Elements

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THE NEWSLETTER OF THE CANADIAN GEOPHYSICAL UNION

IN THIS ISSUE

LE BULLETIN DE L'UNION GÉOPHYSIQUE CANADIENNE

CALL FOR ABSTRACTS

CGU Annual Meeting / UGC Rencontre Annuelle

May 14-17 Mai, 2006, Banff, Alberta

A Joint Meeting with the Canadian Society of Soil Science

See back cover for more details

Abstract Deadline: 15 February 2006

For more information, see the following web sites:

http://www.ucalgary.ca/~cguconf or http://www.cgu-ugc.ca

CGU Awards – Call for Nominations – A Reminder

Please send your nominations for the J. Tuzo Wilson Medal, the CGU Young Scientist Award, and the CGU Meritorious Service Award, to Dr. Hugh Geiger, Chair of the CGU Awards Committee, Geology and Geophysics Dept., University of Calgary, Calgary AB, T2N 1N4 (Email: geiger@ucalgary.ca, Fax: 403-284-0074), by February 28, 2006. For details, see the July 2005 issue of ***Elements***.

The Dominion Observatory: 100 Years of Geoscience

Calvin Klatt, Natural Resources Canada

"1. Primarily the equipment of the DO is designed for the carrying out of definite lines of observation and investigation of a scientific character. These observations will not be astronomical only, but meteorological, seismological, spectroscopic, etc.
2: … develop a class of men of special training and knowledge who will be useful to the country….
3. A branch of the work of the observatory is the determination of longitudes.
4. Another branch of the work will be the transmission of time to the city and the public buildings.
5. Arrangements will be made for testing chronometers…
6. An indirect advantage will be the public interest … in science and astronomy …"

--- Founding Director W.F. King on the purposes of the new observatory

The centenary of the Dominion Observatory in Ottawa was celebrated in June 2005 during "Open Doors Ottawa", an event providing public access to architecturally important buildings. This was a fitting event to celebrate the observatory because of its role in promoting science to the public over the years. As the home of the national time service the observatory was mentioned daily on CBC radio for several decades (1939-1970). In addition, the telescope was open for public observations on Saturday nights from 1905 to 1974.

Of the more than 600 visitors to the observatory during the weekend event, many still associate the observatory with the time service announcements and many recalled Saturday night visits to look through the "giant telescope" (15" refractor).

Founding

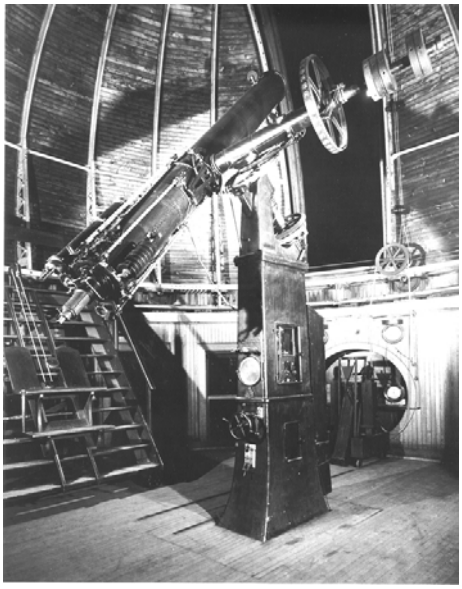
The Dominion Observatory was founded for very pragmatic reasons. The objective was to have a longitude reference (with associated time signal) for surveying in Canada: "To open up the West". Surveyors in the field would compare the time signal of the Dominion Observatory with their local time determined by astronomical observations - the difference corresponding to the longitude difference between Canada's prime meridian (Dominion Observatory) and their location.

In 1898, Otto Klotz, an astronomer in the Department of the Interior (who had spent a great deal of time working with the International Boundary Commission, surveying the US/Canada border), had a vision of a grand facility — a "national observatory" to mirror in Canada the functions of the Royal Observatory at Greenwich, England.

The observatory was to be the primary longitude reference point for Canada and it was to determine and distribute time to government departments and to businesses that required precise time, notably the railroads.

