planning efforts toward coordinated international polar research during 2007-2008, the 50th anniversary of the International Geophysical Year and the Third International Polar Year. This activity is fueled in considerable measure by the conviction that coordinated efforts building on advances in support infrastructure and in instrumentation technology could lead to breakthrough discoveries in subjects ranging from global climate change to astrophysics, oceanography, and micro-biology, to list just a few of those we have heard discussed. The National Science Foundation's Office of Polar Programs–steward of the U.S. Antarctic Program, the U. S. Interagency Arctic Research Policy Committee, and a major source of funding for the education and training of polar scientists, their research and their field support – has engaged in continuing discussions about the upcoming Polar Year with officials responsible for polar research in other U. S. Agencies, in other nations, with a number of international organizations, and with the U. S. planning committee leadership. We have also sought to catalyze thinking in the research community through workshops and discussions and have been monitoring the development of related scientific and educational thrusts. Our goal is to be poised to support U. S. efforts brought forward in timely fashion by researchers and educators and to be ready to facilitate their integration with related international efforts. The time is now rapidly approaching when we will need to begin planning for the support of specific research and education projects. This talk will summarize NSF activity related to planning for the 2007-2008 International Polar Year and will address ways that NSF's focus on People, Ideas, and Tools might support its implementation.

URL: http://www.nsf.gov/home/polar/

C32B-04 1440h INVITED

The Cryosphere in Earth System Science – NASA's Contribution to Polar Research as We Approach IPY.

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The designation of 2007/08 as the next International Polar Year is well timed. The polar regions are undergoing rapid changes, with uncertain - but potentially large - impacts well beyond those frigid climes. Scientists have begun to see the polar regions as bellwethers of global change, beginning with stratospheric ozone depletion (and potential recovery) and extending to the most recent measurements of ice sheet change. The connections between the polar regions and the rest of the Earth system are new and active areas of research. At the same time, our capability to study the polar regions has never been greater. NASA is nearing completion of the deployment of the first phase of the Earth Observing System of remote sensing satellites, and over 20 instruments with active and passive remote sensing capabilities in NASA's current suite of satellites examine the atmosphere, cryosphere and hydrosphere of the polar regions. Stable monitoring of polar sea ice cover have revealed startling trends in recent decades. Two satellite radar mapping campaigns have produce detailed topographic maps of Antarctica and are providing new insights to ice sheet flow characteristics. Laser mapping of Greenland from aircraft has both documented change there and prepared the way for a new space-based capability to map the entire cryosphere. Many nations of the world have recently enhanced and articulated their commitment to Earth observation and the integration of in situ and remote sensing data for use in prediction of future changes. The world scientific community is now well positioned to pose and answer profound questions about polar region change and the implications for the rest of the Earth system. NASA and its domestic and international partners will be essential and active participants in this international scientific effort in the coming decades.

URL: http://www.earth.nasa.gov/

C32B-05 1510h INVITED

Possibilities for NOAA Activities During the IPY

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The International Polar Year and the Declaration from the Earth Observation Summit combine to offer a challenge and an opportunity to improve our knowledge of the polar environment. Within the constraints of available resources, NOAA will strive to emphasize polar observations during the IPY period. Among activities currently foreseen are publication of newly available and recalibrated historical data sets, accelerated deployment of in situ oceanographic sensors, full-scale operation of a network of Arctic atmospheric observatories, increased observation of the polar portion of the carbon cycle, improved access to polar satellite data, and an effort to ensure that all of this information is available to the broad science community. Many of NOAA's planned activities would benefit from close coordination with activities of other U.S. agencies and with agencies of other nations. The IPY offers an opportunity to improve collaboration and sharing of expensive observation platforms and other support facilities. Should the will and resources be available, the IPY could be the catalyst for a 3-5 year deployment of a robust pan-Arctic network of oceanographic moorings to obtain a synoptic view of Arctic Ocean circulation and ice thickness. This could allow more confident specification of a decadal-scale observing system for the Arctic Ocean. For the Arctic region, NOAA will look to the U.S. Climate Change Science Program and the Study of Environmental Arctic Change and its sub-programs for scientific guidance and priority.

C32C MCC: 3010 Wednesday 1600h

International Polar Year 2007-2008 II

(joint with A, B, G, H, OS, PP, S, ED, GC)

Presiding: **R E Bell,** Lamont-Doherty Earth Observatory**; M Albert,** Cold Regions Research and Engineering Laboratory

C32C-01 1600h INVITED

A half century perspective on the International Geophysical Year (IGY) - A Template for the International Polar Year 2007 (IPY 2007)?

