (including solar irradiance).
	Composition:	Carbon dioxide, Methane, and other long-lived greenhouse gases. Ozone and Aerosol, supported by their precursors[2]
Oceanic	**Surface[3]:**	Sea-surface temperature, Sea-surface salinity, Sea level, Sea state, Sea ice, Surface current, Ocean colour (for biological activity), Carbon dioxide partial pressure, Ocean acidity,
	Sub-surface:	Temperature, Salinity, Current, Nutrients, Carbon dioxide partial pressure, Ocean acidity, Oxygen, Tracers, Phytoplankton; Marine biodiversity and habitat properties[4]
Terrestrial	River discharge, Water use, Ground water, Lakes, Snow cover, Glaciers and ice caps, Ice sheets, Permafrost, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (fAPAR), Leaf area index (LAI), Above-ground biomass, Soil carbon, Fire disturbance, Soil moisture, Terrestrial biodiversity and habitat properties[9]	

[1] Including measurements at standardized, but globally varying heights in close proximity to the surface

[2] NO_2, SO_2, HCHO and CO in particular

[3] Including measurements within the surface mixed layer, usually within the upper 15m

[4] At selected sites and areas (e.g., coral reefs; boreal and tropical forest areas)

*** updated ECVs of DRAFT IP 10**

GCOS Reference Upper-Air Network (GRUAN)

GCOS Implementation Plan (Action Item A16):

"Parties need to […] establish a high-quality reference network of about 30 precision radiosonde stations and other collocated observations"

Motivation

- Lack of quality observations at high altitude (UT/LS region)
- Historical upper-air records are not as good as required for studying climate change with respect to accuracy, long-term stability

We need a way of separating the true signal from the inevitable non-climatic effects that will be imparted into the record!

The Role of GCOS

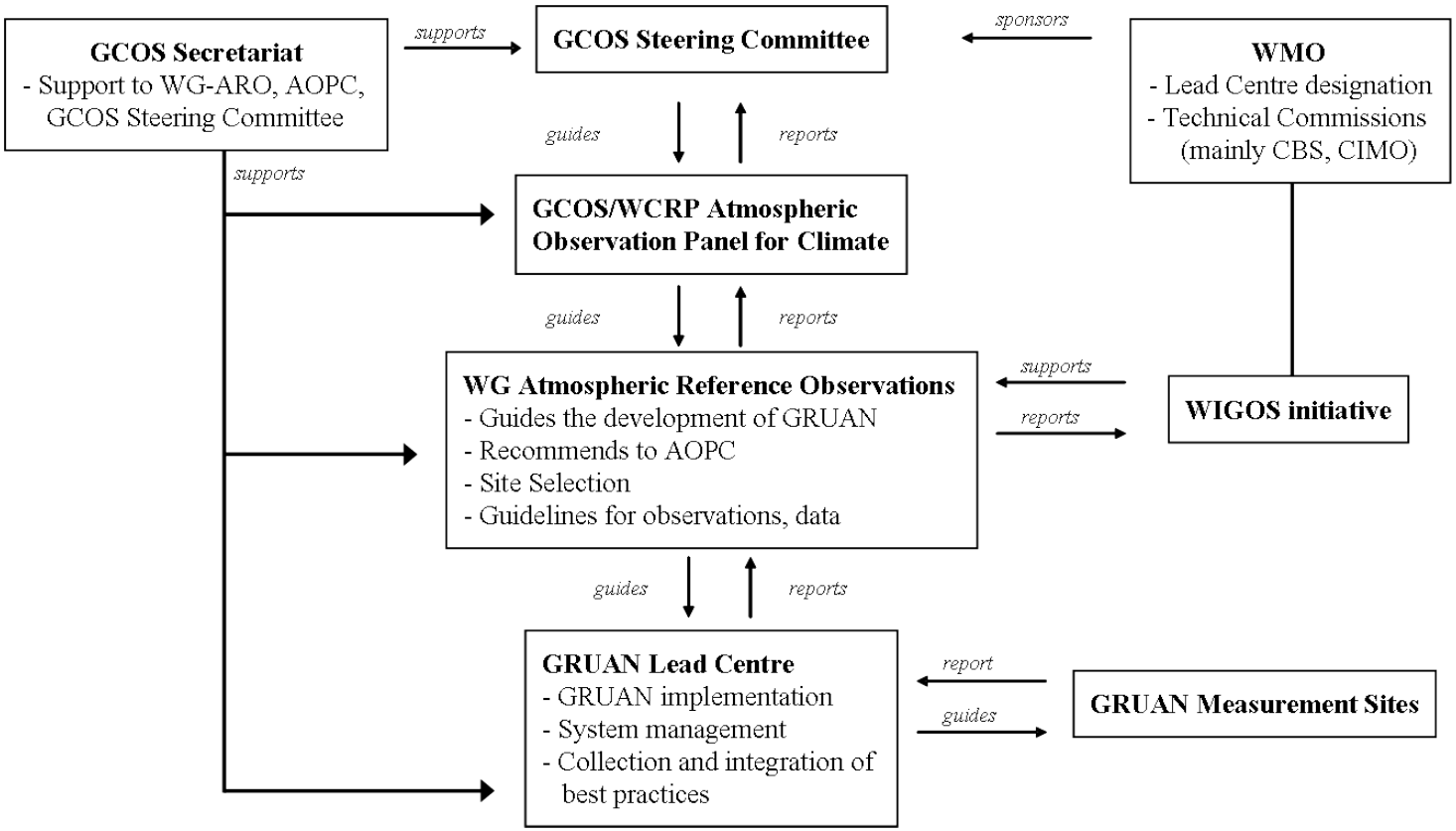
The independent development of observing networks of all sorts is a key issue for GCOS, as extra efficiencies can cut costs and enable more and better observations to be made

