

SE01: Geophysical studies of structure and tectonics of the Canadian Cordillera

Conveners: Pascal Audet¹, David Eaton², Roy Hyndman^{3,4}, and Andrew Schaeffer⁵

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Session Description

The Canadian Cordillera exhibits highly variable past and present tectonic interactions along its western margin with important consequences on the structure, geology and deformation of the crust and uppermost mantle. Despite past (e.g., Lithoprobe) and current (e.g., Earthscope Transportable Array) large-scale efforts to image crust and upper mantle structure in this area, several key scientific questions remain to be addressed. Example questions include: What is the nature of the Cordillera-Craton transition at crustal and upper mantle depth? How is current deformation distributed within the Cordillera? What is the importance of tectonic inheritance in controlling Cordilleran evolution? An opportunity is currently emerging to expand the coverage of geophysical monitoring sensors (seismic, GNSS) and supporting geoscience activities all across the Canadian Cordillera, from the Beaufort Sea to the US borders – the Canadian Cordillera Array (CCArray) initiative. This session aims to bring together Earth scientists who work on deciphering the structure and processes associated with the evolution and current deformation of the Canadian Cordillera, in anticipation of CCArray. We seek contributions from geophysics, seismology, geodynamics, tectonics, structural geology, petrology, geochronology and related fields that yield constraints on the thermal and compositional structure as well as active deformation of the crust and mantle through field observations, laboratory studies and numerical modeling.

Primary Affiliation: CGU (Solid Earth)

SE02: The earthquake cycle: squaring the circle

Conveners: Edwin Nissen¹, and Kristin Morell²

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Session Description

In recent years the earthquake cycle model in its simplest form – the steady interseismic build-up of strain, released at regular intervals in an earthquake – has been challenged by new observations and interpretations. These include (1) apparent seismic and aseismic precursory activity before major subduction earthquakes; (2) a variety of transient fault slip phenomena including fault creep, slow earthquakes and postseismic after-slip; (3) complex fault interactions including earthquake clustering, compound ruptures and remotely-triggered seismicity; and (4) long-term waxing and waning of fault activity. This session provides a platform for work on all aspects of the earthquake cycle, and seeks contributions from studies of surface deformation (such as those using high-resolution imaging techniques like InSAR and pixel correlation); surface topography and geomorphology (such as those exploiting lidar or structure-from-motion); paleoseismic or sedimentary records of earthquake recurrence; laboratory experiments of fault mechanical behaviour; and related modelling and theory.

Primary Affiliation: Solid Earth/Geodesy

SE03: Recent advances in Canadian Arctic Geoscience Research

Conveners: Andrew Schaeffer¹, Fiona Darbyshire², and Pascal Audet³

Co-chairs: Andrew Schaeffer¹, Fiona Darbyshire² and Pascal Audet³

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Session Description

Due to its remote location and correspondingly complex logistics, large-scale detailed study of the Canadian Arctic has been relatively limited in contrast to the southern and central Canadian landmass. However, over the last decade, increased terrestrial geophysical instrumentation and geologic investigation are shedding new insight on the complex tectonic evolution of this northern region. Furthermore, as levels of sea ice coverage continue to decrease over the summer months, access to offshore regions will continue to expand. With such increased access and corresponding instrumentation, long-standing questions elucidating the links between surface geology and subsurface crust and mantle structure can now be more thoroughly investigated.

In this session we encourage submissions from geological, geochemical and geophysical studies examining the tectonic history and natural resource potential of the Canadian Arctic. In particular we welcome innovative and multi-disciplinary approaches addressing large-scale structure and evolution of the Arctic landmass and its margins.

Primary Affiliation: Joint Solid Earth / Earth Surface Processes

SE04: Recent trends in exploration geophysics

Conveners: Claire Samson¹, and Alexander Braun²

Co-chairs: Claire Samson¹, and Alexander Braun²

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Session Description

This session invites contributions on recent trends in exploration geophysics including advances in instrumentation, survey design, data processing and integration, and interpretation. "Exploration" is taken in its broadest sense and is meant to include mineral resources, oil & gas, and groundwater, in both "brown" and "green" field areas. Focus will be on case studies from the Canadian Cordillera and the Western Sedimentary Basin, but the session will include contributions from all regions of Canada. Of particular interest are contributions on the challenges of exploring in rough topography, in complex geological terrains and under overburden cover. New developments in instrumentation, (e.g. gradiometers, airborne IP) and data integration (e.g. joint or stochastic inversion, predictive mapping, 3D subsurface visualization tools) are starting to transform exploration geophysics and will eventually allow for targeting more complex and deeper targets. The session aims at bridging geophysical applications in geology, hydrology and soil science, and therefore contributions featuring how various techniques and approaches can be integrated to increase exploration success are particularly welcome.

Primary Affiliation: CGU Solid Earth Section

SE05: Induced earthquakes: Source processes and hazard assessment

Conveners: Yajing Liu¹, and Rebecca Harrington²

Co-chairs: Yajing Liu¹, and Rebecca Harrington²

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Session Description

In the past decade, there has been a drastic increase in seismicity associated with fluid injection during unconventional oil and gas extraction in North America, including previously seismically quiescent areas. While pore pressure increase due to fluid diffusion is a commonly recognized conceptual mechanism for inducing earthquakes, the complex interaction between pore fluids, solid matrix stress and, if applicable, strength of a pre-existing fault, remains unclear. Regional seismic network and local dense arrays have been established and are starting to provide detailed information about the source process and ground motion of induced earthquakes. In this session, we invite contributions from studies on earthquakes potentially induced by various anthropogenic causes, including but not limited to, wastewater disposal, hydraulic fracturing, geothermal energy extraction, CO₂ sequestration and natural gas underground storage, and reservoir impoundment. We welcome studies using seismological and geodetic observations, geomechanical modeling, statistical analysis and laboratory experiments to address the source mechanism of induced seismicity, their distinctions and/or similarities to natural tectonic earthquakes, and seismic hazard assessment and mitigation.

Primary Affiliation: Solid Earth / Geodesy / Hydrology

SE06: Solid Earth Geophysics: General Contributions

Co-convenors: Andrew Frederiksen, Sam Butler, Phil McCausland

Chairs: Andrew Frederiksen, Sam Butler, Phil McCausland

This session invites contributions from all areas of study investigating the origin, evolution and structure of the Solid Earth, ranging in scale from microscopic to planetary. Topics can take the form of new laboratory or field observations, methods, applications, theory and modelling studies drawn from all areas of solid earth geophysics, including tectonophysics, lithospheric and mantle dynamics, passive geophysical techniques (e.g. seismology, heat flow, potential fields), active source geophysical techniques, petrophysical properties, mineral physics and also the history of geophysical research.

Sponsored by the CGU Solid Earth Section