

**Title:**

BIOME-BGC Monthly Ecosystem Process Model Simulations within the West-Arctic Linkage Experiment (WALE) Domain of Alaska and NW Canada.

**Description:**

This data set provides spatially explicit monthly BIOME-BGC ecosystem process model simulation results within the WALE domain of Alaska and NW Canada. Note that BIOME-BGC annual results for WALE are available through a related data directory. A detailed description of the dataset is provided by Kimball et al. (2007). The WALE domain spans a latitudinal range from 56.19°N to 71.24°N and encompasses boreal forest and tundra biomes of Alaska and NW Canada. Model simulations span the period from 1980 to 2002 and were conducted for each grid cell within the domain using daily surface meteorological data from the NCEP-NCAR reanalysis. The BIOME-BGC model runs at a daily time step using daily meteorological inputs of minimum and maximum air temperature, VPD, precipitation, and incident solar shortwave radiation. BIOME-BGC model simulations of vegetation and soil carbon stocks across the domain were initialized by 'spinning-up' the model to steady-state conditions through continuous cycling of the NCEP reanalysis daily climatology and model assumptions of constant annual fire disturbance and mortality rates within individual biomes, constant atmospheric N deposition, and constant atmospheric CO<sub>2</sub> levels. Model simulations were then conducted on a daily basis over the 20+ year NCEP daily reanalysis period under a constant rate of atmospheric N deposition, constant annual fire disturbance rates, and historical atmospheric CO<sub>2</sub> concentrations.

Model outputs were produced at monthly and annual time scales for major vegetation types identified from a 25-km resolution, NOAA AVHRR land cover classification of the study domain; the map was derived from a 1-km resolution land cover classification and retains sub-grid scale information on the relative proportions of dominant and subdominant land cover types within each 25-km grid cell (McGuire et al., 2007 WALE Special Theme of *Earth Interactions*). Model simulations were conducted over the entire domain for arctic tundra and boreal evergreen and deciduous forest classes. Model outputs were then spatially aggregated according to the relative proportions of individual land cover classes identified within each 25-km grid cell. Spatial aggregation of model outputs within each grid cell was based on linear weighting of dominant and subdominant land cover classes, with no lateral transfers of mass or energy within a specified grid cell or between adjacent grid cells. This work was funded by the NSF Office of Polar Programs and the NASA Terrestrial Ecology program.

**Projection:**

The WALE domain is defined in terms of nodes of the National Snow and Ice Data Center (NSIDC) north polar Equal-Area Scalable Earth (EASE) grid (Armstrong and Brodzik 1995). Land areas within the region comprise 3511 grid cells with nominal 25 km × 25 km resolution and a total representative area of approximately 2.2 million km<sup>2</sup>.

**Spatial resolution:** 25km x 25km

**Number of nodes:** 3511

**Temporal extent:** 1980-2002

**Variable file definitions:**

The following variables represent a subset of the potential outputs available from BIOME-BGC. More detailed descriptions of variable definitions can be found in the BIOME-BGC model code and documentation (e.g., see <http://www.nts.gov/ntsg.umt.edu/models/bgc/>).

Avg\_LAI: Mean monthly LAI ( $\text{m}^2 \text{m}^{-2}$ )  
AvgSnowWMO: Mean monthly snow water storage ( $\text{kg H}_2\text{O m}^{-2}$ )  
AvgSoilWMO: Mean monthly soil water storage ( $\text{kg H}_2\text{O m}^{-2}$ )  
Canopy\_Evap: Canopy evaporation ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
ET: Evapotranspiration ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
Evap: Total evaporation ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
g\_resp: Cumulative monthly autotrophic growth respiration ( $\text{kg C m}^{-2} \text{mo}^{-1}$ )  
GPP: Gross primary production ( $\text{kg C m}^{-2} \text{mo}^{-1}$ )  
h\_resp: Heterotrophic respiration ( $\text{kg C m}^{-2} \text{mo}^{-1}$ )  
LAI: Maximum projected monthly LAI ( $\text{m}^2 \text{m}^{-2}$ )  
LitterC: Monthly litter carbon pool ( $\text{kg C m}^{-2}$ )  
m\_resp: Autotrophic maintenance respiration ( $\text{kg C m}^{-2} \text{mo}^{-1}$ )  
NEE: Net ecosystem exchange of carbon ( $\text{kg C m}^{-2} \text{mo}^{-1}$ )  
NEP: Net ecosystem productivity ( $\text{kg C m}^{-2} \text{mo}^{-1}$ )  
NPP: Net primary production ( $\text{kg C m}^{-2} \text{mo}^{-1}$ )  
Outflow: Hydrologic outflow ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
Precip: Cumulative precipitation (rain and snow;  $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
Snow\_Subl: Snowpack sublimation ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
Snowpack: Cumulative snowpack accumulation ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
SnowWEq: Change in snow water equivalence ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
SoilC: Soil carbon pool ( $\text{kg C m}^{-2} \text{mo}^{-1}$ )  
SoilW: Change in soil water content ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
SoilW\_Evap: Soil water evaporation ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
Trans: Canopy transpiration ( $\text{kg H}_2\text{O m}^{-2} \text{mo}^{-1}$ )  
VegC: Total (above and below ground) vegetation carbon ( $\text{kg C m}^{-2} \text{mo}^{-1}$ )

**Data fields within each variable file:**

ID: Index number of the grids (1-9008);  
Lat: Latitude of the center of each grid;  
Lon: Longitude of the center of each grid;  
BIOME-BGC monthly data values from January (01) to December (12): Model outputs and units vary for each data file. Missing or masked cells are denoted by a -9999 flag.

**References:**

Kimball, J.S., M. Zhao, A.D. McGuire, F.A. Heinsch, J. Clein, M. Calef, W.M. Jolly, S. Kang, S.E. Euskirchen, K.C. McDonald, and S.W. Running, 2007. Recent climate driven

increases in vegetation productivity for the Western Arctic: Evidence of an acceleration of the northern terrestrial carbon cycle. *Earth Interactions* 11(4), 1-23.

**Contact:**

John S. Kimball, [johnk@ntsg.umt.edu](mailto:johnk@ntsg.umt.edu)

Faith Ann Heinsch, [faithann@ntsg.umt.edu](mailto:faithann@ntsg.umt.edu)