**Partitioned respiration from glucose addition manipulation with associated soil temperature, moisture, microbial biomass, mineral N availability, and elemental analysis, Barrow, Alaska, 2014-2016**

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**Summary:**

Measurements made from a 2014-2016 field glucose addition experiment. Dataset includes measurements of surface trace gas emissions (13C of ecosystem respiration and source-partitioned surface CO2 flux, CH4 flux, and GPP), soil profile information (concentrations of carbon, nitrogen, and soil microbial biomass carbon, 13C of soil organic matter and microbial biomass, gravimetric water content, and bulk density), soil mineral nitrogen availability, and field-measured soil temperature, air temperature and soil moisture. Experiment was conducted in a region of high-centered polygons on the BEO.

**Please use this citation to reference the data.**

Vaughn, L.S., Zhu, B., Bimuller, C., Porras, R.C., Curtis, J.B., Chafe, O, Abramoff, R.Z., Bill, M. 2017, and Torn, M.S. Partitioned respiration from glucose addition manipulation with associated soil temperature, moisture, microbial biomass, mineral N availability, and elemental analysis, Barrow, Alaska, 2014-2016. Next Generation Ecosystem Experiments Arctic Data Collection, Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. Data set accessed at…

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**Data Characteristics**

Measurements from 2014-2016 field glucose addition experiment, including (1) 13C and partitioned flux rates of surface trace gas emissions; (2) depth-resolved soil carbon, nitrogen, and microbial biomass carbon concentrations and 13C abundance; (3) soil mineral nitrogen availability; (4) soil temperature, and (5) moisture. There are 5 comma-delimited data files (.csv) within this dataset.

