greenhouse forcing scenario (e.g., A2, B2), the simulated changes of temperature, precipitation and pressure are highly seasonal and spatially variable in these models. When composited over the five models, the Arctic warming is largest in the autumn and winter, as is the associated decrease of Arctic sea level pressure. The corresponding projections of changes in extremes of temperature and precipitation indicate that the Arctic's high level of natural variability reduces the statistical significance of the projected Arctic changes relative to changes in lower latitudes. The projected Arctic changes will also be presented in terms of growing season length and the northward migration of thresholds such as the 0-degree isotherm, which is ultimately related to the distribution of permafrost.

GC21B-02 0845h

Northern climate dynamics during the post-Eemian interglacial-glacial transition

Guido Vettoretti[1] (416-946-7086; guido@atmosp.physics.utoronto.ca)

William R Peltier[1] (416-978-2933; peltier@atmosp.physics.utoronto.ca)

[1]Department of Physics, University of Toronto 60 St. George Street, Toronto, ON M5S 1A7, Canada

The transition of the mean state of the climate system from the Eemian interglacial into the glacial state (the MIS 5e/5d transition) is investigated using both an atmospheric general circulation model (the Canadian AGCM2) and a coupled atmosphere-ocean general circulation model (the NCAR CSMv1.4). Each model has been employed to produce both a modern control integration and an integration focused upon the summertime high latitude insolation minimum that occurred at approximately 116,000 years before present. Using the AGCM2 model, an investigation of the action of an atmospheric-cryospheric feedback mechanism involving the moisture balance of the arctic polar region will be described. This mechanism has been previously referred to in the literature as one involving a 'cryospheric moisture pump' and depends upon changes in the mid-latitude atmospheric eddy-transports of heat and moisture into the polar cap. Using the NCAR AOGCM in a complementary study, we have further investigated the response of the coupled atmosphere-ocean moisture and heat transports into northern high latitudes, both through same atmospheric baroclinic eddy transports but also due to changes in the Atlantic meridional overturning circulation (MOC) which will be fully described. A novel feature of the atmosphere-ocean simulation involves a predicted increase of the MOC during the transition into the state of high latitude continental glaciation. This feature of the coupled atmosphere-ocean simulation is consistent with inferences based upon proxy climate indicators of Thermohaline Circulation (THC) strength.

GC21B-03 0900h

Simulation of the Last and Next Glacial Inceptions With the Green McGill Paleoclimate Model.

Anne-Sophie Cochelin[1] ((514)398-7448; anne-sophie.cochelin@mail.mcgill.ca)

Lawrence A Mysak[1] ((514) 398-3768; lawrence.mysak@mcgill.ca)

Zhaomin Wang[1] ((514)398-7448; wangz@zephyr.meteo.mcgill.ca)

[1]Department of Atmospheric and Oceanic Sciences McGill University, 805 Sherbrooke Street West, Montreal, qc H3A 2K6, Canada

A fundamental question in Quaternary science is to determine when the present interglacial will end and when the next ice age might occur. Whereas scientists predicted an imminent glaciation in the 1970s, it seems today that the present interglacial may last longer, due to an exceptional configuration of the future variations of the summer solar insolation at northern high latitudes. The McGill Paleoclimate Model, with its recently added vegetation component, has first been run to simulate the climate of the past (from 122 kyr to 80 kyr BP), i.e. the last glacial inception. Results show a glacial inception around 117 kyr BP followed by a rapid building of ice sheets over North America, and a slower increase of ice volume over Eurasia. The model has then been run to simulate the short-term future with various increasing atmospheric CO2 concentrations, to find the possible responses to global warming. The results are quite similar to those obtained by GCMs, and lie in the IPCC range of results. Finally, the model has been run to simulate the climate of the next 100 kyr, i.e. the next glacial inception, with different scenarios for the atmospheric CO2 concentration, both constant and variable. We shall present the thresholds in carbon dioxide concentration that will determine the occurrence or absence of glacial inception in 50 kyr.

