



**The Hudson River
Environmental Conditions
Observing System**

Vision for the Future

2016-2020

www.hrecos.org

**The Hudson River Environmental Conditions Observing System (HRECOS)
is operated and managed as a consortium of the following
academic, governmental, and private institutions (in alphabetical order):**

Cary Institute of Ecosystem Studies

Division of Water, NY State Department of Environmental Conservation

Hudson River Estuary Program, NY State Department of Environmental Conservation

Hudson River Foundation

Hudson River National Estuarine Research Reserve

Hudson River Park Trust

Hudson River Pilots Association

Hudson River Sloop Clearwater

Lamont-Doherty Earth Observatory of Columbia University

Marist College

Mohawk River Basin Program, NY State Department of Environmental Conservation

New England Interstate Water Pollution Control Commission

New York-New Jersey Harbor and Estuary Program

Passaic Valley Sewerage Commission, New Jersey

Sarah Lawrence College Center for the Urban River at Beczak

Stevens Institute of Technology, New Jersey

U.S. Geological Survey New York Water Science Center



Mission

The mission of the Hudson River Environmental Conditions Observing System (HRECOS) is to collect high-frequency water quality and meteorological data from electronic sensors located in and along the Hudson River and connecting water bodies. HRECOS provides these data in near real-time to the public through a web interface accessible to novice and expert users alike. HRECOS data and data products are intended to provide new insights on the functioning of the Hudson River system; inform management decisions; support formal and informal education; support safe and efficient river navigation; and serve as a window on the Hudson to engage the general public. HRECOS will benefit the river's health and well-being for years to come.

Background

Technological advances and pressing management problems have coalesced to foster a new mode of observing our environment. Many human benefits derived from the earth's ecosystems are contingent on knowing the current condition of those ecosystems, understanding the controls on those systems and identifying stressors that might lead to deterioration in the future. Continuous, real-time information on multiple variables is essential and increasingly feasible with new instrumentation and communication technologies. Such information is critical for measuring the environmental response to episodic events in the natural and anthropogenic system. Fundamental knowledge of the Hudson River Estuary, its resources and management has progressed dramatically over the past 25 years. Our understanding of the river system, however, has been hampered by manual approaches to data collection that cannot adequately capture rare events or describe rapid fluctuations and episodic pulses in environmental conditions.

A New Lens for Observing the Hudson and Beyond

In 2008, the Hudson River Environmental Conditions Observing System (HRECOS) was established to provide geographically-distributed, high-frequency water quality and weather data in the Hudson River watershed, accessible to anyone in real-time. HRECOS continuous monitoring data support an understanding of some basic questions about important processes and their controlling factors, contribute to assessment of management needs and effectiveness, and help to track direct human benefits from the Hudson River and its tributaries. Scientists, educators, resource managers, mariners, and many

others in the Hudson River Estuary and watershed are currently benefiting from this integrated system for observing key characteristics of the Hudson River and local environmental conditions.

Signature Elements of HRECOS

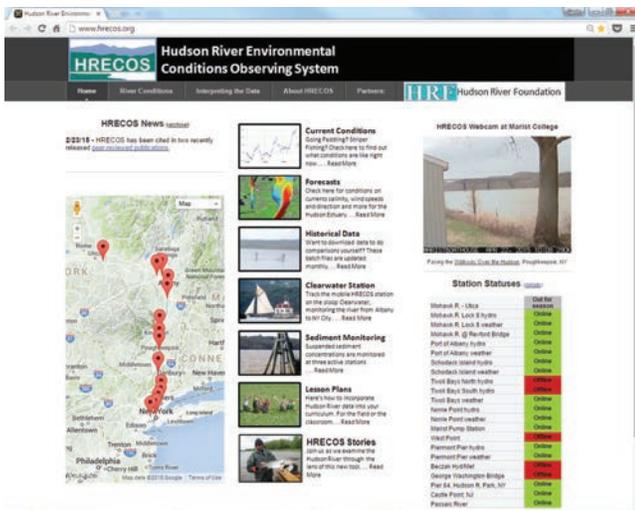
HRECOS is a multidisciplinary system designed to provide observations and information required by a wide range of organizations and programs to address local and regional natural resource, health, safety, navigation, and research issues. The program is operated and managed as a consortium of government, private, and academic institutions (see inside cover page for participating organizations) with common interest in high-frequency monitoring in the Hudson River watershed. HRECOS brings together and develops upon long-standing monitoring projects of its partner institutions. Effective collaboration and close coordination are core principles of HRECOS, and viewed by all partners as essential to program success. Through a shared commitment to operating the observing system, partner organizations maximize the expertise supporting the system.