The cost estimate first given to the Minister of the Interior in 1898 was just over $16,000 for building, astronomical dome, telescope and clocks. The chief architect of the Department of the Interior, David Ewart, was put in charge and he was told to design a building that suited a location near parliament.

David Ewart is one of the more important architects in Canadian history. He was also responsible for the **Victoria Memorial Museum Building** (Museum of Nature, 1905), the **Royal Canadian Mint** building (1905-1912) and the **Connaught building** (1914), all in Ottawa.



15" Refracting Telescope

The site was changed from near Parliament to the current location on the Experimental Farm (off Carling Ave.) in Ottawa because of better astronomical seeing. This site was then on the edge of the city and is slightly elevated. The exterior was built of Nepean sandstone and the trim of Credit Valley sandstone. The interior is simple painted brick.

Buildings of the Dominion Observatory

The Dominion Observatory (1905) is in the centre of this picture. The "transit house" is the lower building attached to the Observatory, on the left side. The building in the upper left is the "Seismology" building (1914). The long "Red Barn" (1908) in the upper center is the former Geodetic Survey standards laboratory. To the right of the Red Barn is the Geophysical Laboratory building (1955). The south azimuth marker (1912) is at the bottom of the picture. The small domed building in the lower right is the Photo Equatorial Building (1914). On the far right is the Observatory House, residence of the Chief Astronomer (1911). This photo from the 1970s shows a Photographic Zenith Telescope (white cross) that is no longer on the site.

Construction of the building began in July 1902. For positional astronomy purposes the western portion of the structure is exactly on an east-west line. The transit house marking the prime meridian, attached on the west side of the main building, was built separately. The final cost of the main building, including furnishings, but not the transit house extension or instruments, was $93,800. The total cost of the building and instruments was over $300,000!

The 15" refracting telescope was ordered in 1901. Precision sidereal time and solar time clocks, were ordered from Paris and received in 1902 at which point they began to be tested for accuracy and reliability.

The Dominion Observatory building was completed in 1905 with the main instrument, the refracting telescope, observing for the first time on April 17th. The telescope was open to the public every Saturday night, with almost 3000 names recorded in the "visitor's book" during the summer of 1905. Public viewing continued until the telescope was moved to the Canada Science and Technology Museum in

1974, where it is still in use.

The stone and brick buildings were famous for how cold they were, but the observatory was even colder. Imagine the astronomers coming to work in the winter evenings, under clear skies, in the unheated telescope dome - working with very little physical activity on cold Ottawa winter nights. One astronomer from the 1920s, Mim Burland, became famous for being the first woman in the Canadian government service to be allowed to wear pants on the job. It wasn't easy though - she had to get a ministerial waiver to allow her to do so! NRCan's "Office of Energy Efficiency" now occupies the observatory buildings – presumably their work environment is inspirational.

Geophysics In Canada

Aside from the time service and surveying, the Dominion Observatory had another mandate — the study of the planet Earth. In particular the Dominion Observatory was the leading Canadian organization in Geomagnetism, Seismology, Earthquake Research and Gravimetry for several decades.

Magnetic observations had begun before 1905, and in 1907 the observatory began systematic observations of terrestrial magnetism. The main purpose of the magnetic observations was for navigational purposes. Magnetic observations were a natural adjunct to land surveying: To measure magnetic declination you needed to determine azimuth, latitude and longitude by astronomical means.

The Dominion Observatory quickly specialized in "repeat" observations, which would extend the usefulness of observations made by the Topographic Survey, which was the group that actually produced the magnetic declination charts. The Dominion Observatory took over production of the magnetic declination charts in the 1940s.

This effort continues today, primarily through the operation of magnetic observatories that record rapid variations of the magnetic field used in the study of the Earth's ionosphere and magnetosphere as well as Earth-Sun interactions. This work is very important because of the effect of the magnetic field on hydro lines and similar infrastructure.

