CREATE
NSERC CREATE Training Program in Climate Science
Programme de Formation FONCER du CRSNG en Science du Climat

CREATE & Campbell Scientific Workshop 2012

Schedule

Day 1:

- starting immediately with programming, using the thermocouple example was good.
- therefore should do the PowerPoint on temperature, not radiation, on Day 1
- could also add the T/RH probe to the program, leaving the RH theory till later
- set up station with thermocouple and T/RH probe
- respecting the feedback that we should spread things out a bit more evenly over days 1 to 3, that might be enough for the first day.

Day 2:

- download some data and introduce idea of graphic displays as a data quality check
- add soil thermistors to the program
- do PowerPoint on radiation
- add radiation sensors to the program
- add thermistors and radiation sensors to the station.
- demonstrate solar panel sizing spreadsheet
- start on some data management issues using supplied data, or other programming language? Maybe need a handout/presentation on data management principles

Day 3:

- download some data and do visual quality check
- do wind and pressure PowerPoint
- add wind and pressure to the program
- do humidity and soil moisture PowerPoint
- can we add a soil moisture probe for each group, and add to the program?
- add wind, pressure (and soil moisture?) probes to the station
- continue with data management or other programming language?

Day 4:

- customize the morning to the requests of the participants. If we do EC again, need to be better prepared to discuss issues of coordinate rotation and WPL corrections.
- might move calibration of sensors to this afternoon?
- more on data management and programming after calibration session.
- take down stations at the end of the day

Day 5:

- calibration of sensors, if not done on Day 4.
- final session on data management using participants' data
- end at noon.

Things to fit in, if time and weather permit:
- field trip to the "blowing snow" meadow site
- history tour at the station
- demo of time constant and/or radiation errors

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CREATE summer Workshop

Student Discussions/Presentations

Wednesday July 25 – 9AM – PSC2036

Sonja Bhatia (Dal)

Demand Side Management in Nova Scotia: Administrative Structure and Program Design

Demand side management (DSM), the practice of acquiring electricity efficiency as a resource, is a growing industry in Nova Scotia. The current administrative structure, its impact on program design and the evaluation and measurement process will be discussed.

Jocelyn Egan (StFX)

Investigating $^{14}CO_2$ chamber methodologies

Radiocarbon (^{14}C) is an extremely useful tool in studying carbon cycle processes. Through its use as a tracer and dating tool, it can provide an abundance of information that can help in the understanding of physical and biological processes that control soil respiration. Although this isotope has proven to be a great tool in giving insight into soil turnover rates and partitioning between CO_2 sources, the methodologies used to measure it need to be clearly understood in order to ensure that they are not inducing biased results caused by disturbances to the soil's natural diffusive regime. Unfortunately, little work has been done to thoroughly investigate the possibility of inherent biases in the current measurement techniques because of high costs and sampling logistics. Presented here is a brief overview of the current methodologies and preliminary results from a numerical modeling experiment and a description of ongoing lab experiments being done to compare to model results.

Keri Bowering (MUN)

Carbon loss from soils of mature and regenerating forests in the Humber River region

This research will quantify two important pathways of carbon loss from forested landscapes of Western Newfoundland. An important outcome of this work will be the design and installation of pan lysimeters that will enable high-frequency collection of soil leachate from the organic horizons of boreal forest soils. The collected water samples will be analyzed to provide quantitative and qualitative measurements of the soluble carbon and nutrients that are leached from the soil. Sampling will be done frequently and at different times during and outside of the growing season so as to characterize dissolved organic material in relation to seasonal changes and precipitation events. These lysimeter collections will be paired with CO2 gas flux in order to quantify carbon losses from the soil system to the atmosphere. An experimental site that features both mature forests and regenerating areas (approximately 10-years post-harvest) within the Humber River watershed region will be utilized. This comparison of systems within the Humber River Basin will compliment work already underway that examines the effect of climate on Labrador Boreal Ecosystem Latitudinal Transect (NL-BELT).

