# Long-term measurements of carbon dioxide fluxes in three undisturbed tundra ecosystems in northern Alaska

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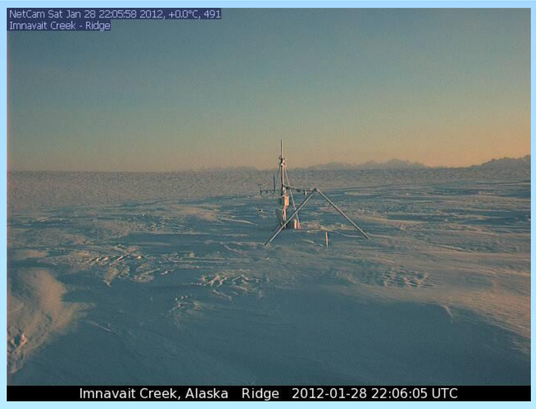
## Background

**Understanding the carbon and water fluxes in the Arctic is essential for accurate assessment and prediction of the responses of these ecosystems to climate change. We established three eddy covariance flux towers in northern Alaska during September 2007, and have now collected carbon (C), water, and energy flux data continuously for over five years in heath, wet sedge, and tussock tundra ecosystems. Here, we highlight some of the recent activity and research based on our flux tower sites.**



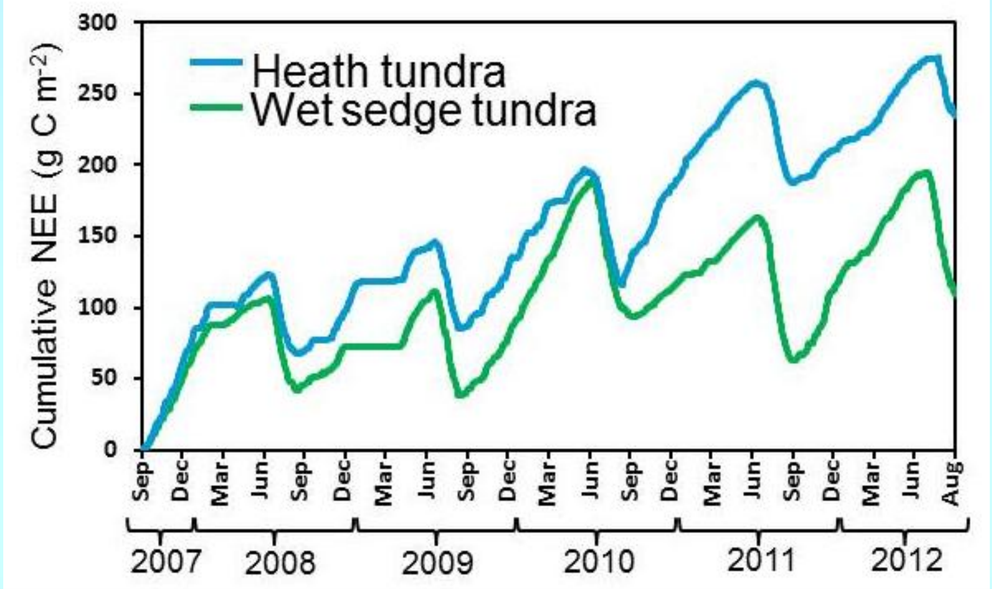

January 28, 2012


May 30, 2012


June 3, 2012

## Webcams

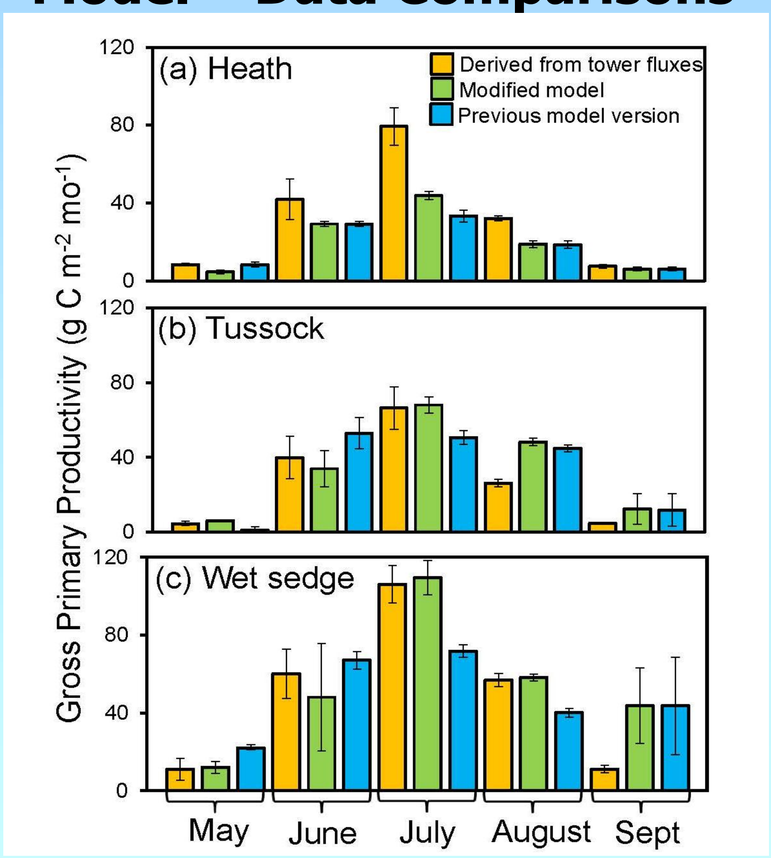
**The installation of several webcams at the sites provides daily information on the land surface conditions (e.g., timing of snowmelt and snow return), which can otherwise be difficult to accurately document.**