URL: http://www.esmg.mcgill.ca

GC21B-04 0915h

Multivariate Analysis of Long Term Variability in Icelandic Hydrological Series and its Relation to the Atmospheric Circulation in the North Atlantic

Jona Finndis Jonsdottir[1] (+354 569 6000; jfj@os.is)

Arni Snorrason[1] (+354 569 6000; asn@os.is)

Trausti Jonsson[2] (+354 522 6000; trausti@vedur.is)

Oli Gretar Sveinsson[3] (oli@iri.columbia.edu)

Pall Jonsson[1] (+354 569 6000; pj@os.is)

[1]Hydrological Service, National Energy Authority, Grensasvegur 9, Reykjavik IS-108, Iceland

[2]The Icelandic Meteorological Office, Bustadavegur 9, Reykjavik IS-150, Iceland

[3]International Research Institute for Climate Prediction, LDEO, University of Columbia, Palisades, NY, United States

Observed long-term variability in Icelandic time series of river flow is quite regular and significant. Similarly, aggregated long-term observations of glacial termini show significant changes since their initiation some 70 years ago. The relationship of these changes to variations in time series of climatic and oceanographic variables is quite important, since it can give indications of the possible relationship between hydrological time series and climate variability such as the Northern Atlantic pressure Oscillation (NAO). It can also give indications of the possible effects of anthropogenic climate changes due to increased concentration of greenhouse gases in the atmosphere. The variability of the atmospheric circulation in the North Atlantic has great effects on the precipitation and runoff in Iceland and in fact on the hydrology of the Nordic countries and the contries of western Europe. The island is situated in the middle of the North Atlantic Ocean in the path of the low-pressure frontal systems that transport moisture and thermal energy from the South to the North. A multivariate statistical analysis is performed on discharge data for several rivers in Iceland. The variability in the characteristics of the rivers is large since their watersheds are in various parts of the country, where glaciers and groundwater play a large role in the hydrology of some of the watersheds. The modes of variability are identified by a principal component analysis and the physical explanation of the modes is searched for by canonical correlation with data on precipitation, temperature, sea level pressure and other climatic and oceanographic variables. This study should give information on what processes relate the variability of the atmospheric circulation to the variability of the Icelandic rivers. It will thereby reveal the options of predicting the hydrological conditions in Iceland based on indices and information from the general prevalent circulation patterns. An extension of these studies is planned within a joint Nordic project on Climate and Energy that will include time series from the other Nordic countries.

GC21B-05 0930h

Climate Change in Northwestern North America Over the Last Three Centuries

Kent Moore[1] (moore@atmosp.physics.utoronto.ca)

Gerald Holdsworth[2] (gholdswo@ucalgary.ca)

Keith Alverson[3] (alverson@pages.unibe.ch)

[1]University of Toronto, 60 St. George Street, Toronto, Ont M5S 1A7, Canada

[2]University of Calgary, 2500 University Drive N.W., Calgary, Alb, Canada

[3]Pages International Project Office, Sulgeneckstrasse 38, Bern, Switzerland

The relatively short length of most instrumental climate datasets restricts the study of variability that exists in the climate system. This is particularly true regarding the atmosphere where high quality spatially dense data exists only since the late 1940s. With this data, the Pacific North America pattern (PNA) has been identified as one of the dominant modes of variability in the atmosphere. Over this period the PNA has been related to the Pacific Decadal Oscillation (PDO), a mode of climate variability that has been shown to influence marine productivity in the North Pacific as well as modulating the impact of the El Niño-Southern Oscillation in North America. Here we present an updated 301-year ice core record from Mount Logan in northwestern North America that shows a statistically significant and accelerating positive trend in snow accumulation from the middle of the 19th century. A manifestation of this trend has been a warming over northwestern North America that, for much of the 20th century, has been associated with secular changes in the PNA and PDO.

GC21B-06 0945h

Impacts of Climate and UV Change on Arctic Freshwater Ecosystems

Fred J Wrona[1] (250-472-5134; fred.wrona@ec.gc.ca)

Terry D Prowse[1] (250-472-5169; terry.prowse@ec.gc.ca)

James D Reist[2] (204-983-5032; reistj@dfo-mpo.gc.ca)

[1]National Water Research Institute @ W-CIRC, University of Victoria PO Box 1700 STN CSC, Victoria, BC V8W 2Y2, Canada

[2]Fisheries and Oceans Canada, Freshwater Institute 501 University Crescent, Winnipeg, MN R3T 2N6, Canada