Seismometers were installed in the Dominion Observatory basement in 1906, and in April of that year produced a spectacular recording of the great San Francisco earthquake. By 1920 a national network of seismometers had been established in Victoria, Saskatoon, Saint Boniface, Ottawa, Toronto and Halifax.

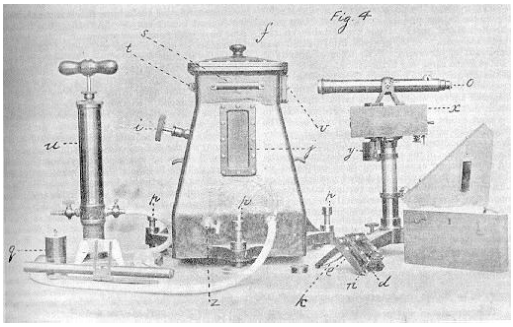
These seismographs were in place to record an unusual sequence of strong earthquakes in Eastern Canada:

- 1929 (magnitude 7, Grand Banks),
- 1933 (7, Baffin Bay),
- 1935 (6, Temiskaming) and
- 1944 (5.7, Cornwall).

The Grand Banks earthquake caused a tsunami killing 27 people.

This seismic work led to an effort to quantize earthquake hazards. An early edition of the National Building Code of Canada (1953) included the first seismic hazard map of Canada and seismic provisions. The 2005 National Building Code has much more precise seismic hazards estimations based on the latest work of Natural Resources Canada.

Geophysical understanding of earthquake processes has advanced significantly over the past century. A recent highlight is the discovery of "episodic tremor and slip" in the Cascadia subduction zone under Vancouver Island enabled by extremely precise GPS measurements combined with seismic recordings. These crustal motions (2-5 mm) gradually move up the length of Vancouver Island over about 15 days and are accompanied by a (previously inexplicable) "noise" on seismographs in the region. The slip events occur with surprising regularity (every 14.5 ± 0.2 months) with a direction of slip opposite to the long-term deformation motion.



Mendenhall Pendulum Gravimeter

Gravity observations began in 1902, when a Mendenhall type pendulum gravimeter was acquired. The beautiful gold plated pendulum was used, with meticulous care, until the 1970s.

Gravity surveys were carried out, among other reasons, to locate bodies of ore that might be the basis of Canada's growing mining industry.

Later, precise spring gravimeters were developed, eliminating the use of pendulums. Eventually these gravimeters could be used aboard ships and aircraft. Airborne gravity has been used in recent years in commercial exploration to discover diamond-bearing kimberlites in Canada's arctic.

"Absolute" gravimeters are now the tool of choice for precise *in situ* measurements. These gravimeters measure the acceleration of a falling corner cube reflector in a vacuum.

A national gravity database with approximately 700,000 points collected over 50 years is used to provide a national picture for use in exploration. The primary use of this database today is the modeling of the geoid - a surface that corresponds to mean sea level. A geoid model will become the official surveying reference for heights above sea level across Canada in the future.

The observatory remained responsible for Canada's official time service from 1905 until 1970 at which time the responsibility was passed to the National Research Council (NRC). By the late 1930s crystal oscillators had been developed which were an improvement on the pendulum clocks in the observatory's underground vaults. Eventually they were found to be more precise than astronomical time keeping and they formally took over from the astronomical method in 1951. Astronomical work continued at the observatory, focussed on measurements of changes in the Earth's rotation and orientation in space. In 1958 the NRC Cs-I ("Cesium One") clock was assembled and was immediately made the master clock for the Dominion Observatory and Canada. The NRC is currently experimenting with a "Cesium Fountain" which will be much more accurate than the current atomic clocks.

Conclusion

Following the founding of the Dominion Observatory in 1905, it provided the prime meridian and time service for Canada, as well as being the home for a wide range of geophysical research activities. The astronomical functions of the observatory, along with the time service, were transferred to the National Research Council in 1970 while the surveying and geophysics activities are now part of Natural Resources Canada.

