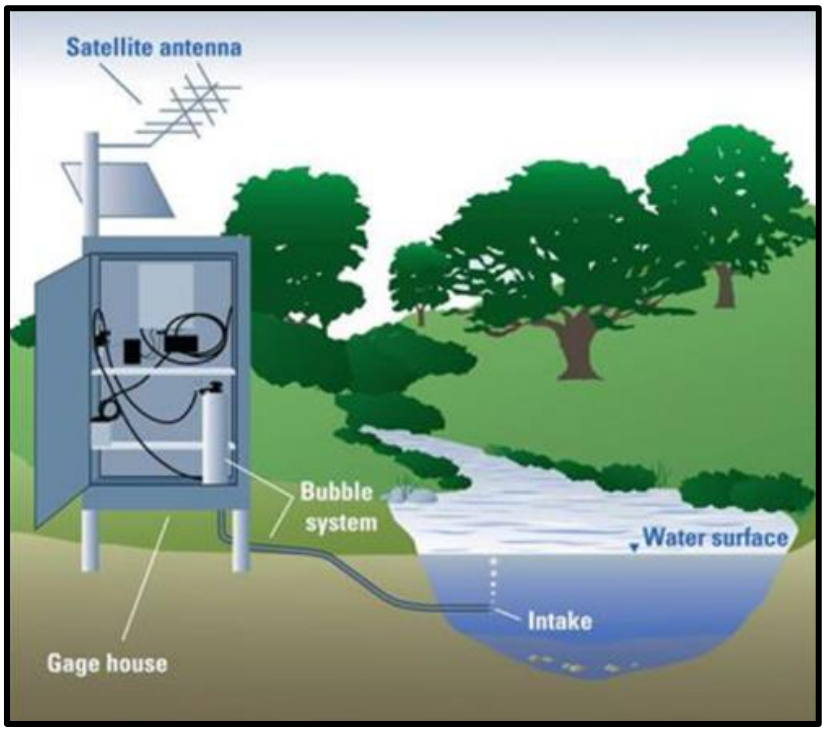
Welcome to the USGS Nebraska Water Science Center Fall 2022 Newsletter

This newsletter highlights a few current water data and science activities conducted by our Center. The newsletter provides a platform for connecting with stakeholders as well as advertising open career and volunteer positions. We value feedback from stakeholders and readers - please feel free to reach out directly to our director, Steve Peterson, with any comments, questions, or ideas. Past newsletters are available here.

Streamgages and Ice Measurements

Streamgages are fixed structures at streams, rivers, lakes, and reservoirs that measure water level and streamflow - the amount of water flowing through a water body over time. Streamgages provide foundational information for diverse applications that affect a variety of constituents. The U.S. Geological Survey (USGS) disseminates streamgage data free to the public and responds to over 887 million requests on streamflows annually. Direct users of streamgage data include a variety of agencies at all levels of government, private companies, scientific institutions, and recreationists. Data from streamgages inform real-time decision-making and long-term planning on issues such as water management and energy development, infrastructure design, water compacts, water science research, flood mapping and forecasting, water quality, ecosystem management, and recreational safety. At some gage locations, additional data are collected, such as precipitation, temperature, or various water-quality parameters.

Diagram of a Streamgage Measuring Stream Gage-Height



Platte River Streamgage near Grand Island, Nebraska

Streamgages estimate streamflow based on (1) continuous measurements of gage-height (also called stage or river level) and (2) periodic measurements of streamflow, or discharge, in the channel and floodplains. USGS measurements are used to create rating curves, in order to convert continuously measured gage-heights into estimates of streamflow. During winter months, ice formation on the rivers causes variable backwater conditions to occur making computation of discharge from gage-height data unreliable. Measuring discharge under ice requires additional safety precautions because of the dangers associated with working on river ice and exposure to the colder temperatures.

Streamgages and Ice Measurements (Continued)

For safety purposes, typically two USGS hydrologic technicians work together wearing cold-weather gear and personal flotation (PFD) coats. After testing the strength of the ice across the channel using a heavy steel razor-sharp ice chisel, technicians use a power auger to drill about 25-30 holes in the ice at measured intervals. A 'tagline' with markings like those on a ruler is used for measuring the location of these ice holes from shore to shore. After physically measuring the ice thickness in each hole (factored into the computations of 'Area' for that hole), the acoustic equipment is lowered below the bottom of the ice to provide river depth (also used for determination of 'area' and for average velocity in each hole). A discharge for each hole is computed using area and average velocity information. The sum of the discharges computed for each hole is the river discharge (in cubic feet per second, or cfs). Real-time discharge data are served through the USGS National Water Information System (NWIS) webpages as well as the USGS National Water Dashboard.