An overview is provided of the key findings of the Arctic Climate Impact Assessment (ACIA), which is an international project of the Arctic Council and the International Arctic Science Committee (IASC), to evaluate and synthesize knowledge on climate variability, climate change, and increased ultraviolet radiation and their consequences. Predicted changes in climate and UV in the Arctic are expected to have far-reaching impacts on the hydrology and ecology of freshwater ecosystems. Key effects include changes in the distribution, abundance and ecology of aquatic species in various trophic levels, dramatic alterations in the physical environment that makes up their habitat, changes to the chemical properties of that environment, and alterations to the processes that act on and within freshwater ecosystems. Interactions of climatic variables, such as temperature and precipitation, with freshwater ecosystems are highly complex and hence can be propagated through ecosystems in ways that are often difficult to predict. This is partly because of our still relatively poor understanding of the structure and function of arctic freshwater systems and their basic interrelationships with climate and other environmental variables, as well as by a paucity of long-term freshwater monitoring sites and integrated hydro-ecological research programs in the Arctic. Predictions of hydro-ecological impacts are further complicated by synergistic and cumulative effects.

GC

GC22A CC: 524 C Tuesday 1030h

Northern Climate Properties, Trends, and Impacts of Change: Past, Present, and Future III

Presiding: **A J Weaver,** University of Victoria**; L Trichtchenko,** Geomagnetic Laboratory, Natural Resources Canada

GC22A-01 1030h INVITED

Reducing Canada's vulnerability to climate change: a new research program of Natural Resources Canada

Josef Cihlar (josef.cihlar@ccrs.nrcan.gc.ca)

There is broad scientific consensus that anthropogenically enhanced climate change is underway, that its impacts will be particularly pronounced in northern areas and that, regardless of the effectiveness of the proposed mitigation measures, future climate changes will occur due to the inertia of the climate system. The Earth Sciences Sector of Natural Resources Canada initiated a new program aimed at providing knowledge that will help Canadians to cope with adverse consequences of, and to benefit where possible, from the impacts of climate change on Canada's landmass. The fundamental goals are to improve the scientific understanding of the impacts of past, present, and future climate variability and change on Canada's landmass and the coastal zone, of associated costs, and of the implications for adaptation options; and to ensure this information is used to better prepare Canadians for the future. The program utilizes geoscience and geomatics techniques and expertise to observe, analyse or model the sensitivity of Canada's cryosphere (glaciers and permafrost), ecosystems (carbon, water, energy cycles) and coasts (coastal dynamics and sea level rise) to climate variability and change. Spatially, program activities address questions at national, regional or local/municipal levels. The time domain of interest spans the last 18000 years and the next 20- 100 years. The key scientific questions are formulated within the following streams: monitoring and analysis; GHG sinks and sources; processes; scenarios; and costs/ adaptation options. Explicit linkages with stakeholders and users of scientific information have been established to achieve effectiveness of the research results.

GC22A-02 1045h INVITED

Recent Trends in Permafrost Temperature From North American Sites Contributing to the Global Terrestrial Network for Permafrost

Sharon Smith[1] (613 947 7066; ssmith@nrcan.gc.ca)

Margo Burgess[1]

Vladimir Romanovsky[2]

Gary Clow[3]

Jerry Brown[4]

[1]Geological Survey of Canada, Natural Resources Canada, 601 Booth Street, Ottawa, Ont K1A 0E8, Canada

[2]University of Alaska, Geophysical Institute, 903 Koyukuk Drive, Fairbanks, United States

[3]United States Geological Survey, Earth Surface Dynamics, Lakewood, Co, United States

[4]International Permafrost Association, P.O. Box 7, Woods Hole, MA, United States

The Global Terrestrial Network for Permafrost (GTN-P) was established in 1999 to provide long-term field observations of active layer and permafrost thermal state that are required to determine the present permafrost conditions and to detect changes in permafrost stability. The data supplied by this network enhances our ability to predict the consequences of permafrost degradation associated with climate warming and to develop adaptation strategies to respond to these changes. The GTN-P contributes to the World Meteorological Organization's Global Climate Observing System and Global Terrestrial Observing System. This paper focuses on the thermal monitoring component of the GTN-P. To date, over 300 thermal monitoring sites have been identified from 16 countries for inclusion in the GTN-P. Site descriptions (metadata) and summary data are disseminated through the GTN-P web site (www.gtnp.org). Plans are being developed for a GTN-P contribution to the International Polar Year which will involve a collection of data from all monitoring sites if possible in 2006 and 2007. This paper reports initial results from North American sites. The results show that although recent warming of permafrost has been observed across the North American permafrost zone, the magnitude and timing of this warming varies. For example, warming has been observed since the early to mid 1980s in the western North American Arctic. Warming however in the Canadian eastern and high Arctic occurred in the late 1990s with cooler permafrost temperature generally occurring in the 1980s and early 1990s. These trends in permafrost temperature are consistent with air temperature trends observed since the 1970s in the Canadian Arctic. Variability in snow cover especially in the high Arctic, is also an important factor influencing the spatial and temporal trends in permafrost temperature.