HRECOS is patterned after larger efforts to observe the global oceans and coastal waters. The U.S. Integrated Ocean Observing System (IOOS) provides quality controlled data and information on the current states of oceans, estuaries, and the Great Lakes, from the global scale of ocean basins to local scales of coastal ecosystems. While the regional IOOS program MARACOOS (Mid-Atlantic Regional Association Coastal Ocean Observing System) is focused on the coastal ocean, it does not extend into either the NY-NJ Harbor or the Hudson River Estuary, a unique geographic niche filled by HRECOS.

All HRECOS data collection and review procedures are subject to several levels of quality control as required by the HRECOS Quality Assurance Project

Plan (QAPP), which is regularly renewed and approved by the New York State Department of Environmental Conservation (NYSDEC). To ensure consistency and comparability, the HRECOS QAPP requires standardization of instrumentation, procedures, and data formats between all HRECOS stations. HRECOS has demonstrated scientific rigor and quality, as its products have been cited in many academic publications since its inception.

As of April 2015, fourteen (14) permanent monitoring stations have been established or added to the HRECOS network with the intent of developing a multi-variable, long-term, time series data set for the Mohawk and Hudson Rivers and the NY-NJ Harbor. These 14 stations span from Utica on the Mohawk River to the NY-NJ Harbor and include the following locations (from upriver to downriver; see map to the right): Mohawk River: Utica, Lock 8, and the Rexford Bridge; Hudson River Estuary: Port of Albany, Schodack Island, Tivoli Bays, Norrie Point, Marist College, West Point, Piermont Pier, Sarah Lawrence College Center for the Urban River at Bezak in Yonkers, Hudson River Park Pier 84 in New York City, Castle Point in Hoboken, New Jersey; and the Passaic River in New Jersey.



All HRECOS data are freely available to the public at www.hrecos.org, where users can download and view real-time and historical data.

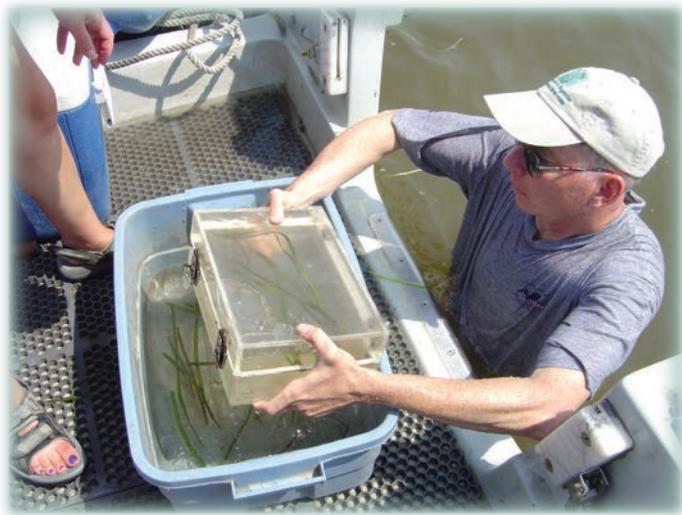
HRECOS 5-Year Vision

We envision HRECOS as a fully integrated, reliable, and accessible network of monitoring stations that characterizes the Hudson River and surrounding water bodies for the purpose of supporting informed research, decision-making, education, and promotion of watershed health and safety. Grounded in a growing network of productive, mutually beneficial partnerships and an expanding number of stations, HRECOS will be a nexus for high frequency Hudson River Watershed monitoring efforts and the acknowledged user-focused platform providing data and information valued by a broad range of community stakeholders within the Hudson River region.

Our vision for HRECOS is structured around a series of goals designed to make contributions across five significant user focus areas:

1. Research – *Enhanced Scientific Understanding*

Document baseline conditions for detecting change caused by human-influenced and natural events, and management actions (e.g., changes associated with sea level rise, regulatory action, and management policies).