The 15-inch refractor telescope was moved to the Canadian Museum of Science and Technology in 1974. Natural Resources Canada still occupies the buildings on the site, but the "Seismology" building is the only one currently occupied by geoscientists. The observatory rotunda has an original painting of the zodiac by Juan Geuer, who worked at the observatory for 27 years and painted the ceiling in 1962. Juan has exhibited his work in leading art galleries around the world and has a permanent installation in the National Gallery of Canada.

While the observatory is no longer used to view the heavens, the beautiful architecture and artwork of the observatory rotunda will remain an outstanding part of our Canadian heritage.

Further Reading:

Hodgson, J.H; *The Heavens above and the earth beneath: a history of the Dominion Observatories: volume I 1905 - 1946;* 1989, Geological Survey of Canada Open File, Ottawa.
Hodgson, J.H.; *The Heavens above and the earth beneath: a history of the Dominion Observatories: volume II 1946 - 1970*, 1994, Geological Survey of Canada Open File, Ottawa.
Thomson, M. M.; *The Beginning of the Long Dash: a history of timekeeping in Canada*, 1978, University of Toronto Press, Toronto.

The NEPTUNE Project: a cabled ocean observatory in the North-east Pacific – transforming our understanding of Earth/ocean processes

Chris Barnes

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NEPTUNE will be an innovative network of over 20 sub-sea observatories linked by 3000 km of powered, electro-optic cables covering the Juan de Fuca Plate (200,000 sq km), North-east Pacific, with shore stations at Port Alberni, BC and Nedonna Beach, OR (www.neptunecanada.ca, www.neptune.washington.edu/). Each observatory will host and power many scientific instruments on the surrounding seafloor, in boreholes in the seafloor, and buoyed through the water column. Remotely operated and autonomous vehicles will reside at depth, recharged at observatories and directed from distant labs. Continuous near-real-time multidisciplinary measurement series will extend over 25 years. Major research themes include: structure and seismic behavior of the ocean crust; dynamics of hot and cold fluids and gas hydrates in the upper ocean crust and overlying sediments; ocean/climate change and effects on ocean biota/fisheries at all depths; deep-sea sedimentation, ecosystem dynamics and biodiversity; and engineering and computational systems research. These involve interacting processes, long term changes, and chaotic, episodic events that are difficult to study and quantify by traditional means.

VENUS, MARS, and NEPTUNE ocean observatories will use most of the same cable and engineering systems with the former two also acting as shallow and deep-water test-beds, respectively, for the latter. The VENUS coastal test bed (www.venus.uvic.ca) was funded at $10.3M jointly by Canada Foundation for Innovation and the BC Knowledge Development Fund (CFI/BCKDF) in 2002 and is led by UVic with Verena Tunnicliffe as Project Director. Its first line should be installed in Saanich Inlet in January 2006 and the other line across the Strait of Georgia added in late 2006 in waters less than 300m. MARS (www.mbari.org/mars/) will be installed in the Monterey Canyon, California, at 900m water depth and 40km offshore in Spring 2006 by the Monterey Bay Aquarium Research Institute (MBARI). NEPTUNE is a Canada/US (30:70) partnership with the total facility cost of about $250M. Over $40M has already been funded by US agencies (e.g., by NSF) for design, development and the MARS test bed. Funding ($62.4M; CFI/BCKDF) for NEPTUNE Canada's installation was announced in October 2003. VENUS and Stage 1 of NEPTUNE will form a linked coastal/regional ocean observatory system, and be among the first of many such cabled ocean observatories.

In the US, the Ocean Observatories Initiative has been spawned by NSF, which established the ORION Project Office in 2004 and is proposing a US$268M infrastructure budget to cover observatory installation costs for coastal, regional and global-buoy observatory facilities. This funding would come from the Major Research Facilities, Engineering and Construction (MREFC) account after approval by Congress. These would be new resources, similar to the US$116M just announced by NSF for the refit of the *Resolution* as part of the US commitment to the new Integrated Ocean Drilling Program (IODP). Other regional ocean observatories are being planned in Japan (ARENA) and around Western Europe (ESONET). It is emphasized that we are entering a new age of the wiring of the oceans with the potential to have large-scale, interdisciplinary, interactive, real-time experiments.

