Review comment responses for

A comprehensive data acquisition and management system for an ecosystem-scale peatland warming and elevated CO2 experiment

Krassovski et al..

General comments

The paper "A comprehensive data acquisition and management system for an ecosystem-scale peatland warming and elevated CO_2 experiment" by M. B. Krassovski et al. describes the instrumentation for the control and monitoring of a complex ecosystem set up in northern Minnesota, USA. In connection with the climate change debate and the possible influence of CO_2 on the development of forest plants this well written description of a controlled test environment is an important contribution to the understanding of quantitative results used to evaluate the effects of greenhouse gas changes on certain aspects of our environment.
The article covers the important aspects of the implemented mechanisms for data quality control, quantitative environment manipulation and the collection of the relevant metadata needed to put the data into a correct context. Also the strategy for the archiving of data, metadata and relevant documentation as well as for the general access to these data sets is covered, outlining the involved difficulties, possible alternatives for data access implementations and their selection criteria.

We appreciate these supportive comments.

Some information to the calibration of the system and the recording of possible errors would have been a useful addition and should perhaps be added before the final publication.

The following paragraph regarding calibrations will be added to the manuscript:

"A calibration schedule for all SPRUCE instrumentation has been established delineating frequency and methods and specifying acceptable operational ranges and error for each type of measurement (http://mnspruce.ornl.gov/content/spruce-calibration). Recalibration of existing sensors versus their replacement with new sensors does consider cost. Where the cost of the calibration effort (personnel time, materials, shipping) exceeds the cost of the acquisition of new sensors (with calibration), new sensors are acquired. A data base is used to track sensors, their deployment, recalibration and replacement when necessary."

Specific comments

Page 179, line 21, in section 1.1: The term "ambient" is used here for reference temperature and CO2 contents without unambiguous definition. Are these the

conditions measured at any given time in the "ambient plots without enclosure" mentioned later, or the conditions in the "fully constructed, non-heated control enclosures" mentioned also in this section?

The term control plots, meaning fully constructed no-energy-added plots, is the correct term. The wording in the document will be changed and clarified.

As the environment is an open-top enclosure (page 179, line 21) how is a controlled environment maintained and how is the temperature increase achieved: by soil heating, IR irradiation (from above, the sides …?)

Soil warming is achieved through electrical resistance heating in an array of vertically installed below ground heaters. Air warming is achieved through forced air moving across a propane-fired heat exchanger. Details on the heating methods can be found in Barbier et al. 2012.

Barbier C, Hanson PJ, Todd DE Jr, Belcher D, Jekabson EW, Thomas WK, Riggs JS (2012) Air Flow and Heat Transfer in a Temperature Controlled Open Top Enclosure, ASME International Mechanical Engineering Congress and Exposition, 2012, Houston, TX, Paper #IMECE2012-86352.

Page 180, line 7 claims a raised dome peat bog: does this insulate the test site from the environment?

A raised dome peat bog isolates the ecosystem from ground water. By definition a raised dome bog obtains all of its precipitation and nutrients from the atmosphere. As such they are nutrient deficient compared to other natural ecosystems, and the plants occupying the bog are adapted to those conditions.

If so, what does the line-21 reference to an open-top enclose refer to? Several details are given in the following paragraph. Slightly rephrasing the introduction in line 21 could make the setup clearer. In the current description it remains unclear how the critical parameters (temperature and CO2 contents) are monitored, controlled and manipulated and what height-dependent variations are to be expected. The details are described later including a rough description of a feedback loop.

We will modify the paragraph with the warming description above to better inform the reader.

"Ecosystem warming is achieved by a combination of deep peat heating and air warming. Soil warming is achieved through electrical resistance heating in an array of vertically installed below ground heaters. Air warming is achieved through forced air moving across a propane-fired heat exchanger. Details on the heating methods can be found in Barbier et al. 2012. To facilitate air warming the experimental plots are enclosed in a 12 m diameter by 8 m high open top enclosure. The open top enclosure allows natural inputs of precipitation (rain and snow) while

limiting total air turnover making it possible to generate an envelope of warm air around the enclosed plot of vegetation."