GRUAN is a prime example for the development of a "new" network under the GCOS umbrella that builds on and enhances existing facilities and networks, and therefore contributes to that end in a synergistic fashion.

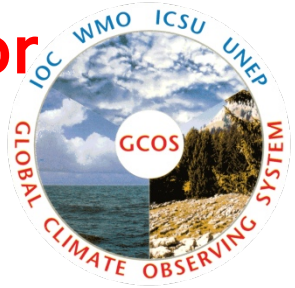
The Role of the GCOS SC and Secretariat is:

- Start-up support for the GRUAN;
- Interaction with WMO processes;
- Outreach and communication activities.

GRUAN Governance



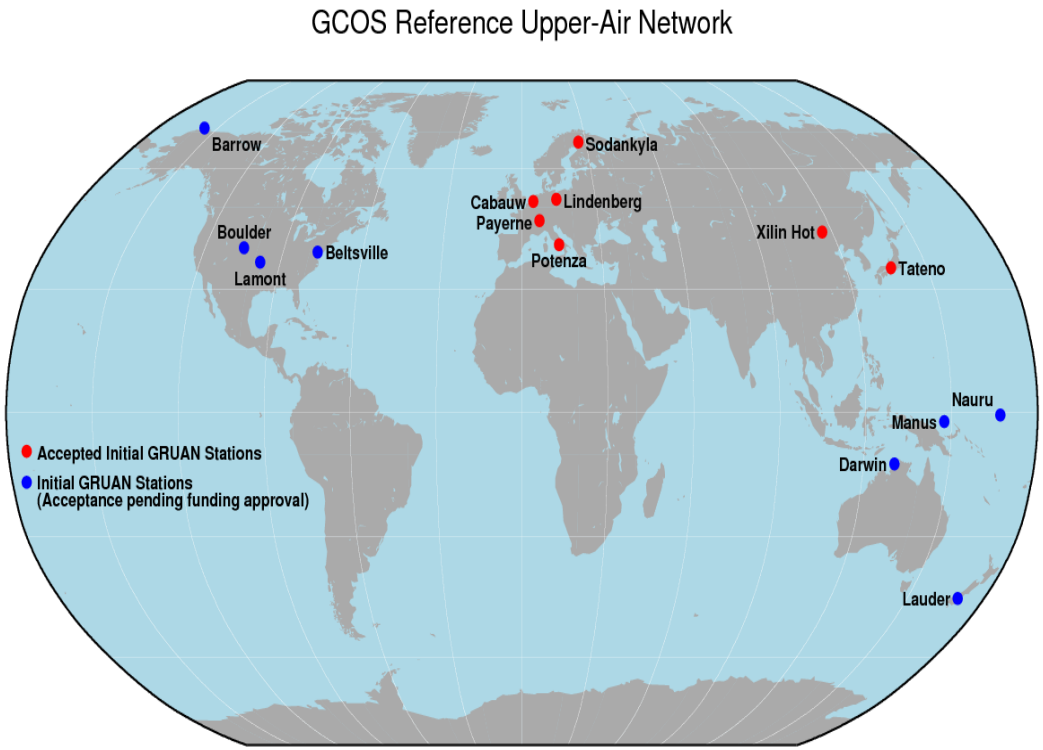
In 2009, The Atmospheric Observation Panel for Climate (AOPC):