GC22A-03 1100h

Soil Temperature in Canada During the 20th Century: Complex Responses of Soil Temperature to Changes in Air Temperature at High Latitudes

Yu Zhang[1] (613-947-1367; yu.zhang@ccrs.nrcan.gc.ca)

Wenjun Chen[1] (613-947-1286; wenjun.chen@ccrs.nrcan.gc.ca)

Sharon L. Smith[2] (613-947-7066; ssmith@nrcan.gc.ca)

Daniel W. Riseborough[2] (613-942-0223; drisebor@nrcan.gc.ca)

Josef Cihlar[1] (613-947-1265; josef.cihlar@ccrs.nrcan.gc.ca)

[1]Canada Center for Remote Sensing, Natural Resources Canada, 588 Booth street, Ottawa, ON K1A 0Y7, Canada

[2]Geological Survey of Canada, Natural Resources Canada, 601 Booth street, Ottawa, ON K1A 0E8, Canada

Most climate records and climate change scenarios projected by general circulation models are for atmospheric conditions. However, the impacts of climate change on permafrost conditions, depth of seasonal freeze and thaw, ecological and biogeochemical processes at high latitudes, are mainly controlled by soil thermal conditions, and in situ measurements of soil temperatures are very sparse. We developed a process-based model of Northern Ecosystem Soil Temperature (NEST) to simulate the transient response of the soil thermal regime to climate change by integrating the effects of climate, vegetation, soil and hydrological conditions based on energy and water transfer in the soil-vegetation-atmosphere system. The long-term monthly climate dataset was down-scaled to force the model and to simulate soil temperature throughout the 20th century in Canada at half degree latitude/longitude resolution. The results show that soil temperature generally responded to the forcing of air temperature, but this response was complex. Spatially, the changes of annual mean soil temperature during the 20th century differed from that of air temperature by -3 to 3 °C. On average for the whole Canada, annual mean soil temperature increased 0.6 °C in the 20th century while annual mean air temperature increased 1.0 °C. Three mechanisms were investigated to explain these differentiations: air temperature change altering snowpack and thereby altering the response of soil temperature, seasonal difference in air temperature change, and changes in precipitation. These complex responses of soil temperature to atmospheric climate change would have significant implications for assessing the impacts of climate change on permafrost thaw, and ecological and biogeochemical processes.

GC22A-04 1115h

Paleoclimate Change and the Closed Great Lakes: Paleohydrological Sensitivity Under Higher Amplitude Conditions

C.F. Michael Lewis[1,3] (1-902-426-7738; miklewis@nrcan.gc.ca); Steve M. Blasco[1] (sblasco@nrcan.gc.ca); Thomas E. Croley[2] (tom.croley@noaa.gov); John W. King[3] (jking@gso.uri.edu); J. Brad Hubeny[3] (bhubeny@gso.uri.edu); Theodore C. Moore[4] (tedmoore@umich.edu); David K. Rea[4] (davidrea@umich.edu); John P. Coakley[5] (jcoakley@cogeco.ca)

[1]Geological Survey of Canada, Natural Resources Canada, Bedford Institute of Oceanography Box 1006, Dartmouth, NS B2Y 4A2, Canada

[2]Great Lakes Environmental Research Laboratory, NOAA, 2205 Commonwealth Blvd., Ann Arbor, MI 48105-1593, United States

[3]Graduate School of Oceanography University of Rhode Island, Bay Campus, Narragansett, RI 02882, United States

[4]Department of Geological Sciences, University of Michigan, 2534 C.C. Little Building, 425 E. University Street, Ann Arbor, MI 48019-1063, United States

[5]Environment Canada, National Water Research Institute, Box 5050, Burlington, ON L7R 4A6, Canada