NEPTUNE Canada is a consortium of 12 Canadian universities (Memorial, Dalhousie, Rimouski, Laval, UQAM, Toronto, Guelph, Waterloo, Manitoba, Simon Fraser, UBC, and Victoria). Under the terms of the CFI/BCKDF awards, UVic is required to both own and then operate the

observatory for at least the first five years. UVic has provided new space for NEPTUNE Canada and VENUS to be co-located on campus. After receiving news of its funding in late 2003, NEPTUNE Canada has been developing rapidly and currently has a full-time staff of 18 with others under contract. It has recently made two major funding announcements: for the wet plant infrastructure and for the scientific instruments supporting the community science experiments.

In October, UVic signed a contract valued at nearly $39M with Alcatel Submarine Networks (ASN) to design, manufacture and install the wet plant infrastructure for NEPTUNE Canada. Some Canadian subcontractors such as Satlantic and Alcatel Canada will be involved in portions of the work. Peter Phibbs (Associate Director for Engineering and Operations) has led a team that has worked tirelessly through an 18-month process of the RFQ/RFP/Contract negotiations. This installation will involve an 800km cable loop from UVic's shore station at Port Alberni, purchased in 2004, out to the Endeavour spreading ridge. Two full observatory nodes will be located at Barkley Canyon and Endeavour Ridge and two Branching Units (BU) at ODP 889 and 1027 sites (see cable route Figure). Full nodes can be readily added to the BUs with an ROV if additional funding is received, as discussed below. ASN will install the facility in mid-2007 with some instruments; most instruments will be deployed in mid-2008 after full testing and commissioning. ASN also earlier won the contract to install the MARS observatory.

We have insufficient funds at present to install the full scope option that was requested in the initial requests to funding agencies. We are, however, able to obtain one that is well beyond the minimum scope approved by those agencies. Once the scope was defined through contract negotiations, we were able to review which community science experiments would be provided at the Endeavour and Barkley sites following an external review committee's recommendations; a stand-by list of instruments is on hand should additional funding be secured. Brian Bornhold and Kim Juniper (Co-chief scientists) have led the exhaustive analyses of the proposals and the required compromises; the details of the $3.5M awarded for instruments and a similar amount for the accompanying for extension cables, interface modules, and installation are listed in the October Newsletter at www.neptunecanada.ca. Many of the instruments will require development work, followed by bench and wet testing, coordinated by Paul Hansen and others using the Saanich Inlet VENUS node, prior to deployment. Science workshops in mid-November further defined formal agreements for the acquisition, development and specifications for the instrumentation requested. We are receiving other requests to add instruments by other scientists funded from other sources.