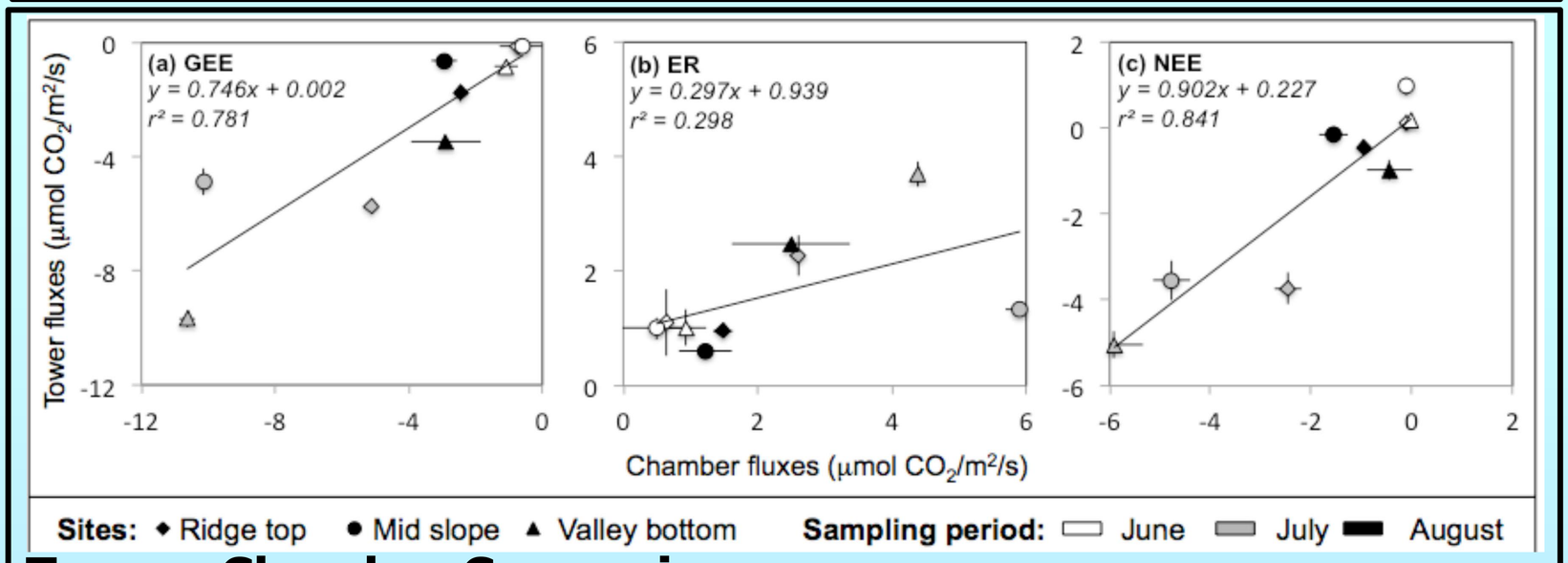

## Long – term Cumulative NEE

**Data from September 2007 – August 2012 for the heath tundra and wet sedge tundra indicate that both of these ecosystems are $CO_2$ sources when considering winter fluxes. See Euskirchen et al. (2012)**