Cary Institute of Ecosystem Studies

Develop a plan for new stations positioned to capture highly variable regions or un-measured inputs (e.g., the upper Hudson River).

Become an attractor for co-location of new research endeavors including (but not limited to) novel sensor field-testing, calibration/verification and observations to support models.

Ensure that HRECOS observations feed directly into multiple research efforts by answering important questions or by providing environmental context for other measurements.

Develop or acquire better capacity for analyzing streams of data, including extraction of summary statistics, hypothesis testing and meshing other real-time, high-frequency observations such as river flows.

Actively synthesize observations to describe novel phenomena and enhance scientific and public understanding of the Hudson River system.

Ensure that noteworthy findings are disseminated to specific user groups (agencies, educators, etc.) in a timely fashion and appropriate “stories” are provided to the interested public.

2. Environmental Regulation and Resource Management – *Better Decision-making*

Cultivate a heightened interest in the use of HRECOS continuous monitoring data by the NYSDEC Division of Water for regulatory applications associated with improving and protecting water quality.



Alene Onion / NYSDEC

💧 Demonstrate and expand the utility of HRECOS long-term monitoring data for:

+ Tracking the effectiveness of Long-Term Control Plans for reducing stormwater discharges from antiquated Combined Sewer Overflow wastewater systems.

+ Developing Total Maximum Daily Loads for impaired waterbodies, wastewater discharge models, and similar applications where ambient water quality and weather data input is required.

💧 Assess the potential of HRECOS continuous monitoring data to provide context for data derived from manual field sampling methods, such as the NYSDEC Rotating Integrated Basin Studies (RIBS) program.

💧 Expand the capabilities of HRECOS to aid the NYSDEC Division of Fish, Wildlife and Marine Resources in monitoring and managing fisheries.

3. Commercial Use and Recreation – *Improved Safety and Efficiency*

💧 Work closely with HRECOS partners and Hudson River navigational stakeholders such as pilots associations, port authorities and marine terminals to:

+ Assess and fill gaps in observational data at locations deemed most useful for tidal river navigation.

+ Develop new support tools for increasing navigational safety and efficiency.

+ Optimize existing resources (*i.e.*, water level measurements and weather observations) for maximum effectiveness in navigational support.

💧 Continue to provide reliable high-quality information on hydrological and weather conditions for maximizing safety and efficiency of commercial and recreational activity on the Hudson River.

💧 Ensure HRECOS data and data products are accessible to, and useful for both novice and expert mariners alike.



Scott Ireland / Hudson River Pilots Association

💧 Become a model navigational support network that can be replicated in other tidal river systems.

4. Education – *Use for Interdisciplinary Learning*

💧 Align classroom use of HRECOS data with learning standards and develop appropriate means to disseminate information about the availability and educational potential of HRECOS data and information.



Tech Valley High School

Expand HRECOS use as an educational resource by developing instructional materials for use at workshops, conferences and meetings relevant to Science, Technology, Engineering, and Math (STEM) learning and regional environmental education.

Partner with regional colleges to develop lessons and programs designed to enhance teacher education and professional development.

Expand the use of public kiosks in selected locations to provide learning opportunities for the general public.

5. Emergency Management – *Increased Capacity for Response and Mitigation*

Become an integral component of emergency response to natural disasters, spills, and other emergencies by providing data to existing and novel modeling efforts aimed at predicting river and atmospheric conditions along the Hudson River estuary.

Ensure that real-time HRECOS observational data are useful and easily accessible to emergency managers and responders by providing data in graphical formats that increase response efficiency and effectiveness.



Doug Kerr / Flickr

Serve a supportive role to emergency monitoring networks, such as the U.S. Geological Survey’s Mohawk River Ice Jam Monitoring project and others, by providing useful ancillary data.

Moving Forward

The success of HRECOS thus far is rooted in its ability to coordinate expert institutions with the common interest of understanding and improving the Hudson River and its connecting waterbodies. In order for HRECOS to achieve its broad-reaching vision, it must continue to engage an energetic, agile, and multidisciplinary partner base. Realizing this vision will require active leadership and innovation by all HRECOS partners. A successful execution of the HRECOS Vision for the Future will benefit the health of the Hudson River and its connecting waterbodies, and the communities and individuals that depend on these natural resources.



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