
Abstract
"Citizen science" generally refers to observational research and data collection conducted by non-professionals, commonly as volunteers. In the environmental science field, citizen scientists may be involved with local and regional issues such as bird and wildlife populations, weather, urban sprawl, natural hazards, wetlands, lakes and rivers, estuaries, and a spectrum of public health concerns. Some citizen science projects may be impeded by the intellectual challenge of scientific observations. Citizen scientists may now examine and utilize remote-sensing data related to their particular topics of interest with the easy-to-use NASA Web-based tools Giovanni and NEO, which allow exploration and investigation of a wide array of Earth remote-sensing data sets. The CARSON (Citizens And Remote Sensing Observational Network) Guide will be an online resource consisting of chapters each demonstrating how to utilize Giovanni and NEO to access and analyze specific remote-sensing data. Integrated in each chapter will be citations of methods that citizen scientists can employ to collect, monitor, analyze, and share data related to the chapter topic which pertain to environmental and ecological conditions in their local region.

A workshop held in August 2008 presented the development of prototype chapters on water quality, air quality, and precipitation. These will be the initial chapters in the first release of the CARSON Guide, which will be used in a pilot project at the Maryland Science Center in spring 2009. The goal of the CARSON Guide is to augment and enhance citizen scientific environmental research with NASA satellite data by creating a participatory network consisting of motivated individuals, environmental groups, and organizations, and science-focused institutions such as museums and nature centers. Members of the network could potentially integrate local citizen science projects, academic research projects, and not-for-profit organizations focused on environmental issues.

The CARSON Guide Workshop
On August 12-13, 2008, a workshop was held at NASA Goddard Space Flight Center to lay the foundation for a program in amateur satellite-based Earth observation, titling "The Citizens And Remote Sensing Observational Network (CARSON) Guide." The CARSON Guide has two objectives: to engage people in observations of their local environment and to help people connect their local observations to global systems using satellite data.

AIR QUALITY WATER QUALITY PRECIPITATION

The 2009 summer workshop focused on air quality, water quality, and precipitation. Each team identified local environmental measurements relevant to the satellite data set(s) appropriate for their topic. In two cases, precipitation and water quality, the teams found an existing citizen science project that had developed procedures for taking the ground-based measurements. The teams then outlined a procedure for comparing the measurements to the satellite data.

AIR QUALITY ACTIVITY
The air quality team developed an activity in which participants select a normally visible landmark and photograph it at the same time daily. The citizen scientist will note weather conditions, sky color, and the Environmental Protection Agency (EPA) air quality in their vicinity. Over several weeks, participants will come to recognize what poor air quality typically looks like. The collected photos will serve as an archive of air quality to track trends over time.

Examples: Views from Look Rock Tower, Great Smoky Mountains National Park

WATER QUALITY ACTIVITY
Prepared sampling sites can be used to measure dissolved oxygen concentrations.

Seawater used to measure dissolved oxygen concentrations.

Seawater chl. concentration in the Chesapeake Bay, April 2006.

PREDICTION ACTIVITY
The precipitation team encouraged citizen scientists to join an existing rain gauge network (such as the Community Collaborative Rain, Hail & Snow (CoCoRaHS) network) and collect rainfall measurements near their home. Citizens can compare their measurements to other local measurements to track regional variability, and/or to historical records, available through the local weather office.

Rainfall data from the Tropical Rainfall Monitoring Mission (TRMM) over the ENSO north and south latitudes. Data from the Global Precipitation Climatology Project can also be accessed.

Next Phase
The activities outlined during the workshop will be developed into three chapters for the CARSON Guide in late 2008 and early 2009. The activities will be evaluated through a partnership with the Maryland Science Center (Baltimore, MD) beginning in April 2009. The science center will sponsor an Earth observation lab for citizens scientists. Based on the reception from participants in the lab, the program will expand citizen scientists' awareness through the NASA Earth Mission Alliance. Further development of the CARSON Guide will include modification of the citizen science website, and development of an observatory network of satellite service providers, including谒者维. CARSON Guide" may include a data-sharing system for participants.

REFERENCES