virtual observatory development across all the geosciences. It provides a common thread among other global geoscientific initiatives - the *4th International Polar Year*, the *International Year of Planet Earth*, the *International Heliospheric Year*, and *Climate and Weather of the Sun-Earth System*. Virtual observatories provide exciting prospects in the geosciences, and are under varying stages of development, for example the Virtual Seismic Network (http://equinfo.ucsd.edu/vsn/), the Virtual Solar Observatory (http://vso.nso.edu/), and the Virtual Geomagnetic Observatory (http://maggy.emgin.umich.edu/mist/). It is only a matter of time before virtual observatories are a standard feature across all the discipline areas within the geosciences, and add a new dimension to the role of the World Data Centers.

U24A CC: 517 A Tuesday 1530h

The International Polar Year 2007-2008 II

Presiding: **M Albert,** Cold Regions Research and Engineering Laboratory**;** **P Harrison,** National Research Council of Canada

U24A-01 1530h

OASIS: Ocean-Atmosphere-Sea-Ice-Snowpack Interactions in Polar Regions

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While Polar regions encompass a large part of the globe, little attention has been paid to the interactions between the atmosphere and its extensive snow-covered surfaces. Recent discoveries in the Arctic and Antarctic show that the top ten centimeters of snow is not simply a white blanket but in fact is a surprisingly reactive medium for chemical reactions in the troposphere. It has been concluded that interlinked physical, chemical, and biological mechanisms, fueled by the sun and occurring in the snow, are responsible for depletion of tropospheric ozone and gaseous mercury. At the same time production of highly reactive compounds (e.g. formaldehyde, nitrogen dioxide) has been observed at the snow surface. Air-snow interactions also have an impact on the chemical composition of the snow and hence the nature and amounts of material released in terrestrial/marine ecosystems during the melting of seasonal snow-packs. Many details of these possibly naturally occurring processes are yet to be discovered. For decades humans have added waste products including acidic particles (sulphates) and toxic contaminants such as gaseous mercury and POPs (persistent organic pollutants) to the otherwise pristine snow surface. Virtually nothing is known about transformations of these contaminants in the snowpack, making it impossible to assess the risk to the polar environment, including humans. This is especially disconcerting when considering that climate change will undoubtedly alter the nature of these transformations involving snow, ice, atmosphere, ocean, and, ultimately, biota. To address these topics an interdisciplinary group of scientists from North America, Europe and Japan is developing a set of coordinated research activities under the banner of the IGBP programs IGAC and SOLAS. The program of Ocean-Atmosphere-Sea Ice-Snowpack (OASIS) interactions has been established with a mission statement aimed at determining the impact of OASIS chemical exchange on tropospheric chemistry and climate, as well as on the surface/biosphere and their feedbacks in the Polar regions of the globe. It is proposed that this program will culminate in a concerted field project during the IPY. In this contribution we will present the details of the emerging OASIS science plan and progress towards its implementation.

U24A-02 1545h

The IPY: an Opportunity to Establish a Legacy of Polar Climate Observations

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Each polar region has similarities but for the most part they are very different from each other. The differences are mainly a consequence of land/ocean configuration and contrasting hydrological states. While the Arctic seems to be warming, Antarctica, with the important exception of the Antarctic Peninsula, is cooling. The engagement of the two Polar Regions in the present climate system and their response and feedback to changes of the global climate and global carbon cycle is of fundamental scientific concern and high societal importance. Climate models indicate that the polar regions will bear the brunt of enhanced greenhouse global warming, and that the influence of polar climate change will spread to lower latitudes through its effect on sea level, Earth's albedo, and the ocean circulation. Recent observations lend support to some of these model-simulated trends. However, climate models do not include many of the physical or biogeochemical processes likely to be important for high latitude climate, nor do they resolve the small spatial scales characteristic of these processes. Our first priority should be to improve the observational grid required for to improve the models. The IPY offers the possibility of an international coordinated multidisciplinary effort, with consistent standards of measurements and observational design spanning both Polar Regions. We suggest the deployment of an array of sensors, much of which, due to the challenging environment conditions, will involve innovative technological systems. All climate elements will have to be covered in a unified program, including atmosphere, ocean, ice and land. For example, one can envision a series, perhaps of order ten per polar region, of heavily instrumented transects radiating from the both poles, spanning the continents, their margins and oceanic realm, to perhaps 60° latitude. Data will be gathered from the heights of the atmosphere to the depths of the ocean, with particular focus on the surface interface. Embedded in these spokes may be more focused objectives, perhaps targeting interaction between climate system elements. As with the IGY, a legacy will be established, a path will be created building the temporal dimension of research, with at least parts of the IPY observational grid extending into the future.