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In 1956 I sailed for Antarctica to spend 18 months as a graduate student participating in geophysical-glaciological investigations , as part of the 18-month IGY. This led to a career in geophysics, which has taken me to all of the continents and oceans. As we approach the IPY 2007, the changes in technology and our understanding of the earth over the past half century are breathtaking to contemplate. Although 70 countries participated in IGY, the disciplines were restricted to geophysics. Originally the Third Polar Year, the name was changed to IGY in 1952, at the suggestion of Sydney Chapman. The geographical area comprised the entire earth. The highest priority was given to "problems requiring concurrent synoptic observations at many points involving cooperative observations by many stations." One category was reserved for research on topics such as ocean levels, weather patterns, and the distribution of glacier ice "to establish basic information for subsequent comparison at later epochs." IPY 2007 seems such an epoch. A major international efforts was concentrated in Antarctica, although only 12 counties participated. Glaciology, seismology, auroral studies, ionospheric soundings, magnetic field measurements, and other solar-terrestrial, and meteorological observations comprised the scientific station activities. The only major field activities away from the stations were the oversnow geophysical-glaciological traverses, which made seismic measurements of ice thickness and other ice properties; gravity and magnetic anomaly profiles; and determination of snow accumulation and mean annual temperature. The most intensive of the oversnow traverse programs were those of the U.S. and USSR. Geology and topographic mapping were excluded from the Antarctica because of potential complications due to territorial claims and the possibility of mineral resource discoveries. Despite this, significant geologic findings, such as the discovery of the Dufek intrusion, were made by glaciologists and geophysicists with geologic training. Biology was not an IGY discipline, but even in this case, noted ornithologist, Carl Ekland (at Wilkes Station), carried out significant investigations of skuas. Physical oceanographic investigations resulted in geologic and biological sampling of the sea floor as well. A very few of the significant accomplishments of the IGY include the discovery of the Van Allen belts (the symbol of the IGY was a satellite circling the earth); the observation (at Mauna Loa) and recognition of the rapid global increase in carbon dioxide; the first major models of Arctic sea ice formation, decay, and drift; and the mapping of the midocean ridge system. In Antarctica, a first approximation of the mass of the ice sheet including the order of magnitude thicker ice than previously known (4 km) was a highlight. A baseline of mean annual temperatures measured (to about 0.1 degree accuracy) at about 40 km intervals along thousands of km of oversnow traverses was defined. Three World Data Centers were established; scientific results and data were deposited and made freely available to all. The peaceful international cooperation in Antarctica led directly to the signing of the Antarctic Treaty in 1959, with the first disarmament and freedom of inspection and scientific investigations clauses in history, covering a large area of the earth. I anticipate even greater international scientific cooperation from the IPY 2007. A new generation of polar scientists was developed as a result of IGY; a few of us are still active in Antarctic research. A similar result will provide continuity for the next 50 years.

C32C-02 1630h

From Darkness Toward Light: The International Geophysical Year's Education and Information Projects

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As geoscientists attempt to integrate education and research across different institutions, cultures, and age groups, it is instructive to examine earlier attempts to interest students and the public in science. The U.S. National Committee for the International Geophysical Year (IGY, 1957-58) developed a poster series, associated classroom activities, publications and newsletters, and a set of thirteen half-hour films to explain the disciplinary and interdisciplinary findings of IGY. This presentation describes the lessons learned by the IGY scientists who participated in the education and information projects.

C32C-03 1645h

Understanding the Causes of Climate Change: Ice Cores, the International Polar Year, and Beyond

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The polar regions have a large influence on the earth's climate, and they contain records of how and why climate has changed in the past. In order to understand how climate might change in the future, and to determine the extent to which climate is changing now, we need to understand how polar regions influence climate. The international ice core community has been discussing interrelated Arctic and Antarctic projects for the investigation of climate on time scales of one to a million years. Some of the key questions are: How will the current interglacial period end?; What is the role of Greenhouse gases in climate change?; What are the triggers for abrupt climate change?; How do the Arctic, tropics and Antarctic interact during climate transitions?. Projects being discussed include: 1) development of a spatial array of Arctic and Antarctic climate records spanning the last deglacial, 2) recovery of climate records with decadal time resolution from the end of the last warm period that was similar to current