The estimation of future Great Lakes water elevations for global warming climate scenarios requires our understanding of the relationship of lake level shifts to climate change. Some scenarios, based on global circulation models, suggest the Great Lakes will be lower than suggested by historically recorded variability. (Experiments in transposition of various climates to the Great Lakes basin show that historical climate variation is relatively small.) Modest climate change could be significant; for example a Midwest US climate would lower Lake Superior by about 12 m, bringing lake levels below the outflow channel sill ("closed" lake) in 37 years. We intend to reconstruct and model past closed-lake conditions to evaluate climate-hydrology sensitivity for higher-amplitude conditions of change. We infer water levels, of tens of meters below overflow outlets, from geological evidence in the Erie and Michigan-Huron basins for a severe dry climate between about 7900 and 7000 BP. The evidence consists of elevations of C-14 dated indicators of former lake-levels such as isolation basins, abandoned strandlines, submerged tree stumps, and sediment unconformities, all corrected for glacial isostatic rebound. A new project will quantify the closed-lake event by reconstructing former topography and bathymetry with GIS technology and a digital elevation model of the Great Lakes basin. We will determine mean paleoclimatic parameters from geological, ecological, and geochemical proxies. We will develop probable paleoclimates for the transitions into and out of closed-lake conditions by shifting modern climates to fit the paleoclimatic parameters. Paleohydrological modeling will recover information about the sensitivity of the Great Lakes to climate change under high-amplitude conditions.

GC22A-05 1130h

History of Sea Ice Changes in the Canadian Arctic and the Impact on Humans

Peta J. Mudie[1,2] (1-902-823-1651)

Andre Rochon[2] (1-418-723-1986 x1742; andre_rochon@uqar.ca)

Elisabeth Levac[3] (1-902-423-8487; elevac@stfx.ca)

[1]Geological Survey Canada Atlantic, Box 1006, Dartmouth, NS B2Y 4A2, Canada

[2]ISMER, University of Quebec at Rimouski, Rimouski, QE G5L 1V5, Canada

[3]Centre for Marine Geology, Dalhousie University, Halifax, NS B3H 4J2, Canada

The discontinuous chronology of archaeological records from the Canadian Arctic suggests that major climatic changes caused the abrupt abandonment of settlements and life style shifts in Paleo- and Neo-Eskimo societies. The centennial-scale resolution of previous paleoclimate reconstructions, however, does not permit detailed examination of this idea. Climate warming of more than 1.5C during the past 3 decades has caused reduction of sea ice and loss of marine mammals, forcing catastrophic changes on the Inuit people. Computer models forecast continued Arctic warming up to 4C but the 150-year database for the models covers only a fraction of the warm-cold cyclicity data in Holocene geological records. We therefore examine the decadal-scale paleoclimatic changes recorded by quantitative palynological data in a 6,500 year-long record from Coburg Polynya (Core LSSL 2001-006 75 35' N, 78 41'W) near the Palaeo- and Neo-Eskimo occupations of the North Devon Lowlands and in cores Hu 91-039-008 and 007 from the central North Water Polynya (NOW) between Ellesmere Island and Thule, Greenland (77 16.0'N, 74 19.9'W). Palaeotransfer function data from dinoflagellate cyst assemblages in the cores provide quantitative estimates of changes in sea surface temperature (SST) and sea ice cover (SIC) with the same accuracy as historical shipboard oceanographic measurements. Both sites record abrupt temperature changes of 2 - 4C that can be related to the archaeological record of major changes in hunting modes of Paleo- and Neo-Eskimo peoples and to detailed occupation-abandonment cycles on Devon and Ellesmere Islands. The paleoceanographic reconstructions show that from 6500 to 2600 BP, there were large oscillations in summer SST from 2-4C cooler than now to 6C warmer, and that annual variations in SIC ranged from 2 months more of heavy (more than 50 percent) ice to a 4-month extension of open water. This interval corresponds to the period of pre-Dorset Palaeo-Eskimo cultures that hunted muskox and caribou. The subsequent marine-based Dorset and Neo-Eskimo cultures correspond to progressively cooler intervals with expanded sea ice cover. Our records show that in the past, the warming took about 50-100 years and lasted about 300 years before being replaced by colder intervals of about 200-500 years. These climate oscillations are more rapid than the major cultural changes in the archaeological record, but are of similar length to successive Palaeo-Eskimo occupations in the NOW region of Nares Strait.

