

## Training: Software tools and strategies for managing sensor networks Report to the LTER Network Office, September 26, 2013

Training: LTER Network Office, Albuquerque, NM, April 23 - 26, 2013

### Trainer participation:

Don Henshaw (AND co-organizer)  
Corinna Gries (NTL co-organizer)  
Wade Sheldon (GCE)  
John Porter (VCR – remote presentation by vtc)  
Jeff Horsburgh (CUAHSI)  
Matt Miller (DataTurbine)  
Chad Sebranek (DataTurbine)  
Sameer Tilak (DataTurbine)  
Tony Fountain (co-sponsor, DataTurbine)  
Jeff Taylor (NEON)

The “Software tools and strategies for managing sensor networks” training workshop was conducted at the Long-Term Ecological Research (LTER) Network Office (LNO) on April 23-26, 2013. Funding was provided by the LNO with cost-sharing from Tony Fountain’s DataTurbine group at the University of California - San Diego (UCSD). Twenty-three participants and eight trainers were on hand representing a very diverse mix of researchers, students, technology experts, and information managers from over 20 domestic and international institutions and including affiliations with 10 LTER sites.

This training workshop was intended to introduce participants to a variety of software tools that are useful in the transport, quality control (Q/C), management, analysis, and storage of data streams from sensor networks. Hands-on exercises were provided for each tool and several students were able to successfully employ their own data logger (.dat) files. Jeff Horsburgh (CUAHSI) introduced the CUAHSI Hydrology Information System including the HydroServer and HydroDesktop. Participants learned how to prepare and map their data into the Observation Data Model (ODM) for storage and access through CUAHSI tools. Sameer Tilak and Matt Miller presented DataTurbine (DT) and its installation and trainees were able to pull data from an active North Temperate Lakes (NTL) DT server, graph the data for quality checking and explore with the Real-Time Data Viewer (RDV). Wade Sheldon presented the GCE Data Toolbox and highlighted many features including Q/C, metadata management, and visual graphics. Wade also illustrated the integration of software tools by demonstrating the import of both Campbell data logger and data from a DT server as well as the export of this data into the CUAHSI ODM. Corinna Gries presented an overview of Kepler and hands-on exercises to build analytical components for importing data from a DataTurbine server into Kepler. John Porter followed via videoconference with an introduction to R and examples of analyzing sensor data using R within Kepler. Demonstrations showing the integration or “chaining” of these software tools was intended to provide continuity over the 3.5 days of training. The workshop agenda, presentations and additional materials are posted ([http://im.lternet.edu/im\\_training/sensors\\_2013](http://im.lternet.edu/im_training/sensors_2013)).

Consideration of strategies for managing sensor networks was a secondary theme to the workshop. Jeff Taylor (NEON) presented an overview of NEON with a focused on Q/C and publication of NEON data. Don Henshaw presented some of the preliminary results from an earlier workshop, "Sensor management best practices", which is part of a community effort to summarize problem statements, best practices and present use cases on a variety of sensor network issues. This work will be posted on a wiki hosted by the Federation of Earth Science Information Partners (ESIP) ([http://wiki.esipfed.org/index.php/EnviroSensing\\_Cluster](http://wiki.esipfed.org/index.php/EnviroSensing_Cluster)).

Overall, the initial feedback for this workshop was very positive. Favorable comments were expressed for each of the presented tools, with perhaps the GCE Data Toolbox for MATLAB receiving broadest acclaim. Please see the editorial in the Spring 2013 DataBits issue written by participant, Fox Peterson, on her workshop experience.

This is the second cost-shared sensor training workshop co-organized by Henshaw and Gries following up a similar workshop funded by the LNO, NCEAS and DataONE in May 2012. Once again there were far more applicants than spaces available for this training. LTER and other ecological sites are actively developing sensor networks and are looking to share or adopt technological solutions. This training session, along with the concurrent effort to describe best practices for sensor network management, represent great examples of the LTER reaching out and working with the broader ecological community to improve efficiency and standardize approaches in managing sensor networks.

## Participants:

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