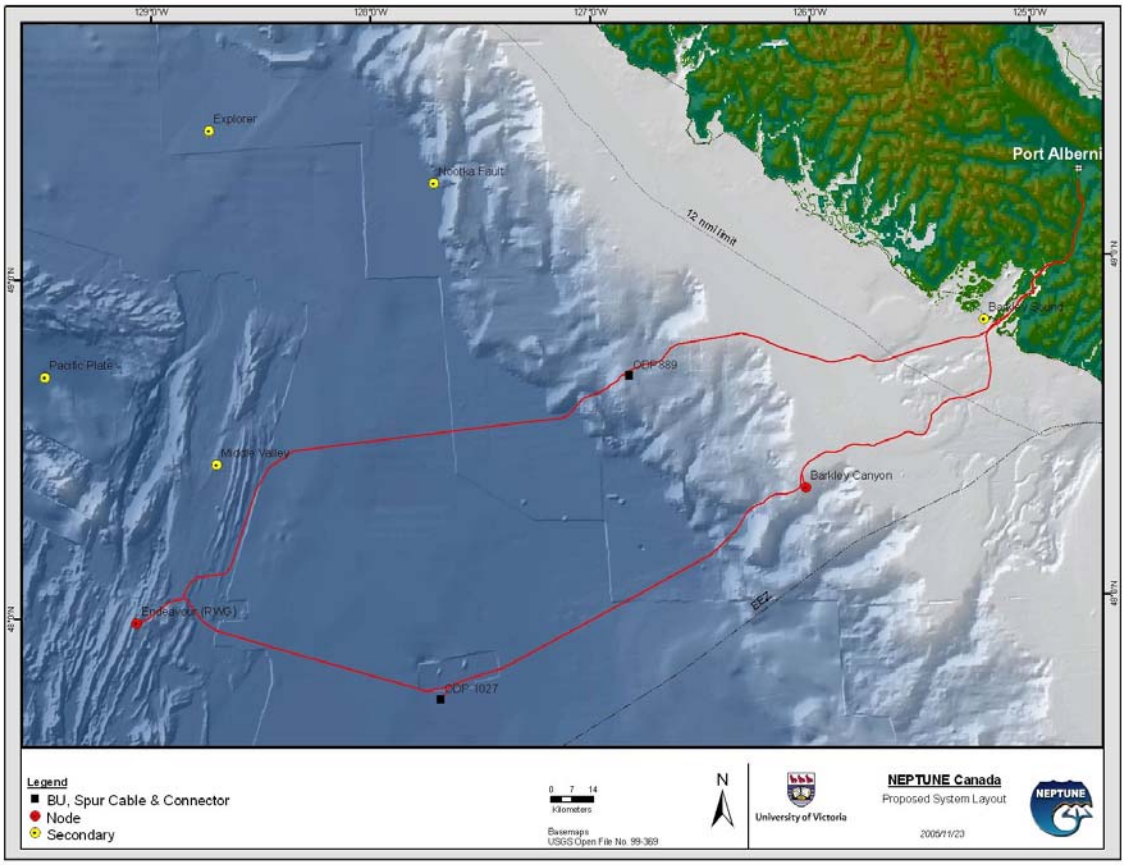
NEPTUNE Canada will provide ASN with the necessary detailed route surveys for the cable/nodes. Cheryl Katnick has been compiling all available data along the 800km route. Additional survey work has been necessary and much if this was accomplished in Fall 2005. The University of Washington's *R/V Thompson* was used for a month-long cruise to Endeavour, led by John Delaney and Deborah Kelley. NEPTUNE Canada and NSF provided funding to ensure that the *Autonomous Benthic Explorer* (ABE/AUV, from WHOI) was available to undertake systematic seabed mapping to facilitate the task of laying the cable along the narrow Endeavour rift valley and *Jason 2* remotely operated vehicle (ROV) for specific photographic imagery (including HDTV). Adien Aggenbach was on board for part of the period as the NC route engineer. Both she and Brian Bornhold participated on other vessels to complete two surveys across the shelf, including cone penetrometer tests, totaling over 1000km; Brian worked diligently to secure the vessels, specialists and equipment for these cruises.

NEPTUNE Canada continues to add new staff, especially to develop the Data Management and Archive System (DMAS) and good progress has been made by the team led by Benoit Pirenne (Assistant Director for Information Technology) on the interim DMAS for the VENUS project that will serve as a prototype for the needs of NEPTUNE Canada. We have just received $1.4M through the CANARIE Intelligent Infrastructure Program (CIIP), in partnership with IBM, to develop web services and service-oriented architecture to control al the remote sensors from distant research labs. A parallel award to John Roston, McGill University, of $1.1M, in partnership

with NEPTUNE Canada and FlexMet Inc, is to develop software solutions for controlling the use and communication systems for high definition TV from the deep ocean environments.

In August, UVic Vice Presidents and NC staff met with Alex Isern (NSF) and Bob Detrick and Rick Jahnke (ORION Project Office) to discuss ways to improve the collaboration in planning and installing the Stages I and II of NEPTUNE, ahead of the approval of the major US funding of the Ocean Observatories Initiative (OOI). Meetings were held in August and December with the Canadian navy and the US Ocean Observatories Security Systems Working Group of the US Navy, which has been established to review how issues of national security can be balanced with the scientific priorities in OOI, and with Stage I of NEPTUNE in particular. Most potential major problems appear to be now resolved in this relationship.