GC22A-06 1145h

The effect of climate change on the hydrology and the hydrodynamic characteristics of the Peace Athabasca system

Alain Pietroniro[1] (306-975-4394; al.pietroniro@ec.gc.ca); Brenda Toth[1] (306-975-5724; brenda.toth@ec.gc.ca); Robert Leconte[2] (514-396-8992; robert.leconte@etsmtl.ca); Malcom Conly[3] (306-975-4833; malcom.conly@ec.gc.ca); Nick Kouwen[4] (519-885-1211 ext 3309; kouwen@uwaterloo.ca); Daniel Peters[5] (250-472-5113; dan.peters@ec.gc.ca); Terry Prowse[5] (250-472-5169; terry.prowse@ec.gc.ca)

[1]National Water Research Institute, 11 Innovation Boulevard, Saskatoon, SK S7N 3H5, Canada

[2]Department of Construction Engineering Ecole de technologie superieure, 1100 Notre Dame Ouest, Montreal, QC H3C 1K3, Canada

[3]Prairie Northern Wildlife Research Centre, 115 Perimeter Road, Saskatoon, SK S7N 0X4, Canada

[4]Department of Civil Engineering University of Waterloo , 200 University Avenue West, Waterloo, ON N2L 3G1, Canada

[5]Water and Climate Impacts Research Centre Department of Geography University of Victoria, PO Box 1700 STN CSC, Victoria, BC V8W 2Y2, Canada

The Peace Athabasca Delta (PAD) is an extensive freshwater delta fed by the confluence of the Peace and Athabasca Rivers, in North West Canada. The Peace River, with regulation at the W.A. Bennett Dam, has a direct influence on the wildlife habitat of the PAD. With the stated objective of investigating the relative roles of climate variability and flow regulation, the Peace Athabasca watershed and delta were modeled using both a physically based, distributed hydrologic model and a hydraulic model of the open channel flow system. These models were forced using both historical, station-observed data and climate change scenario temperature and precipitation. All simulations were compared against observed stream flow. The distributed hydrologic model hydrographs were compared for selected streamflow measurement stations with good agreement for volume and timing of flow.

A comparison of estimated current and future climate scenario exhibited a decrease in the peak and volume of flows, particularly for the dominant Peace River. Also the warmer temperatures of future climate scenarios and lower flows in the Peace and Athabasca Rivers influences the timing and growth of ice jams, the major mechanism by which the PAD is hydrologically regenerated. This effect is compounded by the reduction of flow depth and volume. The sensitivity of the PAD to climate change was assessed by utilizing the hydrographs generated by the hydrologic model forced with climate change scenarios temperature and precipitation. Using the hydrodynamic model, it is estimated that lake levels will be reduced considerably (in the order of 30 - 60 cm) under climate change. Increased temperatures, which accelerate spring melt and reduces its impact, is key. Water fluctuations in the major rivers feeding the PAD are even more significant with up to 2 m reductions in water levels estimated. Flow reversals occur less frequently under a changed climate.

GC23A CC: 220 C-E Tuesday 1330h

Northern Climate Properties, Trends, and Impacts of Change: Past, Present, and Future IV Posters

Presiding: **H Leighton,** McGill University**; K Szeto,** Meteorological Service of Canada

GC23A-01 1330h POSTER

Contributions of Plant Respiration to Ecosystem Respiration at Mer Bleue Bog, Ottawa, Ontario, Canada

Meaghan T. Murphy[1] (507 597 2970; mtmurphy_2000@yahoo.com)

Jill Bubier[1] (jbubier@mtholyoke.edu)

Tim Moore[2] (514-398-4961; moore@felix.geog.mcgill.ca)

[1]Mount Holyoke College, Department of Earth and Environment, South Hadley, MA 01075, United States

[2]McGill University, 805 Sherbrooke St. W., Montreal, QC H3A 2K6, Canada

The goal of this research was to quantify the relative contribution of plants to ecosystem respiration at Mer Bleue Bog, Ottawa, Ontario in order to better understand the variations in ecosystem respiration recorded by an eddy covariance tower at the site. Mer Bleue Bog is an ombrotrophic peatland dominated by dwarf evergreen and deciduous shrubs with a continuous Sphagnum moss ground cover. As part of the Fluxnet Canada program, the bog is a long-term research site for carbon cycling involving a host of collaborators from a variety of fields and institutions. We attempted to exclude plant respiration by shading the plants and reducing PAR to less then 40 umol photons/m2/sec during the growing season assuming that by preventing photosynthesis, plant respiration would also be eliminated. Reductions in plant respiration were measured by changes in net ecosystem exchange of CO2 using a LiCor 6200 photosynthesis system and a closed chamber system. Soil respiration was not significantly reduced in the shaded plots compared with the unshaded plots. The only significant difference between shaded and unshaded plots was the slope of the linear regression of soil respiration against temperature. Shaded plots maintained their slope throughout the summer while unshaded plots showed a decrease in the slope, indicating that soil respiration became less sensitive to temperature over that time. It is possible that shading may have benefited the plants by conserving soil moisture during the drought period spanning July and August when the water table dropped 30 cm.