- Welcomed the US' Atmospheric Radiation Measurement (ARM) Climate Research Facility's (ACRF) 5 global sites towards meeting GRUAN requirements.
- Warmly welcomed JMA's offer to include Tateno as a GRUAN station.
- Approved that the report from the ICM-1 meeting in 2009.
- Sought approval for the GRUAN Lead Centre to be included in the management board of the WMO CIMO 2010 upper-air inter-comparison.
- Recommended to WMO CBS the establishment of an expert team on GRUAN by the end of 2010.
- Approved the preparation of a GRUAN Implementation Plan by 2013.
- Welcomed the decision by the WG ARO to designate parts of GRUAN as a pilot project for WIGOS.
- Stressed the importance of developing a GRUAN Technical Manual.
- Recommended that the Head of the GRUAN Lead Centre be invited to attend the next meeting of the AOPC.
- Supported the strategy by the WG ARO to start implementation of GRUAN based on a limited set of initial stations, and then expand the network as possible.

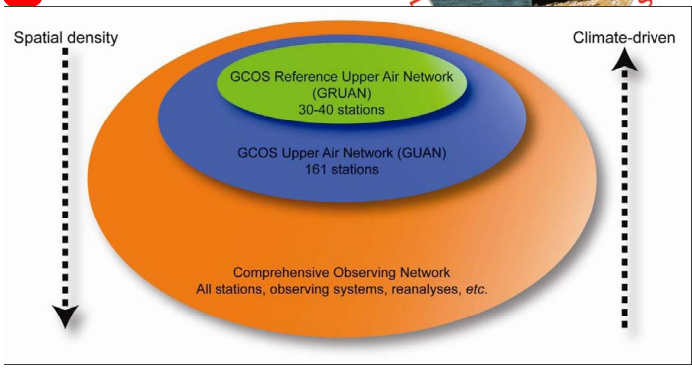
GRUAN Milestones achieved so far

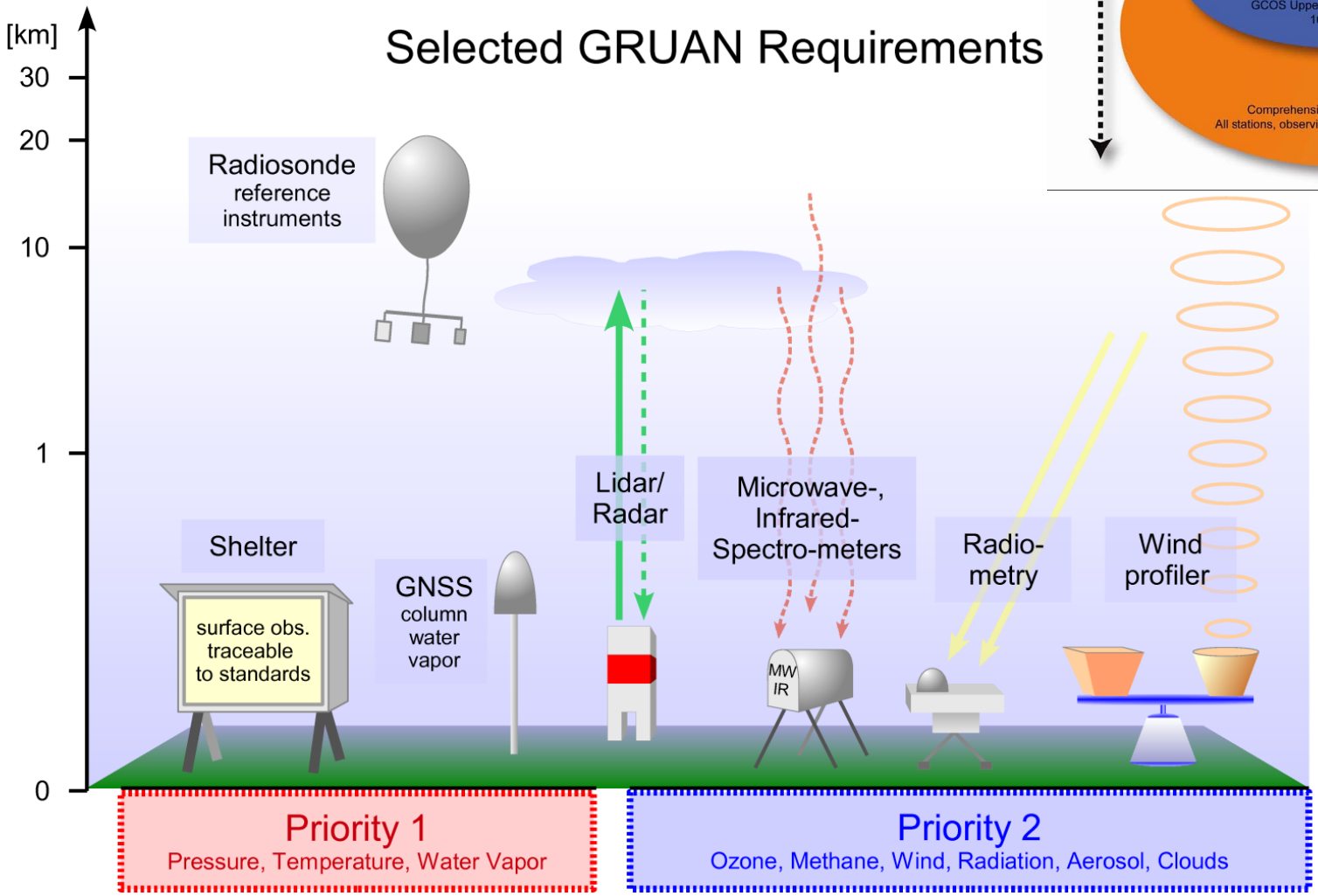
- Designation of a GRUAN Lead Centre at the Lindenberg Observatory (Germany)
- Definition of major requirements for reference observations
- Appointment of initial GRUAN stations
- Publication of the GRUAN Implementation Plan 2009-2013 (GCOS-134)
- GRUAN Pilot Project for the WMO Integrated Observing System (WIGOS)



