

# EVENING LECTURE

by Prof. W. Richard Peltier  
University of Toronto, Canada

## "The Application of GRACE Time-Dependent Gravity Measurements to the Understanding of Land Surface Hydrology and Global Sea Level"

Where: International Space Science Institute  
Hallerstrasse 6, Bern, Second floor

When: Tuesday, February 7 2012, 18h00

The Gravity Recovery and Climate Experiment (GRACE) has now provided ten years of monthly averaged observations of the changing gravitational field of the planet. The mission was designed (eg see Tapley et al, 2004, Science 305, 503-505.) to enable the direct inference of the rates at which the polar ice sheets are currently losing mass and the surface of the continents are drying/moistening as a consequence of the continuing action of the global warming process. It was also recognized by the mission design team that the dual satellite system would be sensitive to the continuing changes in planetary shape and sea level that are occurring due to the action of the glacial isostatic adjustment (GIA) process. That was forced by the cyclic process of glaciation and deglaciation that dominated climate variability during the last half of the Pleistocene epoch of Earth history. This long memory of ancient ice age influence is due to the high value of the effective viscosity of Earth's iron-magnesium silicate mantle. The GIA process continues to act to as to obscure the influence of the global warming process that it is our goal to fully understand

In this lecture I will explore and explain the manner in which, though the development of a detailed theory of ice-Earth-ocean interactions, it has proven possible to obtain accurate inferences of the rates of mass loss from the great polar ice-sheets and to provide direct verification of the validity of the global theory of the GIA process that is required to properly interpret the GRACE constraints upon the mass balance of these systems.. This theory has also proven to be critical to understanding the extent to which the GRACE inference of the modern rate of gain of mass by the oceans is contaminated by ongoing GIA influence of equal importance are the additional constraints that are now being provided by observations of changes in Earth's rotational state which, when combined with the GRACE observations, and the theoretical model, are enabling us to refine our knowledge of the geographical regions from which the additional land ice melting is occurring that is required to understand observations of the total rate of sea level rise that are being provided by satellite altimetry. These analyses have finally enabled us to demonstrate that the budget of global sea level rise is closed AND to isolate the primary regions of Earth's surface from which the contribution to global sea level rise from the melting of small ice-sheets and glaciers is being derived.