GC23A-02 1330h POSTER

Evaluation of Global and National LAI Estimates over Canada

Richard Fernandes[1] (613-947-1292; richard.fernandes@ccrs.nrcan.gc.ca)

Chris Butson[1] (613-947-1292; chris.butson@ccrs.nrcan.gc.ca)

Sylvain Leblanc[1] (613-947-1292; sylvain.leblanc@ccrs.nrcan.gc.ca)

Rasim Latifovic[1] (613-947-1292; rasim.latifovic@ccrs.nrcan.gc.ca)

[1]National Resources Canada, Earth Sciences Sector, Climate Change Program, CCRS, 588 Booth St, Ottawa, Ont K1A 0Y7, Canada

Leaf area index is a fundamental land surface parameter. Moderate (1km) resolution sensors currently offer sufficient repeat frequency to provide large area estimates of LAI within the growing season. Recently, a number of LAI products have been produced and distributed for use in ecosystem and climate models. We describe an approach to validet these products using a sampling of consistent in-situ LAI measurements scaled up with Landsat data. This reference data set is used to quantify both the contribution of scaling versus retrieval algorithm uncertainties in the MODIS, CCRS , ESA and IGBP LAI products. An additional intensively sampled site near Ottawa, Canada and within the VALERI international validation network is used to compare our reference approach to other international reference standards. The LAI uncertainties are propoagated into a land surface process model to quantify expected downstream uncertainties in modelled fluxes.

GC23A-03 1330h POSTER

Quantitative Reconstruction of Holocene Climates of Canadian Arctic and Greenland from pollen assemblages

Johanne Whitmore[1] (jwhit001@uottawa.ca)

Konrad Gajewski[1] (gajewski@aix1.uottawa.ca)

[1]Laboratory for Paleoclimatology and Climatology, Dept. of Geography University of Ottawa, Ottawa, ON K1N 6N5, Canada

Ice cores have provided key records of the late-Quaternary climates of the North American Arctic. However, these are spatially restricted and are available only in the glaciated eastern Arctic and Greenland. Ten pollen diagrams are available from Banks, Prince of Wales, Somerset, Ellesmere and Baffin Island describe the changes in the postglacial vegetation. These pollen assemblages, along with other proxy-climate data, have been interpreted as indicating a relatively warm early Holocene with a cooling in the past several 1000 years. However, quantitative reconstructions of the magnitude of temperature change have been hampered by lack of a sufficiently extensive modern calibration dataset. A new modern pollen dataset has recently been prepared, permitting the quantitative reconstructions of summer conditions across the Arctic. We use the modern pollen dataset, along with high-resolution estimates of July temperatures to estimate the magnitude of the Holocene climate changes across the Arctic and compare these results to the ice core records.

URL: http://www.uottawa.ca/academic/arts/geographie/lpcweb/

GC23A-04 1330h POSTER

Aerosol Radiative Forcing over Western Canada from CERES and MODIS Observations

Jian Feng (jian.feng@ec.gc.ca)

Henry Leighton[1] (henry.leighton@mcgill.ca)

[1]Department of Atmospheric and Oceanic Sciences, McGill University, 805 Sherbrooke Street West, Montreal, QC H3A 2K6, Canada

Aerosol radiative forcing can have an important effect on the climate system. The CERES and MODIS instruments on the Terra and Aqua satellites provide a very good opportunity to investigate aerosol radiative forcing. In this study, solar fluxes at the top of the atmosphere (TOA) and cloud amount information are taken from the CERES ES8 dataset, and aerosol optical depths are retrieved from the MODIS MOD04_L2 dataset over western Canada within the longitude range $210^o - 280^o$ and latitude range $45^o - 75^o$, covering the Mackenzie River basin. The data are interpolated temporally and gridded spatially onto a 0.2^o latitude x 0.2^o longitude grid for each overpass. Results show that during the two months of July and August 2001 the retrieved aerosol optical depth from MODIS has a large spatial variation. Within the Mackenzie River basin, the mean optical depth over these two months varied spatially from less than 0.1 to more than 0.3. For the boreal forest region on the southern edge of the Mackenzie River basin, the mean aerosol optical depth was typically about 0.3 but for many locations it was greater than 0.5. Aerosol radiative forcing at the TOA is derived from coincident and co-located CERES and MODIS overpasses centered at around 18.56 UTC (local time around 11.56AM) in July and August 2001. The aerosol forcing at the surface is calculated from the parameterization of Li et al. (1993) and an aerosol correction term to the parameterization proposed by Masuda et al. (1995). The noon-time basin-averages of aerosol radiative forcing at the TOA and at the surface for these two months are $11 Wm^{-2}$ and $-30 Wm^{-2}$ respectively, and the average of the aerosol optical depth is 0.15 over the study region.