U24A-03 1600h

Earth Science Research as IPY Priority

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The preparations for IPY 2007/2008 are evolving from conceptual to implementation planning. Many earth scientists are concerned that the emerging plans for IPY are too narrowly focused on environmental processes and therefore appear discriminatory with respect to other fundamental sciences. National/international efforts such as USGCRP (U.S. Global Change Research program) and IPCC (Intergovernmental Panel on Climate Change) are also involved in the multitude of climate change issues, and just how the proposed IPY program could augment and complement these ongoing activities without reproducing them requires careful analysis and coordination. In particular, the polar research is unthinkable without study of the geological history of the Arctic and the Southern Oceans as a clue to tectonic evolution of the entire planet and test of the current geodynamic paradigm. In addition to these fundamental objectives, the circum-polar continental margins of the Arctic and Antarctica are likely to become the scenes of geopolitical intrigue provoked by implementation of the provisions of the Law of the Sea that require acquisition of specific earth science knowledge at internationally recognized levels of credibility. Interdisciplinary international programs (e. g. JEODI), based on geophysical data acquisition and analysis that would lead, where appropriate, to scientific drilling, had independently been proposed for studying the coupled tectonic and oceanographic history of the polar regions. Admitting the importance of identifying fundamental constraints for paleooceanography and climatic history of the high latitudes, and acknowledging the progress achieved so far in promoting IPY activities, the international earth science community has suggested developing the proposed approach into a major IPY endeavor - to examine the Polar Ocean Gateway Evolution (POGE). Such study would enable linking the geological history of the Polar Regions during the last 100 Ma and related fundamental changes that occurred in the face of the Earth with modern consequences of these processes and their impact on contemporary world. In good agreement with this project idea, although on a shorter time scale, is another initiative SALE (Subglacial Antarctic Lake Exploration) that has also been submitted for consideration in IPY context. It is hoped that IASC, SCAR and IUGS will take an active stand in endorsing earth science component of IPY, and that other bodies responsible for formulating IPY agenda will eventually recognize the fundamental importance of learning the past in order to understand the present and predict the future.

U24A-04 1615h

A Proposed Arctic Ocean Field Program During the International Polar Year 2007-2008

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The Arctic Ocean represents a glaring void of measurements appropriate for monitoring and understanding the climate changes currently occurring in the Arctic region. We propose a field program in the central Arctic Ocean to develop and improve methods for the long-term monitoring of the Arctic atmosphere, ice, and ocean and the interactions among them, and to study physical processes crucial to the regional climate change. The approach will include developing and evaluating methods by which long-term satellite-, surface-, and ocean-based measurements of the thermodynamic and kinematic properties of the atmosphere, ice, and ocean can be integrated to measure key parameters with accuracies necessary to detect climatic change, to attribute responsibility to the processes causing this change, and to evaluate the role of anthropogenic sources in this change. Key measurements include the atmospheric circulation above and within the atmospheric boundary layer, cloud macro and microphysical properties, atmospheric aerosols and chemical constituents, all components of the energy budget of the pack ice including the oceanic heat flux, and the pack ice mass balance. Many of the techniques to be developed will likely use in-situ surface and ocean-based measurements to evaluate and improve the accuracy of the satellite-based measurements. These measurements will generally integrate existing technology, though some will require technological development as well. Many physical processes over the pack ice are different than those over the circumpolar land areas where SEARCH (Study of Environmental Arctic Change) intensive observing sites are being established. Observations at the land sites are largely influenced by processes forced by coastal gradients or by orography, and are much less influenced by the oceanic heat source omnipresent over the Arctic Ocean. The proposed pack ice field program will make measurements specific to processes important for climate models and that are unique to the pack ice environment. The long-term utility of such process studies comes from improving numerical models through improved parameterizations, using the detailed process observations for validating numerical models, and enhancing the conceptual understanding of the pack-ice environment. We propose that this ocean deployment be undertaken with support of at least one icebreaker and that the deployment ideally last a year. The successes of recent field programs demonstrate the logistical viability of such a project. This proposed field program is an appropriate contribution to IPY2007 because it will provide 1) short-term, detailed measurements at a point in a crucial but data-sparse region of the Arctic during the IPY, 2) a long-term legacy by developing long-term measurement methodologies and model improvements, and 3) a direct and substantial benefit to the ongoing SEARCH and CliC (Climate and Cryosphere) programs.

U24A-05 1630h

Capturing Large-Scale Change in the Arctic Ocean and Cryosphere

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Dramatic changes in the Arctic have been documented over the past few decades in the ocean and ice cover that are attributable to atmospheric forcing and longer-term climate change. The polar regions are the most sensitive to changes in global climate and the oceanographic, cryospheric, and atmospheric changes noted there could be harbingers of dramatic global change. The obstacle to completely understanding the nature and genesis of the change is the difficulty of adequate sampling as a result of logistical problems associated with the year-round ice cover. Advances in satellite measurement have greatly expanded our monitoring capability; however, to be fully utilized, these measurements must be calibrated and validated with surface measurements. The Naval Research Laboratory has developed a suite of tools to provide a “snapshot” of the state of the ocean and cryosphere over large regions. We propose to use these tools to help better understand Arctic changes for the International Polar Year effort. Using long-range aircraft, we are able to measure ice freeboard with radar and laser altimeters, sample temperature and salinity (T&S) of the water column using expendable bathythermographs (XBT) and CTD profilers, and calculate dynamic sea-surface height (SSH) by steric leveling determined from XBT and XCTD data and by comparison with our gravimetric geoid. Synoptic measurements of ice freeboard, water column T&S, and dynamic SSH can be made over large grids to provide baselines of these quantities which can be re-measured to provide time series of change. This information could be assimilated into models of ocean circulation and climate change and used to calibrate and validate ice-freeboard measurements of concurrent ice-observing satellites.