C32C-04 1700h

IPY and the Southern Ocean

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The Southern Ocean produces much of the deep and bottom waters of the global ocean, hence is a major conduit by which the abyssal ocean communicates with global climate. Given the vast heat content and area of the ocean around the Antarctic continent, along with recent paleoceanographic evidence that the Southern Ocean dominated bottom water production during the last glacial maximum, it is plausible that deep convection there is at least as important for climate change as its better known counterpart in the North Atlantic. Understanding ocean dynamics in the Antarctic thus represents an important missing component in the quest for realistic climate simulation and prediction. A special session of the 2002 Spring Polar Research Board meeting addressed several aspects of the connection between Southern Ocean dynamics and climate, including: (i) the critical role of remote sensing for observing the system (Comiso); (ii) the intricate coupling between the ocean and vast floating shelves of continental ice (Holland); (iii) sea-ice variability and teleconnections with well known atmospheric indices (Martinson); (iv) wintertime stability of the upper ocean and possible triggers for a mode change in deep convection (McPhee); (v) pathways by which cold, dense water formed in the Antarctic finds its way to the rest of the abyssal world ocean (Padman); and (vi) recent atmospheric circulation trends and possible connections with the stratosphere (Thompson). A recurrent theme was the paucity of data from this remote part of the globe, particularly during winter. A brief review of the PRB session and other recent findings will suggest that programs designed to significantly expand our knowledge of the Southern Ocean should be a major thrust in the upcoming International Polar Year.

C32C-05 1715h

Antarctic Array: A vision for seismology on an ice-bound continent

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Antarctic Array is an emerging initiative designed to improve the understanding of the structure and evolution of the Antarctic continent by advancing seismic instrumentation on Antarctica. A long list of scientific questions motivate the development of Antarctic Array. Some of these questions are common to all continents; such as, How has Antarctica grown and evolved and what are the processes that have shaped the lithosphere? Others questions relate to Antarctica's unique position as the keystone in the paleo-history of supercontinent formation and break-up throughout Earth's history, as well as its present unique tectonics and geochemistry. In this context, the scale and nature of rifting as a process that has shaped the continent and dominated its evolution is of primary importance. Still other questions are unique to the Earth's single ice-bound continent; for example, How do lithospheric processes drive and how may they be driven by global environmental change (sea level, climate)? Also, how does the tectonic and thermal structure of the Antarctic lithosphere affect current ice sheet dynamics? A workshop to discuss Antarctic Array was held in Boulder, CO USA in March, 2003, entitled "Structure and Evolution of the Antarctic Plate 2003". A preliminary science plan for Antarctic Array is currently being developed by the Science Team. Antarctic Array is envisioned to encompass four components, with significant similarities to the rapidly developing Earthscope US-ARRAY technology: (1) process-oriented experiments along the line of PASSCAL experiments, (2) an active source system, (3) a set of evolving regional arrays with a "pinwheel" geometry, and (4) an enhanced permanent "backbone" network. Antarctic Array is currently scheduled to initiate as part of the International Polar Year. Developments can be followed at the Antarctic Array web site (www.antarcticarray.org).

URL: http://www.antarcticarray.org

C32C-06 1730h

Opportunities and Challenges for Arctic Geoscience in the IPY (International Polar Year)