The experimental setup description starting on page 180 at line 12 and continuing to the end of this section could benefit from restructuring to allow the reader to estimate which aspects of the described sensor and data handling environment might be applicable to own similar test set-ups. My interpretation of the text is as follows, but I am not certain that it is correct:

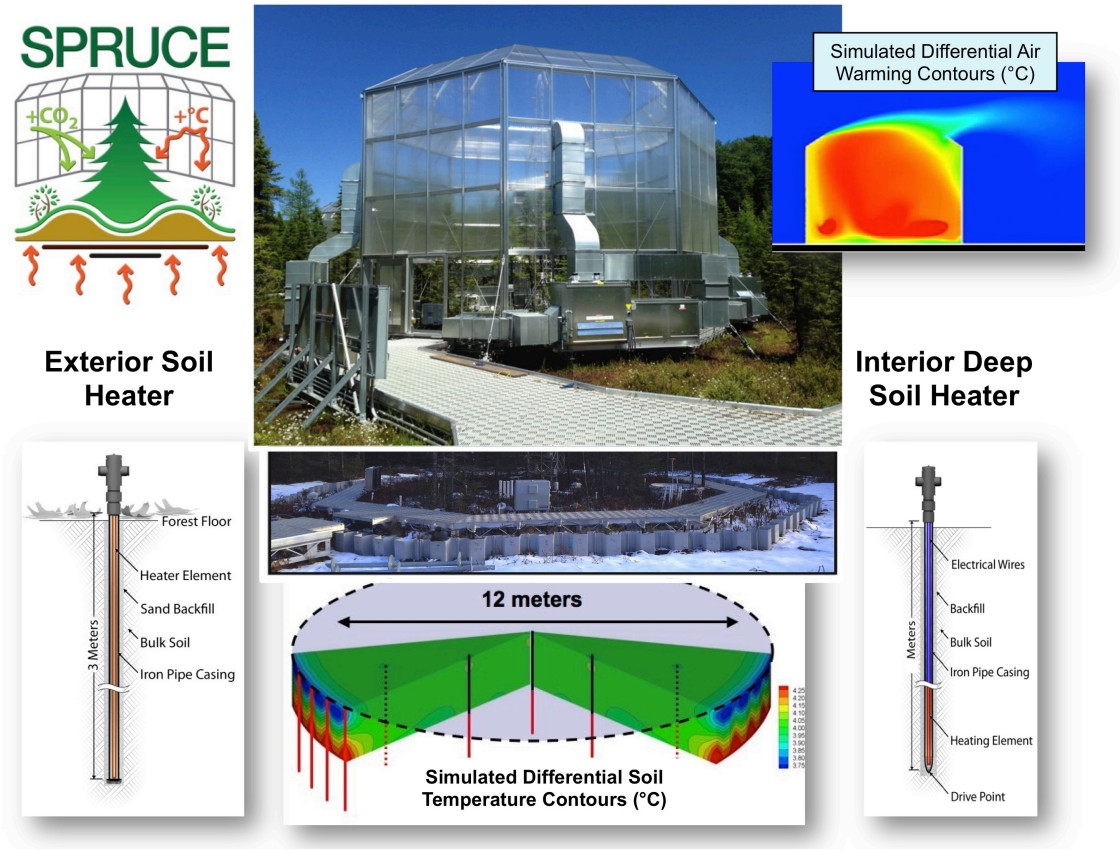
Based on your suggestions we will add the following paragraphs:

17 plots of 12 m diameter were initially established open to the environment; each of them has a 10m- high instrumentation tower with environmental sensors with observations conducted at 0.5, 1, 2 and 4 meters above the ground (nominal heights of typical shrub and tree foliage and branches. The enclosure surface is glazed with greenhouse panels allowing 80% of the photosynthetically active radiation to reach the vegetation.

10 plots are thermally isolated from the environment by 8-m high side walls, open above, which can be heated at ground level and throughout the vertical space of the enclosure. Two plots are fully constructed and operational without heating and 8 are heated in pairs to the target levels mentioned. Half (5 enclosures) of each pair of the treatment plots receive CO_2 injections. Six of the non-enclosure plots are also used as ambient reference monitoring.

How are they related to / different from the 17 12m-plots mentioned in the first group? Also the different heating systems – one for soil heating from underneath the surface, the other for air heating above the surface – would be useful to highlight in the text. This information is currently only available from thorough studying of figure 2.

The edited text above should resolve these issues, and a revised Figure 2 will be added with up-to-date images of the final enclosures.



Page 182 line 10 mentions 16 instrumented plots, I count 33 plots based on the description on page 180. Probably several plots are mentioned more than once according to their various equipment types.