Christian Hart (StFX)

Depth resolution of soil respiration temperature response using a physical CO2 transport model

CO2 emissions from terrestrial ecosystems contribute much uncertainty to the future Global climate. Automated soil respiration chambers have gained widespread use over recent years, providing temporally dense measurements of CO2 emis- sions from soil which are of tremendous value because of the complexity asso- ciated with understanding these fluxes (Martin, 2012). A variety of approaches and measures to quantify the sensitivity of soil carbon to climate, with most common measure being the Q10 temperature function(Sierra, 2012). Q10 usu- ally calculated holistically from soil respiration and temperature at a single fixed depth, is problematic because CO2 production in an integrated response

a to non-uniform temperature profile, with depth soil carbon is variable in its absolute and relative temperature response with respect to quality, and Efflux rates are effected by several factors which very temporally across horizontal and vertical gradients. A more reasonable mechanistic understanding of soil respiration dynamics is needed before fate of soil carbon under a warmer cli- mate can be determined. Modelling studies remain the only approach to assess soil respiration sensitivities in-situ without soil disturbance. Using data from five observational stations equipped with Forced Diffusion (FD) chambers (Risk, 2011) and several subsurface CO2 concentration arrays, deployed across Canada. This study use an inverse method to determine subsurface CO2 production us- ing a high frequency process based soil respiration model and fitting algorithm. In order to asses the potential of resolving vertical CO2 dynamics solely with Forced Diffusion (FD) chambers and automate derivation of environmental pa- rameters across a variety of field sites. Continuous forced diffusion soil efflux measurements, in combination with novel modelling techniques, offer an impor- tant trade-off in subsurface resolution and required equipment, which may be advantageous in estimating future changes in soil CO2 respiration across spatial gradients under limiting conditions.

Edmundo Gurza (StFX)

Borehole Climatology

The study of past climatic change is important for understanding the climatic and energy cycles of our planet, as well as to place future change in a large term context. The use of ground surface temperature histories (GSTH) has been well established since the initial finding of climatic information from borehole temperature profiles (BTP) [Lachenbruch and Marshall, 1986][Beltrami et al., 2005].
Climate reconstructions based on BTPs assume that the surface air temperature changes are coupled with ground surface temperature (GST) changes. The GST propagate towards the interior of the earth by thermal conduction at a rate determined by the thermal properties of the subsurface. For a typical rock, a perturbation propagates approximately 16 meters in one year, 50 meters in 10 years, 160 meters in 100 years and 500 meters in 1000 years. The borehole method has the potential to obtain records for the past millennium within the uppermost 500 meters of the Earths crust [Beltrami and Bourlon, 2004].
If the temperature at a specific depth is given at any time by the combination of the equilibrium heat flow and the temperature perturbation, the earth's subsurface stores an extensive and useful database of temperature changes that can be recovered through BTPs [Beltrami and Mareschal, 1992].
This research intends to obtain data from boreholes in South America, which can be used to perform climate change and earth interior heat flux studies for this region. Researchers working in this field have highlighted the benefits that data from South America would bring to large scale climatic studies [González-Rouco et al., 2008] [Huang et al., 2000] [Pollack and Chapman, 1993].
The single value decomposition (SVD) method employed in this research has been previously used to study prevalent temperature changes in the Northern Hemisphere [Beltrami and Mareschal, 1991] [Beltrami et al., 1995] [Beltrami et al., 2003]. In this method the data obtained from the subsurface through a temperature-depth profile is used to estimate the equilibrium heat flow. Once the equilibrium is calculated, the temperature perturbations are defined as the difference between the raw profile and the calculated equilibrium. The data can be inverted by

single value decomposition to estimate the time at which the temperature change occurred at the surface. From these estimates a GSTH can be created. The inversion method description is better explained by Mareschal and Beltrami [Mareschal and Beltrami, 1992].

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