Make sure to check back in our Spring 2023 newsletter, where we'll have an article describing the methods and approaches used to measure high flow and flood events!

Find more information about the USGS streamgageing network here.

Logan Neal measuring discharge under ice at the Big Nemaha River at Falls City, Nebraska.

Logan Neal measuring discharge under ice at the Platte River near Duncan, Nebr.

Ty Cope and Mike Andersen measuring discharge under ice at the Elkhorn River at Waterloo.

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Product Highlights

High Plains Aquifer Water-Level Report

The High Plains aquifer underlies 111.8 million acres (about 175,000 square miles) in parts of eight States—Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. Water-level declines began in parts of the High Plains aquifer soon after the beginning of substantial groundwater irrigation (about 1950). This report presents water-level changes and change in recoverable water in storage in the High Plains aquifer from predevelopment (about 1950) to 2017 and from 2015 to 2017. Find report here.

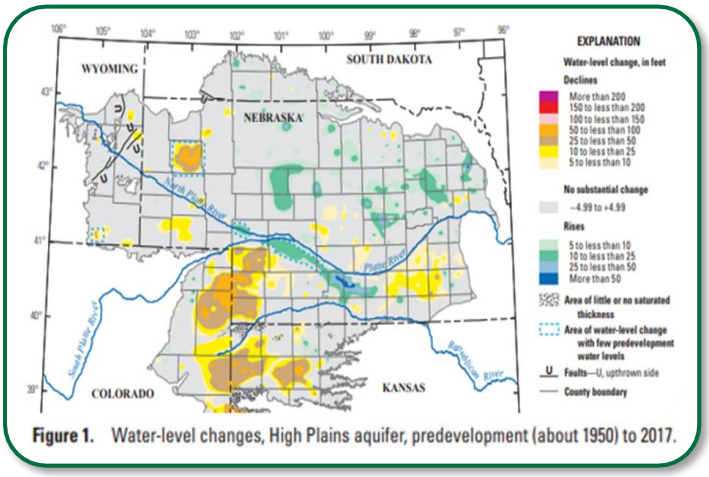
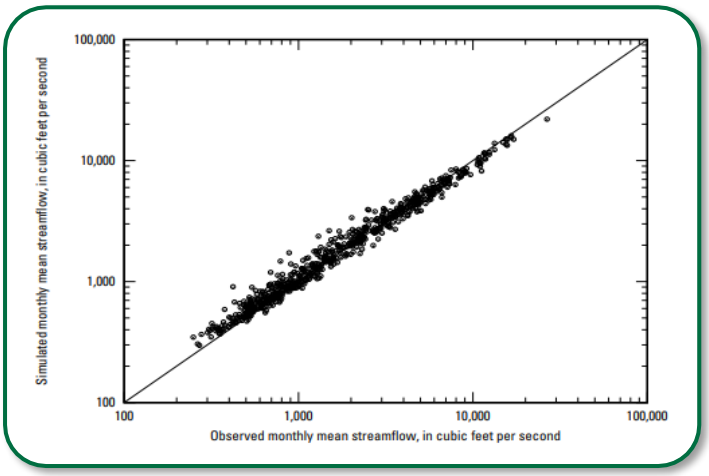


Figure 1. Water-level changes, High Plains aquifer, predevelopment (about 1950) to 2017.

Mississippi River Alluvial Plain Monthly Base Flow Simulation Report

Improved simulations of streamflow and base flow for selected sites within and adjacent to the Mississippi River Alluvial Plain area are important for modeling groundwater flow because surface-water flows have a substantial effect on groundwater levels. One method for simulating streamflow and base flow, random forest (RF) models, was developed from the data at gaged sites and, in turn, was used to make monthly mean streamflow and base-flow predictions at 162 ungaged sites in the study area. Daily streamflow observations and computed base flow from 247 streamgages were used as the basis for the development of these RF models. Models were used to compute monthly base-flow estimates from selected streamgages in and adjacent to the Mississippi River Alluvial Plain extent. Soon to be available here.



