A Web-based Application to Manage Carbon Cycle Network Operations

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1. Introduction

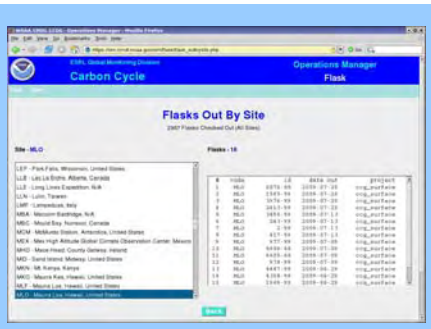
The ESRL Carbon Cycle Group (CCG) has expanded considerably in the past few years. In 2008, more than 20,000 discrete samples were collected and analyzed from 74 surface sites and 20 aircraft sites. Maintaining, deploying, and tracking 5000 network flasks, 100 surface samplers (PSU) and 170 programmable flask packages (PFP) is an ongoing challenge. Operations are further complicated as the number of laboratories measuring the air samples increases (e.g. CCG, the ESRL Halocarbons/Trace Gases Group (HATS), and the University of Colorado (CU) Institute of Arctic and Alpine Research (INSTAAR)) and the number of compounds measured increases (up to 60 per sample). To help manage the logistical and operational tasks of the carbon cycle observing network, we developed a web-based Operations Manager (OM). From any location, ESRL and CU researchers have ready access to the carbon cycle measurement and meta database.

2. Framework

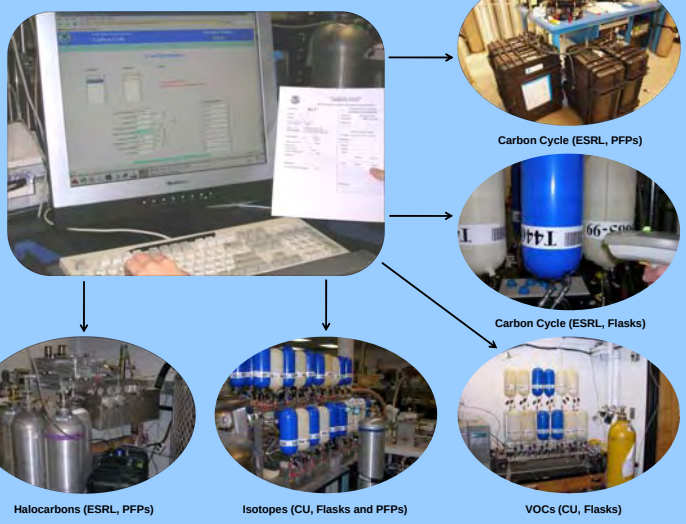
OM is a web-based tool that manages and displays content of a MySQL database. Tasks are performed by PHP, Perl and JavaScript functions. A modular design allows us to readily add new features to meet changing needs.

3. Network Logistics

Reliable sampling equipment and a continuous supply of flasks and PFPs are critical for uninterrupted long-term monitoring. The shipping and receiving of all supplies are tracked by OM. The figure to the right shows the individual flasks currently checked out to Mauna Loa, Hawaii.



All air samples are returned to Boulder for analysis. Sample collection details are entered into the database via OM either manually (network flasks) or electronically (PFP). All samples are automatically identified by a unique event number that is accessible from all measurement systems.



Carbon Cycle (ESRL, PFPs)

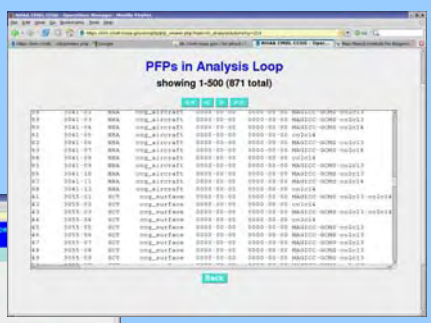
Carbon Cycle (ESRL, Flasks)

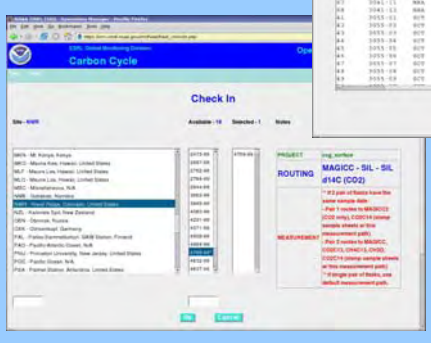
Halocarbons (ESRL, PFPs)

Isotopes (CU, Flasks and PFPs)

VOCs (CU, Flasks)

OM manages specific instructions for routing samples to the appropriate laboratories and measurement systems. The page to the right summarizes the analysis path of individual flasks within PFP units.





The page to the left shows the analysis instructions for network samples collected at Niwot Ridge, Colorado.

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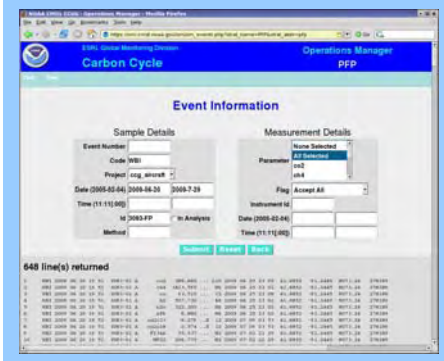
4. Data Access



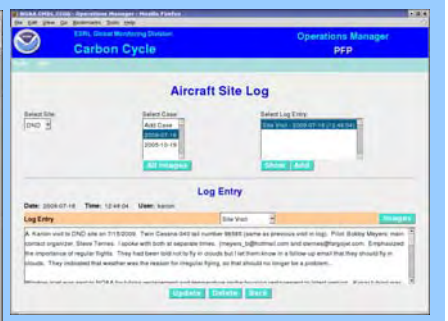
ESRL and CU researchers have access to all sample collection details and measurement results. Because the carbon cycle database is updated automatically, researchers can use the latest results to potentially identify sampling or analytical problems soon after they develop.

OM also provides tables of active sampling locations and summaries of all available data. Plots of near real-time observations and site information including location, sample intake height, topography, site photos and cooperating agencies are also readily available from the Interactive Atmospheric Data Visualization (IADV) web site.

www.esrl.noaa.gov/gmd/ccgg/iadv/

5. Quality Control

Shared electronic logs allow researchers to document field and laboratory equipment modifications and repairs. The logs include reports on sampling problems and solutions. The archive of log entries can be readily searched which is helpful when diagnosing problems that other ESRL researchers may have already encountered.



All sample collection details in the database are routinely compared with information recorded in the field. Corrections are easily made using OM.

6. Conclusions

Operations Manager is a web-based application to manage the logistical and operational tasks of the carbon cycle observing network. From anywhere in the world, ESRL and CU researchers can make entries into electronic notebooks, track equipment, manage meta data and view measurement results. A flexible framework ensures that OM can continue to evolve to meet future needs of the ESRL carbon cycle observing network.

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