U24A-06 1645h

An Uninhabited Aerial Vehicle (UAV) Concept for Low-Altitude Geophysical Exploration in Antarctica

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A concept for a small, agile UAV platform for conducting geophysical mapping in the IPY and beyond has been explored. We have developed a framework concept for community input and feedback based on a low-cost, autonomous vehicle with onboard high-precision inertial navigation that performs vertical take-off and landing (VTOL). The vehicle we have focused on is the GoldenEye-100, developed by Aurora Flight Sciences Corp. (www.aurora.aero), which can carry a lightweight payload and achieve a range of 300-500 km (roundtrip). The VTOL capability would potentially allow flights to be launched from the helicopter deck of an icebreaker, and would remove the logistical burden of ensuring a hazard-free runway on the ice. Vehicle operations are controlled using a portable ground station. A payload concept has also been developed, indicating that the vehicle could easily carry a lightweight, compact magnetometer, camera and laser altimeter. Instruments developed for space missions exist that would enable a high performance system to be carried within the 10 kg payload envelope. A gravity measurement system and radar sounder are also considered. A capable UAV platform for geophysical mapping would complement the existing aerial research platforms in Antarctica and has the potential to accelerate the exploration and monitoring of critical but remote areas in a cost-effective manner.

U31A CC: 517 A Wednesday 0830h

Time-Variable Gravity: Observation, Modeling, and Interpretation I

Presiding: **J Hinderer,** Ecole et Observatoire des Sciences de la Terre

U31A-01 0830h

Status and Early Results from the GRACE Mission

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The objective of Gravity Recovery and Climate Experiment (GRACE) is to map the global gravity field with unprecedented accuracy over a spectral range from 500 km to 40,000 km. The measurement precision supports gravity field solutions in this frequency range whose accuracy is between 10 and 1000 times better than our current knowledge. The mission profile calls for a gravity field solution with this accuracy every thirty days. Accurate measurements, with this spatial and temporal resolution, will allow studies of the gravitational signals associated with the seasonal mass exchange between the Earths solid, ocean and atmospheric system components. The two Grace satellites, which were launched on March 17, 2002, are completing their second year of operation. The initial data has provided a significant improvement in the mean field and, for the first eighteen months of the mission, the results have demonstrated the ability to discriminate the time varying gravity signal associated with the seasonal redistribution of the mass in the earth's dynamic system. This presentation will describe the Status of the Project, including the plans for calibration and validation, the characteristics of the solutions and the methods used to account for high frequency mass variability associated with the atmosphere and oceans,

URL: http://www.csr.utexas.edu/grace/

U31A-02 0845h

GRACE: From Measurement to Gravity

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The twin satellites of the US/German GRACE mission are now beginning their third year in orbit and produce nearly continuous measurements, which allows the estimation of monthly and mean global gravity field solutions with unprecedented accuracy. In this talk the focus will be on the GRACE science measurements used for the gravity field determination process. A review will be given of each measurement and its contribution to the overall process of determining the gravity field. Furthermore, the unique aspects associated with the GRACE science measurements will be highlighted and how these impact the gravity result. Also, other non-gravity science possibilities from the GRACE science measurements will be discussed, for example aeronomy and ionospheric studies. Finally a status will be given of the Level-1 processing, which processes raw GRACE science measurements into the input data for the gravity field determination process called Level-2.

URL: http://www.csr.utexas.edu/grace

U31A-03 0900h

Geodetic characterization of the monthly GRACE gravity field estimates

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The joint NASA/DLR Gravity Recovery And Climate Experiment (GRACE) was launched in March 2002, with the goal of mapping mean & time-variable components of the Earth's gravity field. The mass balance and variability within the Earth system can be traced by a sequence of monthly gravity field estimates. For this purpose, sequences of monthly gravity field spherical harmonic coefficients, spanning between launch and end of 2003 were derived from GRACE science data, and were made available to the GRACE Science Team. The presentation starts with an overview of the relationship of the GRACE gravity estimates to the omissions and errors in background models used in GRACE data processing at UTCSR. We then present the current assessment of the errors in these models. The patterns of errors are discussed both spectrally (by spherical harmonic degrees) and by their geographic distribution. For various levels of spatial smoothings,