Training Prepared for Afghanistan Ministry of Energy and Water

The U.S. Geological Survey (USGS) created a virtual training series for the Afghanistan Ministry of Energy and Water (MEW), now known as the National Water Affairs Regulation Authority (NWARA), to provide critical hydrological training as an alternative to an in-person training. The virtual training consisted of prerecorded and live presentations that were scheduled during 4 weeks in August 2021. However, the training was halted after the second week due to the collapse of the Afghan Government. Fortunately, the prerecorded presentations and training materials were delivered before the trainings were halted, so they can be viewed or shared by the participants in the future. Find report here.

USGS science for a changing world — USAID

Prepared in cooperation with U.S. Agency for International Development

Virtual Training Prepared for the Former Afghanistan Ministry of Energy and Water—Streamgaging, Fluvial Sediment Sampling, Bathymetry, and Streamflow and Sediment Modeling

Introduction

The U.S. Geological Survey (USGS) created a virtual training series for the Afghanistan Ministry of Energy and Water (MEW), now known as the National Water Affairs Regulation Authority (NWARA), to provide critical hydrological training as an alternative to an in-person training. The USGS was scheduled to provide in-person surface-water training for NWARA during 2020; however, travel was halted because of the Coronavirus disease 2019 (COVID-19) pandemic. The virtual training consisted of prerecorded and live presentations that were scheduled during 4 weeks in August 2021. However, the training was halted after the second week due to the collapse of the Afghan Government. Fortunately, the prerecorded presentations and training materials were delivered before the trainings were halted, so they can be viewed or shared by the participants in the future. A benefit to having produced prerecorded trainings is that USGS can leverage or adapt the trainings for nongovernmental organizations (NGOs) involved in humanitarian water relief efforts in Afghanistan or can be used for other international training efforts.

Background

Since 2004, the USGS has aided efforts to rebuild Afghanistan's capacity to monitor water resources by collaborating with scientists from different Afghan Government agencies, including the MEW, NWARA, and the Afghanistan Ministry of Agriculture, Irrigation, and Livestock (MAIL). The USGS has worked to compile and (or) recover Afghanistan's hydrologic data and has provided trainings on water-resource data collection in the past (Mack and others, 2014). These collaborations have assisted Afghan scientists in developing the data collection networks necessary for improved understanding and management of water resources that may affect current and future water supplies and conditions.

Goals

The goal of the virtual trainings was to efficiently provide surface-water capacity training to NWARA. Because the trainings were prerecorded and delivered prior to training events, the recordings could be viewed during the trainee's schedule or at locations with limited internet access. This approach made the trainings more transcribed. The prerecorded trainings provided the participants with the opportunity to translate, pause, or view multiple times during the trainings.

Training Format

The prerecorded and live trainings were scheduled to be presented to the Afghanistan Ministry of Energy and Water during a 4-week period. The learning objective was to better understand how to collect useful and meaningful surface-water data as a basis for understanding hydrologic processes and management of water resources. Each week consisted of three components:

- 1-hour live introduction to the weekly topic
- subject material (sent weekly)
  - prerecorded presentations
  - videos
  - exercises
- 2-hour live summary of the weekly topic with a question-and-answer session at the end of the week

Each training topic was developed to be completed in a week; however, trainings were self-guided, and participants could complete the trainings at their own pace. The following four sections highlight the training topics and objectives during the 4-week period.

Employee Spotlight


Virginia (Ginny) McGuire (Hydrologist)

For the last 30 years, Wisner, Nebraska native Ginny McGuire has worked for the USGS in the Hydrologic Investigations Section of the Nebraska Water Science Center (NEWSC). Ginny started with USGS in 1992 as a SCEP intern while she was working on a master's degree in Geology from the University of Nebraska—Lincoln (UNL). As an intern, Ginny provided GIS, data processing, and field support on various USGS projects. Ginny's thesis study was to characterize the aquifer at the USGS-UNL Management Systems Evaluation Areas (MSEA) site, near Shelton, Nebraska. In 1994, upon graduation from UNL, she transitioned to full-time work as a USGS hydrologist for the NEWSC. As a hydrologist, one of the first studies that she worked on was a water-quality reconnaissance study for the Upper Big Blue Natural Resources District (NRD). The associated report described the hydrogeologic framework and water-quality in the NRD's aquifers. In 1996, after Jack Dugan's passing, Ginny took over the High Plains Water-level Monitoring (HPWLM) study and has continued to be responsible for that study. First annual and then biannual reports from the HPWLM study present water-level changes and percent changes in saturated thickness in the High Plains aquifer from predevelopment to the current date. Other associated HPWLM study reports include water-level changes maps of the aquifer or part of the aquifer for other time periods.