GC23A-05 1330h POSTER

Long-term variability and trends in the shortwave albedo of North America Rocky Mountains detected from coarse resolution satellite data as indicator of changing climate

Alexander P. Trishchenko[1] ((613) 995 57 87; trichtch@ccrs.nrcan.gc.ca)

Michael N Demuth[2] ((613) 996-0235; Mike.Demuth@Nrcan.gc.ca)

Alexandar Jevtic[3] ((613) 947-1823; ajevtic@ccrs.nrcan.gc.ca)

[1]Canada Centre for Remote Sensing, Natural Resources Canada, 588 Booth Str, Ottawa, Ont K1A 0Y7, Canada

[2]Terrain Sciences Division, Natural Resources Canada, 562 Booth Street, Ottawa, Ont K1A 0E4, Canada

[3]Noetix Research Inc, 588 Booth Str, Ottawa, Ont K1A 0Y7, Canada

Shortwave (SW) albedo of mountainous regions serves as indicator of climate change. SW albedo for relatively low altitudes may reduce due to shrinking of snow/ice pack in the warming climate. For high elevations, albedo may change due to changes in amount of precipitation (snow). We analysed coarse resolution satellite data available from AVHRR and International Cloud Climatology Project to detect variations and trends of shortwave albedo over Canadian Rocky Mountains from 1983 to 2000. Despite quite substantial interannual variability, there exist well-defined negative trends in SW albedo for mid summer (July) conditions. For 11 selected regions, that cover areas from 45N to 65N, the average observed trends varied from -3.3 to -8.6 percent for decade. Average trend is -6.1 percent for decade. Similar negative trends are detected from satellite radiation budget missions, such as ERBE and CERES.

GC23A-06 1330h POSTER

How consistent is cloudiness over Canada from satellite observations and modeling data?

Alexander P Trishchenko[1] ((613) 995 57 87; trichtch@ccrs.nrcan.gc.ca)

Konstantin Khlopenkov[1] ((613) 947 12 94; kkhlopen@ccrs.nrcan.gc.ca)

Rasim Latifovic[1] ((613) 947 18 16; rasim.latifovic@ccrs.nrcan.gc.ca)

[1]Canada Centre for Remote Sensing, 588 Booth Str, Ottawa, Ont K1A 0Y7, Canada

Being one of the major modulators of radiation budget and hydrological cycle, clouds are still significant challenge for modeling and satellite retrievals. For example, our analysis shows that for Western Canada the systematic difference in total cloud amounts between NCAR/NCEP Reanalysis-2 and ISCCP reaches 20-30 per cent. Especially difficult are satellite retrievals for Northern climate regions over snow-covered surface and during night-time. To understand better these differences and their influence on earth radiation budget in Northern latitudes, we are attempting to undertake the re-analysis of satellite AVHRR data over Canada using improved data processing and cloud detection algorithms. Details of cloud detection algorithm for day-time and night-time conditions over snow-free and snow-covered surfaces are discussed. Selected results of satellite retrievals for typical summer and winter conditions over Canada are compared to previous analyses, such as ISCCP and Pathfinder projects. Consistency between our cloud retrievals using AVHRR data and those available from MODIS will be also considered.

GC23A-07 1330h POSTER

Simulation of Snow Dynamics in Response to Climate Variability

Yinsuo Zhang[1] (1-613-947-1290; yinsuo.zhang@ccrs.nrcan.gc.ca)

Shusen Wang[1] (1-613-947-3592; shusen.wang@ccrs.nrcan.gc.ca)

Alexander Trishchenko[1] (1-613-995-5787; trichtch@ccrs.nrcan.gc.ca)

[1]Canadian Center for Remote Sensing, Natural Resources Canada, 588 Booth Street, Ottawa, ON K1A 0Y7, Canada

Snow dynamics not only affects the energy dissipation in northern ecosystems during non-growing season, but also affects plant growth through its impact on the soil water conditions of early growing season. To better simulate the snow and soil dynamics, a multiple-layer