In summary, NEPTUNE Canada has moved from a variety of planning and design efforts to allocating most of its budget for defined acquisitions and developments. We are now on a more specified track with precise coordination over the next two years to ensure the installation of the wet plant infrastructure and then a further year to establish the full working systems. As US funding for the OOI has not yet been approved and as Stages I and II of NEPTUNE will be installed at least three years apart, it has not been possible to effect substantial savings had both projects been installed together. NEPTUNE Canada therefore requires an additional $20M to install the full scope of the observatory, with six rather than two instrumented nodes as initially requested. CFI has allowed the project to apply for these Supplementary Funds and a site visit is arranged for mid-January 2006. Canada is therefore playing a leading role in the advent of the new technologies for cabled ocean observatories that will transform the ocean sciences. Scientists interested in joining the experiments or in adding instruments to the arrays are urged to contact NEPTUNE Canada (neptune@uvic.ca).



Call for Papers

40th Annual CMOS Congress, May 29- June 1, 2006

Toronto, Canada

Abstract Submission Deadline: February 1 2006. **Early Registration Deadline: April 15 2006.**

The Canadian Meteorological and Oceanographic Society (http://www.cmos.ca) will hold its 2006 Congress from May 29 to June 1, 2006, at the Sheraton Hotel in downtown Toronto, Ontario, Canada. The Congress website is http://www.cmos2006.ca and the Congress email contact is cmos2006@cmos.ca.

This year's Congress has the theme ***"Weather, Oceans and Climate: Exploring the Connections."***

The Congress will feature:
* Science sessions that highlight top Canadian and international research contributions to meteorology, oceanography, atmospheric chemistry and pollution, remote sensing, climate modelling, and weather and climate forecasting.
* Plenary presentations by leading researchers.
* An evening general-interest lecture, open to the public, on the theme of climate change.
* Outreach sessions that focus on education, on communicating our research results to the media, on policy implications of our research, and on career opportunities for young scientists.
* A banquet, a hosted lunch, awards of CMOS prizes, and the CMOS Annual General Meeting.

Please submit abstracts electronically to the Congress website (http://www.cmos2006.ca) before the deadline of February 1, 2006. You will be asked to submit your abstract to one of several planned sessions that are listed on the website. Because only a limited number of slots for contributed oral presentations will be available, the Congress will put a strong emphasis on high-quality poster sessions that will take place each afternoon. An abstract fee of $50 will be charged at the time of submission. Your abstract will be evaluated by the Congress's Science Program Committee and you will be notified by mid-March 2006 if your presentation has been accepted for oral or poster presentation.

Student CMOS members are welcomed and encouraged to apply for a Student Travel Bursary when submitting an abstract.

If you are an exhibitor, an educator, a member of the media, or anyone else with an interest in the meeting, please visit the Congress website (http://www.cmos2006.ca) and contact us at cmos2006@cmos.ca for further information.

Some Upcoming Scientific Meetings

CGU or CGU-sponsored Meetings:

2006: The 100th Anniversary Earthquake Conference Commemorating the 1906 San Francisco Earthquake, April 18-22, San Francisco. For details, visit the web page http://www.1906eqconf.org/index.htm.

2006: Joint Annual Meeting of the CGU and the Canadian Society of Soil Science (CSSS), May 13-17, Banff. For details, contact Rod Blais, blais@ucalgary.ca, 403-220-7379, or visit the CGU web page http://www.cgu-ugc.ca.

Other Meetings:

2006: Ocean Sciences Meeting, February 20-24, Honolulu. For details, visit the web page http://www.agu.org/meetings/os06/.

2006: IAHS: 4th World Water Forum, Mexico City, March 16-22, http://www.worldwatercouncil.org /forum_4.shtml.

2006: IAG: Fifteen Years of Progress in Radar Altimetry Symposium, March 13-18, Venice, http://www.esa.int/venice06.

2006: Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP), April 2-6, Seattle, http://www.eegs.org/sageep/index.html.