There are only 17 instrumented plots as can be seen in the revised Figure 1.

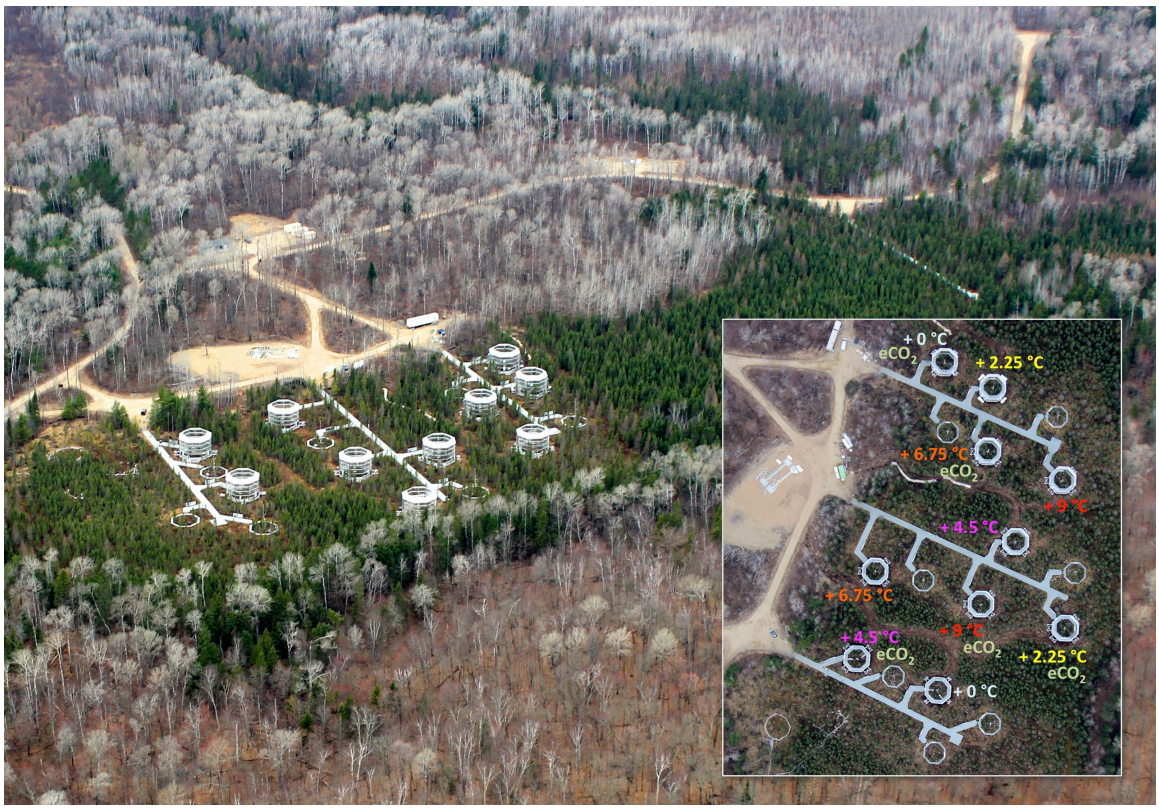


Figure 4 lists 17 network nodes numbered up to 21. Where do the discrepancies come from? Perhaps the numbering scheme used in figure 4 should already be mentioned as references in the set-up description of pages 180 to 182 where possible. Another possibility could be a table with 1 line per plot and different columns for the various properties, then just across if a property is applicable.

There is no discrepancy. There are only 17 plots.

Page 189 line 23: A list with the detailed evaluation criteria for a network service provider is fine, but the name of the finally selected company does not belong into a journal article and should be removed.

It is standard practice in most scientific journals to include the name of the manufacturer of products to allow future research the best chance to replicate the methods if they choose to do so. If, however, this is not standard practice here the change can be made as follows:

"After extensive consultation with many providers, one with the highest uplink speed was selected"

Page 192 line 22: Time is mentioned as important. The means of time synchronization should be mentioned here: via GPS, radio time server, local clock

standard? How is time-synchronization provided in the LAN to the local data loggers?

"Time synchronization is achieved by synchronizing LAN time with one of the Internet time servers and then propagated to all dataloggers"

Technical corrections

Page 182 line16: is meant "experimental reference" rather than "experimental control"?

"experimental temperature reference" would be most appropriate.