GCOS SC noted the progress that has been made in the last year in setting up GRUAN. It appreciates the work that the GCOS Secretariat has done in facilitating the establishment of this network and encourages the Secretariat to continue to facilitate its further development.

Observations to be made at GRUAN Sites
http://gruan.org





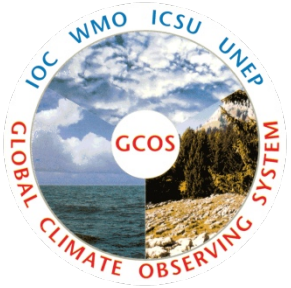
UNEP

ICSU
International Council for Science

Key scientific questions to be addressed by the GRUAN

- Characterization of changes in temperature, humidity, and wind, using current operational radiosonde capabilities
- Understanding the climatology and variability of water vapour, particularly in the UTLS, as well as changes in the hydrological cycle
- Understanding and monitoring tropopause characteristics
- Understanding the vertical profile of temperature trends
- Bringing closure to the Earth's radiation budget and balance
- Understanding climate processes and improving climate models

GRUAN Data Management Effort



•Data Management Planning Meeting held at NCDC in Sep 2009

- Participants
  - GRUAN Lead Center [Lindenberg]
  - U.S. Department of Energy's ACRF Program
  - NOAA's National Climatic Data Center

- Intent: To develop a way forward for the activities necessary to manage GRUAN data in the following areas:
  - Data archiving capabilities at NCDC and ARM
  - Capabilities of the Meta-database (located at the lead center)
  - Development of a data dissemination portal that links the Meta-database and the GRUAN data archive with the data users
  - The role of NCDC and ARM in radiosonde QA/QC
  - Organizing data flows from the GRUAN sites, through a QA/QC institution to the GRUAN data archive.

- All slides and meeting report are posted at the following FTP site at ftp://dossier.ogp.noaa.gov/GCOS/GRUAN-DM-Meeting/

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GOSIC

Global Observing Systems Information Center

Global Ocean Observing System

Global Terrestrial Observing System

Home | About GOSIC | GCOS | GOOS | GTOS | Data Registry | Search | Publications | Acronyms | Contact Info

Facilitating Access to Global Observing Systems Data and Information

The GOSIC Portal provides convenient, central, one-stop access to data and information identified by the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS) and their partner programs, such as the Global Atmosphere Watch (GAW) and regional observing systems, such as the GOOS Regional Alliances (GRA). More information on the GOSIC and the GOSIC Portal

Updated August 5, 2009

Access Data, Metadata & Data Products

- GCOS - Global Climate Observing System
- GAW - Global Atmosphere Watch
- GTOS - Global Terrestrial Observing System
- GOOS - Global Ocean Observing System
- GRA - GOOS Regional Alliances
- Maps and Google Earth(TM) Products

Search Tools

- Data Registry *(search for data and metadata)*
- Portals *(search for metadata in NASA's Global Change Master Directory (GCMD))*
- Data Access Matrices *(provides quick access to data download by program or theme)*
- Text Search
- Publications *(search by observing system, year or title keyword/cross referenced by GCOS, GOOS, GTOS, GAW, WMO and UN ID) (1985 to present)*