**Data Dictionary [DATA IS NOT YET AVAILABLE 2016-11-04]**

**Data Files:**

priming\_flux\_Barrow\_2014\_2016

priming\_SOM\_Barrow\_2014\_2016

priming\_N\_avail\_Barrow\_2014\_2016

priming\_temperature\_Barrow\_2014\_2016

priming\_moisture\_Barrow\_2014\_2016

| **column\_name** | **units/format** | **Description** |
| --- | --- | --- |
| **region\*** |  |  |
| **locale\*** |  |  |
| **administrative\_area\*** |  |  |
| **site\*** |  |  |
| **area\*** |  |  |
| **plot\_type\*** |  |  |
| **pologyon** |  | individual polygon within specified area |
| **mesocosm** |  | individual mesocosm within the specified polyogn |
| **treatment** | Ct/HG/LG | glucose addition treatment (Ct = control; HG = high glucose; LG = low glucose) |
| **easting** | m | location in UTM coordinates, zone 4 |
| **northing** | m | location in UTM coordinates, zone 4 |
| **observation\_date** | yyyy-mm-dd | The date at which the measurement was made at the site or the sample was collected from the site. |
| **chamber\_type** | Opq/Trns | whether the static chamber used to make the trace gas flux measurement was opaque or transparent (Opq = opaque; Trns = transparent) |
| **flux\_CO2\_total** | umol m-2 s-1 | CO2 flux, calculated from the linear portion of the CO2 concentration vs. time regression |
| **flux\_CO2\_total\_se** | umol m-2 s-1 | standard error of the CO2 flux regression slope |
| **flux\_CO2\_total\_Pvalue** |  | p-value of the CO2 flux regression. If p < 0.05, flux is significantly different from 0 umol m-2 s-1 |
| **flux\_CO2\_total\_Rsquared** |  | adjusted R squared value of the CO2 flux regression |
| **flux\_CO2\_glucose** | umol m-2 s-1 | flux of CO2 attributed to glucose mineralization, calculated from flux\_CO2\_total using 2-pool mixing model |
| **flux\_CO2\_background** | umol m-2 s-1 | flux of CO2 attributed to native ecosystem respiration, calculated from flux\_CO2\_total using 2-pool mixing model |
| **Reco\_13C** | ‰ | Keeling plot-derived 13C of ecosystem respiration |
| **flux\_CH4** | nmol m-2 s-1 | CH4 flux, calculated from the linear portion of the CH4 concentration vs. time regression |
| **flux\_CH4\_se** | nmol m-2 s-1 | standard error of the CH4 flux regression slope |
| **CH4\_Pvalue** |  | p-value of the CH4 flux regression. If p < 0.05, flux is significantly different from 0 nmol m-2 s-1 |
| **CH4\_Rsquared** |  | adjusted R squared value of the CH4 flux regression |
| **GPP** | umol CO2 m-2 s-1 | gross primary production, calculated from transparent and opaque soil chamber CO2 flux measurements |
| **depth\_temperature** | cm | depth of temperature measurement, measured from the top of the moss layer. If standing water present, measurement is from the water surface. |
| **instrument** |  | instrument used to make temperature measurement |
| **time** | AKT | local time when the measurement was taken |
| **T\_soil** | C | soil temperature |
| **T\_soil\_n** |  | number of averaged soil temperature measurements |
| **T\_soil\_sd** | C | standard deviation of soil temperature measurements |
| **T\_air** | C | air temperature |
| **T\_air\_n** |  | number of averaged air temperature measurements |
| **T\_air\_sd** | C | standard deviation of air temperature measurements |
| **depth\_moisture** | cm | depth from surface over which the moisture measurement is integrated |
| **Ka** |  | apparent dielectric constant, measured with a Soilmoisture Minitrase TDR |
| **Ka\_n** |  | number of Ka measurements averaged in reported Ka |
| **Ka\_sd** |  | standard deviation of Ka measurements |
| **VWC** | % | volumetric water content, calculated using the intstrument's internal calibration |
| **VWC\_n** |  | number of VWC measurements averaged in reported VWC |
| **VWC\_sd** | % | standard deviaton of VWC measurements |
| **layer\_top** | cm | The top (upper) depth of the layer, measured from the surface of the moss layer. |
| **layer\_bot** | cm | The bottom (lower) depth of the layer. |
| **oc** | % | Percent by weight of carbon in an oven-dried soil sample with material >2 mm or 1 cm diameter removed. |
| **n\_tot** | % | Percent by weight of nitrogen (organic and inorganic) in an oven-dried soi sample. |
| **13c** | ‰ | δ13C of the sample relative to Pee Dee Belemnite. |
| **MBC** | mg g-1 | mg of microbial biomass per g dry soil |
| **MBC\_13C** | ‰ | δ13C of the microbial biomass relative to Pee Dee Belemnite. |
| **bulk\_density** | g cm-3 | soil bulk density |
| **gwc** | % | gravimetric water content (relative to dry soil) |
| **N\_total** | ugN 10cm-2 20days-1 | supply rate of inorganic nitrogen to PRS probes |
| **NO3** | ugN 10cm-2 20days-1 | supply rate of nitrate to PRS probes |
| **NH4** | ugN 10cm-2 20days-1 | supply rate of ammonium to PRS probes |

\* Values for these location fields have been standardized for NGEE Arctic and are required fields for all data dictionaries. (<http://ngee-arctic.ornl.gov/content/metadata-entry-data-upload-and-data-management-help>)

**Example Data Records:**

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**Data Acquisition Materials and Methods**

