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New Ways to Collect Data in the Antarctic

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and providing models. The WDC system has a large, long-term archiving capacity involving a unique data management expertise and is thus of great importance to GEOSS.

2. *WDC Networking:* Usually, data are available from scattered sources, in heterogeneous formats, and conflicting semantic specifications and are thus unequal in representation and quality. Conversely, the holistic understanding of the Earth system requires data sharing, harmonization, and integration. The already successful interoperability among WDCs is the key to a further integration into other communities.

As a next step, a limited number of data centers shall validate the network's backbone through an all-WDC data portal via open and international information standards and protocols that promote GEOSS data sharing principles.

3. *WDC Data Access and Quality:* WDCs provide online access to scientific data free of charge and without discrimination. A common concept for the advancement of data quality and access is necessary. Scientific knowledge is communicated through scientific literature and knowledge is ultimately derived from data, and thus consistent data publication is paramount. Development of standards for peer review, persistent identification, open access, and long-term availability are necessary for good scientific practice, and to fulfill intergovernmental and funding policies.

4. *WDC and IPY:* Since the first International Polar Year in 1881–1884, IPYs have always been large-scale scientific enterprises. The International Polar Year Data and Information Service (IPYDIS) is an international federation of data centers, archives, and networks working to ensure proper stewardship of IPY and the long-term preservation of, and broad, interdisciplinary, and nonexpert access to, IPY data. The WDC system will provide support for close partnership among IPY data centers and organizations around the world to contribute to an internationally distributed data management system.

Within the past half century, an enormous technical evolution in computer techniques and a fundamental change in clients' requirements have occurred that have changed scientific data management. Overcoming heterogeneity in the data centers' equipment and the work flow in the WDC system are important challenges to the goals of open access to scientific data and transdisciplinarity that are unique benefits of a strong WDC.

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Use of Alternative Sampling Platforms in the Antarctic; Washington, D. C., 2–3 August 2006

PAGE 525

Conducting Antarctic research is challenging. Not only is the environment difficult, given low temperatures, high winds, and ice cover, but also the availability of sampling platforms is limited. The U.S. National Science Foundation has only two vessels that can routinely operate in ice-covered waters, the research vessel/icebreaker *N. B. Palmer* and the Antarctic research support vessel *L. M. Gould*. The restricted availability of vessels makes research operations difficult to schedule, especially during austral spring and summer. Traditional sampling methods (those confined to ships and moorings) have provided insights into distributions and processes in the Southern Ocean, but new research questions require new sampling means.

Recent technological revolutions in oceanographic sampling (via remotely operated vehicles (ROVs) or autonomous underwater vehicles (AUVs)) have allowed the investigation of features that previously could not be assessed. A recent workshop in Washington, D. C., discussed the potential and difficulties of using alternative sampling platforms (ASPs) such as ROVs and AUVs in the Antarctic (http://www.vims.edu/ASP_report/index_pdf).

There are a number of different types of oceanographic sampling devices that are not widely used in polar regions. ROVs can be deployed from ships and relay data in real time. AUVs vary depending on the power source for propulsion, as well as their sensors' packages. Gliders can sample for up to 9 months; however, their sensors are limited due to power and hydrodynamic considerations.

Using autonomous vehicles will require improvements to allow routine use in the Antarctic. They include enhanced battery life at low temperatures; increased numbers of platforms to resolve spatial and temporal scales unique to the Antarctic; development of ice-tolerant mooring equipment, including cabled configurations, to allow docking capability for AUVs; incorporation of ice-avoidance technology; and development of smaller, power-efficient sensors. These developments are not necessarily confined to polar systems but are imperative in a location where recovery is difficult.

There are risks involved using ASPs in polar systems. Ice poses a great risk of damaging ROVs and AUVs, and battery life is compromised at low temperatures. However, these same difficulties argue for greater emphasis on alternative platforms. Because ships are infrequently available, the data generated using AUVs are unique and over the course of a study far more cost-effective than conventional sampling. Many remote regions can be sampled more conveniently by alternative sampling platforms than by ship-based procedures and can extend the duration of sampling as well.

Those in attendance at the workshop agreed that there are many critical research questions concerning the Southern Ocean that are of global impact, and progress throughout Antarctic science would be enhanced through the use of new sampling platforms. Their development and deployment are not inexpensive, but the scientific returns promise to be substantial. Workshop participants unanimously agreed upon the following:

- The use of ASPs within multidisciplinary projects should be strongly encouraged;
- the Antarctic Sciences Division (and specifically the Antarctic Oceans and Atmospheres Program and the Antarctic Organisms and Ecosystems Program) should encourage the use of ASPs;
- the Office of Polar Programs should fund the development of oceanographic sensors to allow more effective use of Southern Ocean ASPs; and
- the oceanographic community should acknowledge the substantial benefits of using ASPs in the Southern Ocean.

The attendees concluded that a variety of sampling platforms would provide timely, critical, and unique insights into the oceanography of the Southern Ocean.

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