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Anyone who has seen a weather map of the northern hemisphere understands that the Arctic Ocean has a climatic and oceanographic influence far beyond its limited geographic extent. This influence is not matched by our understanding of the basin history. For example, we do not know when sea ice first covered the Arctic Basin. The detailed geologic composition and history of major morphologic features, ridges, plateaus and margins is unknown. We could learn the coupled histories of the ocean basin and high latitude climate from the record preserved beneath the Arctic seafloor. Capturing this buried history requires a coordinated program of site surveying and drilling in the Arctic. The IPY is an opportune time to concentrate on this program. Over the past fifty years, we have learned the history of the continents from understanding the histories of the adjacent ocean basins. In the Arctic, we have inferred the history of the Amerasian basin from the limited stratigraphic record exposed on the Canadian and American continental margins. Large tectonic features, such as Lomonosov Ridge, the Alpha-Mendeleev Ridge, Makarov Basin, the Canada Basin and a number of continental margin features are virtually unknown. Reconstructions of the paleogeography of the northern hemisphere prior to Cenozoic times are hypothetical and can only be solved by deciphering the plate tectonic puzzle of the Mesozoic Arctic. Continental margins and sedimentary basins of polar and sub-polar areas contain large quantities of natural resources. The geological history of the northern hemisphere and the framework for the formation of such resources cannot be reconstructed properly if the nature and evolution of the basement of the Arctic Ocean is not determined by directly sampling basement rocks. The IPY offers an opportunity for a coordinated assault on the unsolved problems of the Arctic Ocean. The primary scientific goals during the IPY would be to understand: A) the climatic and paleo-oceanographic evolution of the Arctic region and its effects on global climate, the biosphere and the dynamics of the world ocean and atmosphere; and B) the nature and evolution of the major structural features of the Arctic Ocean Basin and circum-Arctic continental margins. NAD (Nansen Arctic Drilling Program) has suggested that the primary target areas in a first phase of drilling in the Arctic Ocean are the rises and plateaus. Here, the sediments are primarily biogenic fallout from the water masses and hemipelagic/pelagic clays. A later phase of drilling would give priority to the deep ocean basins where the water depth is 4000 m or greater and the sediment thicknesses are greater than 1 km. A major part of all plateaus and ridges would be accessible with a water depth capability of 1500 m except for Alpha Ridge. While the logistics of this work would be quite difficult, the drilling itself would present few challenges. From the available seismic reflection records it appears that 500m of penetration would reach basement on all plateaus and ridges as well as the major unconformity on the Lomonosov Ridge, which overlies a Mesozoic-aged passive margin, the European edge of the Mesozoic Arctic Ocean. This could be the most scientifically productive drilling ever undertaken (per meter).

C32C-07 1745h

Study of Environmental Arctic Change (SEARCH) and the IPY

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Recent studies of the arctic environment have revealed unexpected changes including lower sea-level atmospheric pressure, increased air temperature over most of the Arctic, but lower temperatures over eastern North America and Greenland, changed ocean circulation and rising coastal sea level, warmer Atlantic waters penetrating farther in the Arctic Ocean, reduced sea ice cover, and thawing permafrost. These changes are affecting every part of the arctic environment and are having repercussions on society. To understand the recent observations and put them into the context of natural variability and anthropogenic forcing, a multi-disciplinary, multi-agency program, has recently been developed. This program, SEARCH (Study of Environmental Arctic Change), has the potential to significantly contribute to the IPY by creating a framework for extensive new observations and placing the results into the context of a changing physical, biological, and social environment. Our contribution will outline SEARCH and explore its possible connectivity with the IPY.

C41A MCC: 3002 Thursday 0800h

Ice-Ocean Interactions and the Cryosphere II *(joint with OS, GC)*

Presiding: **M A Lange,** University of Muenster**; D MacAyeal,** University of Chicago

C41A-01 0800h

STABILITY OF ANTARCTIC ICE SHELVES AND THEIR ROLE IN THE GLOBAL CLIMATE SYSTEM

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The Earth's radiation budget, a key determinant of global climate, depends critically on the spatial distribution of surface albedos of our planet. Climate is also driven by major oceanic transport and exchange processes. In that regard, the polar regions play a particularly decisive role. While attention has so far mainly been paid to the annual and inter-annual variability of polar sea ice covers, a number of recent dramatic changes, i.e., the disintegration of the Larsen A- and parts of Larsen B Ice Shelves as well as the major calving events of Filchner-Ronne- and Ross Ice Shelves have led to renewed interest in the role of ice shelves for the global climate system. In this regard, it is not only the disintegration of ice shelves itself that is of particular concern. Ice shelves are known to play a distinct role in the overall stability of the (West-) Antarctic Ice Sheet. Thus, ice shelf disintegration could lead to instability of (parts of) the Antarctic ice cover, with corresponding consequences for the global albedo. Furthermore, the disintegration of major ice shelves will ultimately lead to a significant change of Antarctic Bottom Water (AABW) formation with widespread implications for the world ocean and ultimately global climate. In this paper we will, firstly based on a conceptual model, elucidate the possible impact chain leading from initial regional climate warming, over surface processes on the ice shelves and an increase in calving events to their possible disintegration. We will strive to consider possible feedback between reduced ice shelf surface area and sub-ice shelf exchange processes and their role for global climate and AABW formation. The more qualitative conjectures will be compared with first results from coupled ice shelf-ocean models under varying climate conditions.

URL: http://earth.uni-muenster.de/projekte/clivar.html