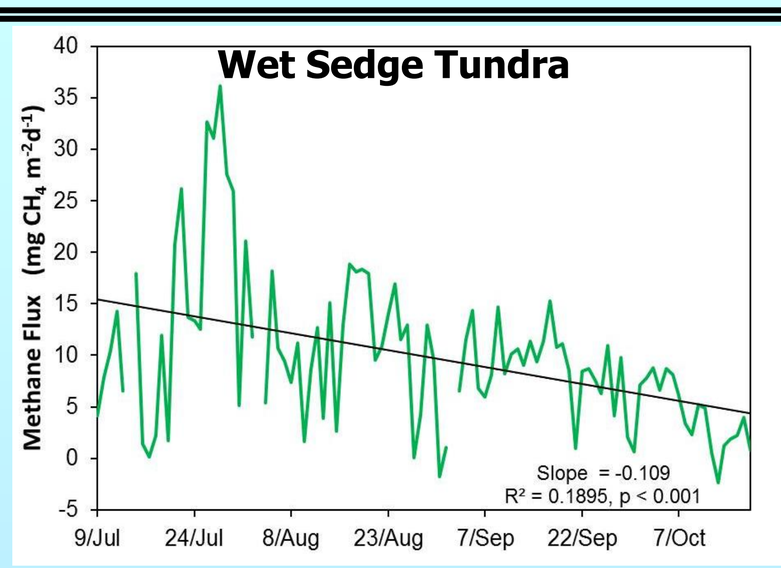
## Model – Data Comparisons




**The tower - derived estimates of GPP are compared to a modified and old version of the Terrestrial Ecosystem Model with dynamic vegetation. A new leaf phenology algorithm in the modified model generally resulted in better agreement with the tower GPP in July, the time of peak C uptake, compared with the previous model version (Euskirchen et al., in prep.).**




**Tower- Chamber Comparisons** **Using footprint models & simple scaling principles, chamber and eddy covariance estimates of GPP, ER and NEE across different tundra types can show good agreement. See Kade et al. (2012).**

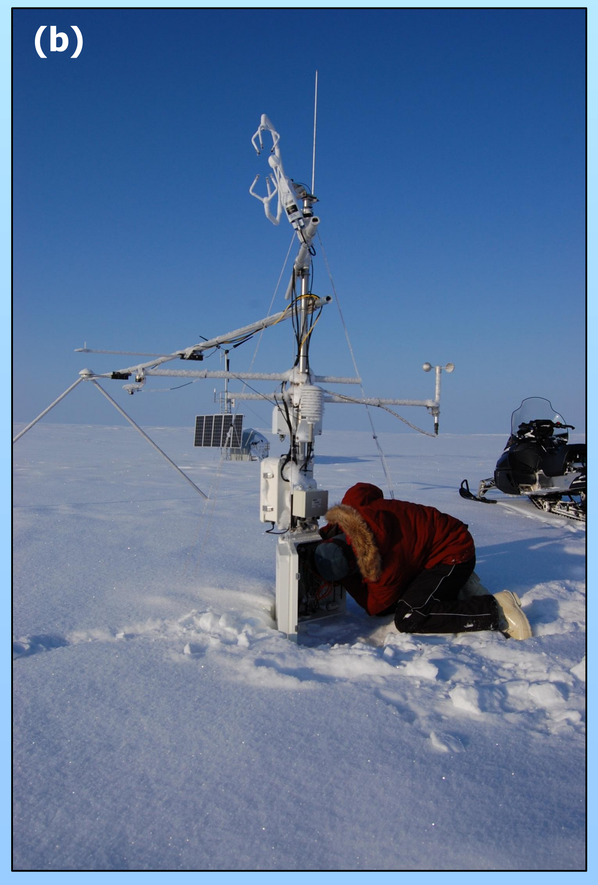



**Eddy covariance measurements of $CH_4$ began in July 2012 in the wet sedge.**

## Study Area


**The wet sedge site (a) and (b) data collection continues in the winter.**

- **The study site is located in the foothills of the Brooks Range of northern Alaska, at the Imnavait watershed, approximately 12 km north of the Toolik Field Station.**
- **The three tundra sites include a seasonally wet fen, a moist tussock site, and a drier ridge site.**
- **We collect year-round eddy covariance data of C, water, and energy fluxes as well as basic meteorological variables.**




## Summary

- **Due to respiration outside of the growing season, the ecosystems are a source of $CO_2$.**
- **Tower- chamber comparisons help to better understand spatial heterogeneity of tundra $CO_2$ fluxes.**
- **Methane fluxes in the wet sedge tundra show a peak at the end of July, decreasing thereafter.**

**Further information about this project is available from: http://aon.iab.uaf.edu/**

**References:**

Euskirchen, E.S., M.S. Bret-Harte, G.J. Scott, C. Edgar, and G.R. Shaver. 2012. Seasonal patterns of carbon dioxide and water fluxes in three representative tundra ecosystems in northern Alaska. Ecosphere.

Kade, A., M.S. Bret-Harte, E.S. Euskirchen, C. Edgar, and R.A. Fulweber. 2012. Upscaling $CO_2$ fluxes from heterogenous tundra plant communities in Arctic Alaska. Journal of Geophysical Research.

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