In addition to her well-known High Plains aquifer work, Ginny has been a part of or led many other studies, such as water-quality monitoring for Lincoln Water System and the Papio-Missouri River NRD; part of a national support team for the statistical package SPLUS; measuring streambed conductivity using slug tests in the Platte River and its tributaries for the Platte River Cooperative Hydrology Study (COHYST); water-quality monitoring for Omaha's Metropolitan Utilities District well field; a base of aquifer map for the Elkhorn-Loup model area, North-Central Nebraska; a report of water quality analysis from 1992 through 2009 in the Papio-Missouri River NRD; and a report on the occurrence of brackish groundwater in the Nation's principal aquifers. Ginny is currently engaged in a USGS study to characterize the Mississippi River Valley alluvial aquifer--producing potentiometric surface maps for 2016, 2018, and 2020, as well as other hydrogeologic maps. In 2015, Ginny became the NEWSC Groundwater Specialist and in 2017, she became the NEWSC Report Specialist. In 2022, Ginny began a study for the Upper Big Blue NRD to reassess their groundwater-quality monitoring network. Ginny has enjoyed working for the USGS because of the variety of interesting studies she has been a part of and because of tremendous support from USGS colleagues in NEWSC and other offices, who have been very willing to discuss and answer questions about approaches, methods, and analysis. In addition, Ginny benefitted from many hydrogeology-related classes, which were taught by USGS scientists and provided valuable and timely guidance.

Ginny was raised on a farm, 8 miles north of Wisner. She was the fifth oldest in a family of fifteen. Her father, Leo, was a farmer and her mother, Mary Ann, was a nurse. From kindergarten to eighth grade, she attended a county school with about 13 other children, many her siblings. After graduating from Wisner-Pilger High School, she attended Creighton University (CU), worked in CU's microbiology lab and computer center, and graduated from CU with a BS in math. Afterwards, she worked for natural gas companies doing computer system design, development, and support until, in 1991, she went to UNL for a master's degree in geology. Outside of work, Ginny likes to visit family and friends, walk while listening to audiobooks, NPR, and podcasts, attend UNL women's volleyball games, bike, travel, watch movies, and cook.

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Did you know?

…that the USGS collects 'remotely-sensed' data using satellites? The USGS Earth Resources Observation and Science (EROS) Center, studies and produces land change data products, operates the Landsat satellite program within NASA, and maintains the largest civilian collection of images of the Earth's surface, numbering in the tens of millions of images. The example figure below, shows a mosaic of Landsat data compiled for the state of Nebraska. This and other kinds of satellite data are available through EarthExplorer and other interfaces from EROS, at https://www.usgs.gov/centers/eros. The EROS webpage also offers a variety of online outreach and education activities, such as :

Remote Sensing Classroom: Fun and engaging educational lessons that allow students to look at satellite imagery and perform the same analysis as the scientists at the EROS Center.

Landsat Change Pair game: View satellite imagery of change side-by-side and see if you can guess what's different!

Earthshots: A world map filled with fascinating stories of change over time, from shrinking glaciers and burning forests to nuclear disasters and recovery.

State Puzzle Game: Have you ever wanted to take your state apart and put it back together? Our state puzzle game gives you the chance!

Test Your Memory: The classic memory game with a remote sensing twist: You'll match images captured by Landsat satellites.

JW Powell Story Map: Learn more about the historic Colorado River journey of John Wesley Powell, the second director of the USGS with our interactive story map.

Example figure of a Landsat state mosaic of Nebraska, available at Nebraska | EROS (usgs.gov).

Announcement: Pathways Student Trainee (Hydrology) Advertisement

The Nebraska Water Science Center is seeking associate, undergraduate, or graduate level students in physical or natural science or engineering to gain practical experience in gathering basic hydrologic data concerning any one or a combination of four areas, i.e., quantity, quality, availability, and movement and distribution of water. The position is year-round; during the school year, part-time hours can be scheduled around your classes, and during the summer and breaks, we'll put you to work full time! Gain valuable professional experience while you complete your degree! **We expect the advertisement to come out, on January 3rd, 2023, through USA Jobs at** USAJOBS - DOI--Lincoln, NE, or contact Brenda Densmore (bdensmore@usgs.gov) or Steve Peterson (speterson@usgs.gov) for updates.

2022 Student Trainee Sarah Thompson