2006: EGU General Assembly, Vienna, April 2-7, http://www.copernicus.org/EGU/meeting_overview.html.

2006: SSA Annual Meeting, April 18-22, San Francisco. Part of the 100th Anniversary Earthquake Conference Commemorating the 1906 San Francisco Earthquake (see above).

2006: GAC/MAC Annual Meeting, Montreal, May 14-17, http://www.esd.mun.ca/~gac/ ANNMEET/annmeet.html.

2006: IASPEI: Workshop on the Conduct of Seismic Hazard Analyses for Critical Facilities, May 15-19, Trieste, http://agenda.ictp.it/smr.php.1747.

2006: IAG: 3rd IAG Symposium on Geodesy for Geotechnical and Structural Engineering, May 22-24, Baden, Austria, http://info.tuwien.ac.at/ingeo/sc4/baden.

2006: AGU/GS/MB/MSA/SEG Joint Assembly, May 23-26, Baltimore, http://www.agu.org/meetings/ja06/.

2006: IAHS: Conference on Water Observation and Information Systems for Decision Support, May 23-26, Ohrid, Macedonia, http://www.balwois.net.

2006: IASPEI: Seismic Anisotropy and Geodynamics of the Lithosphere-Asthenosphere System, June 17-21, Castle of Trest, Czech Republic, http:// www.ig.cas.cz/activities/trest2006.php.

2006: IAHS: Sediment Dynamics and the Hydromorphology of Fluvial Systems, July 3-7, Dundee, Scotland, http:// www.dundee.ac.uk/geography/IAHS2006.

2006: 7th International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences, July 5-7, Lisbon, http://2006.spatial-accuracy.org.

2006: Western Pacific Geophysics Meeting, July 24-28, Beijing. For details, visit the web page http://www.agu.org/meetings/wp06/.

2006: AGU Fall Meeting, December 11-15, San Francisco, www.agu.org.

2007: SSA Annual Meeting, April 11-13, Waikoloa, Hawaii, http://www.seismosoc.org/.

2007: Alluvial Fans, June 18-22, Banff, Alberta, Canada, http://husky1.smu.ca/%7Epgiles/ AF2007/AlluvialFans2007.htm.

For information on IUGG meetings, visit the web page http://www.iugg.org and click on “Meetings Calendar”.

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CGU WEB SITE ADDRESS : http://www.cgu-ugc.ca

***Editor's Note*: ELEMENTS, the newsletter for the Canadian Geophysical Union, is published and distributed to all CGU members twice each year; one Summer issue and one Winter issue. We welcome submissions from members regarding meeting announcements or summaries, awards, division news, etc. Advertisements for employment opportunities in geophysics will be included for a nominal charge (contact the Editor). Notices of post-doctoral fellowship positions available will be included free of charge.**

General submissions should be sent to the Editor:
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Geodesy-specific submissions should be sent to:
Prof. Marcelo Santos, Email: msantos@unb.ca

Electronic submission is encouraged.

Canadian Geophysical Union
Union Geophysique Canadienne
www.cgu-ugc.ca

Canadian Society of Soil Science
Société Canadienne de la Science du Sol
www.csss.ca

GEOSPATIAL PROCESSES:
INTEGRATING PEDOSPHERE, LITHOSPHERE AND HYDROSPHERE

ANNUAL MEETING / RENCONTRE ANNUELLE
THE BANFF CENTRE
14-17 May/Mai 2006

CGU/UGC Sessions

Hydrology
Geoelectromagnetics
Geodesy & Geodynamics
Earthquakes & Natural Hazards
Environment & Climate Systems
Geocomputations & Visualization
Glaciology & International Polar Year 2007
General Geophysics

CSSS/SCSS Sessions

Soil Water
Problem Soils
Northern Issues
Climate Change
Nutrient Management
Forest Soils & Management
Land Reclamation & Remediation
General Soil Science

Joint Sessions: Hydrogeophysics, among others

Field Trip to Burgess Shales on 14 May/Mai 2006

ABSTRACTS / RESUMES: 15 February/Février 2006

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