Information

- Data Flow Diagrams
- **Meeting Calendars:** GCOS - GOOS - GTOS
- **Publications/Documents:** GCOS - GOOS - GTOS - GAW - GOSIC
- **Data Management Plans:** GCOS/GOOS/GTOS - GCOS - GOOS - GTOS - GAW
- **Strategic Plans:** GOOS - GAW - GCOS/GOOS/GTOS
- **Review the scientific and technical basis for the design of** GCOS - GOOS - GTOS - GCOS/GOOS/GTOS
- Scientific Panels
- Climate Change News Feeds *(from the Ocean United web site)*
- Related Links
- Disclaimer

GOSIC is supported and hosted by the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC), and the U.S. GCOS Program on behalf of the global observing community.

Done

The GOSIC Portal can be access at:

http:// GOSIC.ORG

Diamond, H. J., and C. J. Lief (2009), A Comprehensive Data Portal for Global Climate Information, Eos Trans. AGU, 90(39), 341-342, doi:10.1029/2009EO390001

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A Comprehensive Data Portal for Global Climate Information

The Global Observing Systems Information Center (GOSIC), initiated in 1997 at the request of the Global Climate Observing System (GCOS) Steering Committee (see http://www.wmo.int/pages/prog/gcos/Publications/gcos-39.pdf), responds to a need identified by the global climate observing community for easier and more effective access to observational climate data and information. GOSIC manages an online portal providing an entry point for users of climate-related global observing systems data and information systems.

Following its initial development and implementation at the University of Delaware from 1997 to 2006, the U.S. National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC) assumed operational responsibility for GOSIC on behalf of the international climate observing and data user communities. The goal of GOSIC is to provide basic user services, including a description of the systems and their data as well as a tailored search capability that facilitates access to a worldwide set of observations and derived products. GOSIC's unique value is its ability to make up each system. In addition, the portal provides the opportunity for users to overlap observing systems, allowing users, for instance, to search for data that two observing systems have in common.

The portal provides data and metadata search capabilities through various search mechanisms and matrices, which are optimized to facilitate access to a worldwide set of observations and derived products. For example, the GOSIC Data Registry (http://GOSIC.org/Datasets/ds-report.asp) provides quick access to data and information. In addition, the portal provides a comprehensive list of programs and related data sets for various observing systems and for regional alliances such as the Global Ocean Observing System Regional Alliances (http://www.GOSIC.org/goos/GRA.htm). GOSIC provides support to regional observing systems by aiding in the establishment and maintenance of a Web presence, such as for the Pacific Islands regional GCOS (PI-GCOS) program (http://PI-GCOS.org/), and in the development of data and information management and exchange capabilities.

Improving Stream Studies With a Small-Footprint Green Lidar

Technology is changing how scientists and natural resource managers describe and study streams and rivers. A new generation of airborne aquatic-terrestrial lidars is being developed that can penetrate water and map the submerged topography inside a stream as well as the adjacent subaerial terrain and vegetation in one integrated mission. A leading example of these new cross-environment instruments is the Experimental Advanced Airborne Research Lidar (EAARL), a NASA-built sensor now operated by the U.S. Geological Survey (USGS) [*Wright and Brock*, 2002].

Standard airborne terrestrial lidars, which currently produce the highest-resolution maps of extensive land areas, use reflected near-infrared laser pulses to make millions of point measurements of ground and vegetation elevations. However, near-infrared energy is absorbed by water, which limits the use of these systems to mapping features outside of water bodies. EAARL uses a narrow-beam green, rather than near-infrared, laser with a footprint of only 15 centimeters from the nominal flying height (for system technical specifications, see Table S1 in the electronic supplement to this *Eos* issue (*http://*

but these may require some local calibration [*Feurer et al.*, 2008; *Gao*, 2009]. EAARL offers an unusual combination of attributes: aquatic and terrestrial mapping at up to watershed scales (hundreds of kilometers of channel length), done with relatively high precision, accuracy, and spatial resolution [*Kinzel et al.*, 2007; *McKean et al.*, 2008].

EAARL Performance and Applications

One test of the performance of EAARL is how well it maps in-channel topographic forms relative to traditional wading surveys. For example, does the EAARL accurately define the locations and three-dimensional (3-D) geometry of major features such as pools and riffles? Figure 1 is a side-by-side comparison of EAARL and field-surveyed channel bathymetry of a 150-meter length of a small channel. The maps of basic channel topography are very similar, and detailed field checking indicates that EAARL more accurately mapped the bed of the stream, as the higher-density lidar data detected two small deep pockets in the pool at 68°90'E,

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