* Experimental setup and glucose addition manipulation
  + On 8/24/14, mesocosms were constructed by inserting 45 cm-long PVC columns vertically in the soil to span the full active layer depth (32-44 cm). A 4 cm high collar fitted with a 3 cm deep trench was fitted to the top rim of each mesocosms, in order to create an airtight water lock with a static soil chamber.
  + On August 29, 2014, one of three treatment solutions was injected into each mesocosm, for a set of three treatment levels per polygon.
    - The high glucose (HG) treatment contained 6.125 g of 13C-labeled glucose in 122.5 mL DDI water; the low glucose (LG) treatment contained 1.225 g of 13C labeled glucose in 122.5 mL DDI water; and the control (CT) treatment contained 122.5 mL DDI water only.
    - Glucose had an isotopic enrichment of 6 atom %, made from a mixture of 99 atom % and natural abundance glucose.
    - Hypodermic needles were used to inject solutions into the mineral soil, 15 cm below the soil surface in a 5 × 5 grid.
  + HG and CT treatments were repeated on August 1, 2015.
* Trace gas flux measurement and ecosystem respiration partitioning
  + Fluxes of CO2 and CH4 were measured using opaque or transparent static chambers (25 cm diameter, 15-20 cm height), seated directly on mesocosms in water-filled airlocks. Chambers were tall enough to enclose vegetation and were vented according to Xu *et al.*, (2006) to minimize pressure excursions due to the Venturi effect. A Los Gatos Research, Inc. (LGR) portable Greenhouse Gas Analyzer was used to record CO2 and CH4 concentrations within the chamber over 4-8 minutes, and the flux rate of each gas was calculated from the slope of the linear portion of the concentration vs. time curve.
  + The carbon isotope composition of ecosystem respiration was measured in 2015 using the Keeling Plot method (Keeling, 1958). Over 60-80 minutes immediately following CO2 flux measurement, opaque chambers were left in place and 5 25 mL gas samples were collected at ~15 minute intervals. CO2 concentration and 13C abundance were measured from each gas sample. With each set of 5 samples, 13C abundance was plotted against 1/[CO2], and ecosystem respiration 13C abundance was calculated as the y-intercept of the linear regression.
  + Using known glucose 13C values and calculated 13C values for CT and HG respiration measurements, a 2 end-member isotope mixing model was used to partition ecosystem respiration from HG plots into glucose-derived and background (non-glucose derived) components.

## Soil collection and analysis

## 2014 soil cores were collected from a set of replicate HG, LG, or CT plots established on 8/31/14, using a 1” diameter manual push corer

## 2016 soil cores were collected frozen from the primary HG and CT plots, using a 2” SIPRE coring auger.

## Soil cores were divided into 10 cm depth increments.

## Microbial biomass was extracted from 10-20 cm increments of 2014 soil cores using chloroform fumigation extraction (Vance *et al.*, 1987). Carbon contents were measured from aqueous microbial biomass extracts on a TOC analyzer. 13C of microbial biomass carbon was measured from dried aqueous extracts.

## From all soil increments collected in 2014 and 2016, soils were dried at 55 °C for gravimetric moisture content analysis, then analyzed for carbon isotope composition and carbon and nitrogen concentrations.

## Measurement of inorganic nitrogen availability

## N availability was measured from the replicate HG, LG, and CT plots.

## On 8/31/14, a set of probes containing cation and anion exchange membranes (Plant Root Simulator (PRSTM) probes, Western Ag Innovations) was inserted vertically in each replicate plot, spanning a layer of soil 10-20 cm in depth.

## Probes were excavated on August 20, rinsed free of soil with DI water, and sent to Western Ag for analysis.

## Volumetric water content was measured with a MiniTrase TDR (Soilmoisture Equipment Corp).

## Soil temperature was measured with a thermistor or thermocouple probe, as indicated.

**References**

Keeling CD (1958) The concentration and isotopic abundances of atmospheric carbon dioxide in rural areas. *Geochimica et Cosmochimica Acta*, **13**, 322–334.

Vance ED, Brookes PC, Jenkinson DS (1987) An extraction method for measuring soil microbial biomass C. *Soil Biology and Biochemistry*, **19**, 703–707.

Xu L, Furtaw MD, Madsen RA, Garcia RL, Anderson DJ, McDermitt DK (2006) On maintaining pressure equilibrium between a soil CO 2 flux chamber and the ambient air. *Journal of Geophysical Research*, **111**.

**Supplemental Files:**

[*Insert any additional contextual information for describing and understanding the dataset such as pictures, maps, etc.]*

## Data Access:

*Example: This data set is available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).*

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