

Innovative River Stage Gage

Abstract

Real-time river data availability, or lack thereof, across Alaska has always been a challenge for National Weather Service (NWS) meteorologists and hydrologists responsible for the forecasting of hazardous weather and flooding conditions. Real-time data is critical information needed when issuing warnings to the public for river or coastal flooding. The NWS Alaska-Pacific River Forecast Center has developed and tested a compact, low cost, ultrasonic river stage gage that uses satellite telemetry. These gages started out as a concept for a rapidly deployable flood monitoring device that was small, self-contained, and with global telemetry. The gage is a unique combination of off-the-shelf and custom components in a small, low cost package that is easy to mount and maintain. The small package (3 inches x 5 inches x 7 inches) is completely self contained and includes a solar charging power supply.

Details

- Capability Name: Innovative River Stage Gage (iGage)
- Capability Owner: National Weather Service
- Partnerships in Development: USACE (previously)
- Capability Brief Description/Status:

The NWS Alaska Region has successfully installed approximately thirty gages over the past three years on bridges that span rivers and streams that previously measured once per day manually. These prototype implementations are fully integrated into the National Weather Service Advanced Weather Interactive Processing System (AWIPS) with complete end-to-end communications.



Figure 1. The iGage is a compact, low cost acoustic sensor used by the NWS to measure river stages, coastal water levels and snow depths.

Key Capability and Distinguishing Innovation

- Key Capability: Water level measurement
The distinguishing features of this new gage are:
- Extremely small form factor
 - Lightweight
 - Global telemetry coverage
 - Integrated unit for easy/rapid installation
 - No external wires or equipment
 - Solar Powered (1 Watt Panel)
 - Two-way communication
 - Data integration into AWIPS

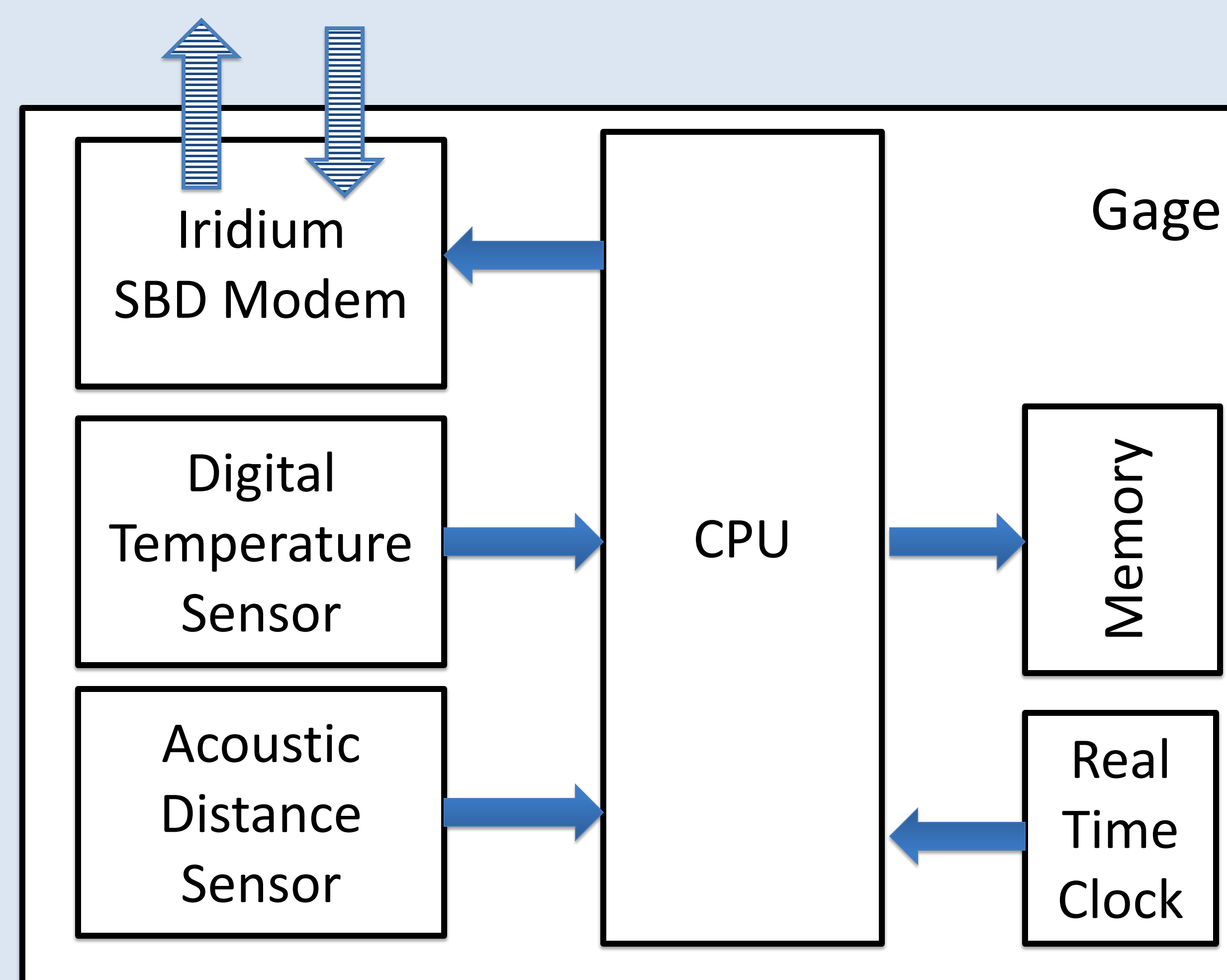


Figure 2. Block diagram for the iGage showing the combination of off the shelf components into a compact package to measure river water levels.

Anticipated Impacts

These innovative gages fill critical gaps in Alaska's stream monitoring network by supplementing high quality USGS streamflow monitoring stations with supplemental river stage information. The end results are a) improved hydrologic situational awareness in previously unengaged watersheds b) improved hydrologic forecasts

These gages provide a cost effective method to extend our existing hydrologic monitoring networks.

Mission Areas:

- Hydrology and Water Resources (Integrated Water Forecasting) (WRN-IWF)
- Marine Weather and Coastal Events (WRN-MWX)
- Severe Thunderstorms, Tornadoes and Flash Floods (WRN-SEV)

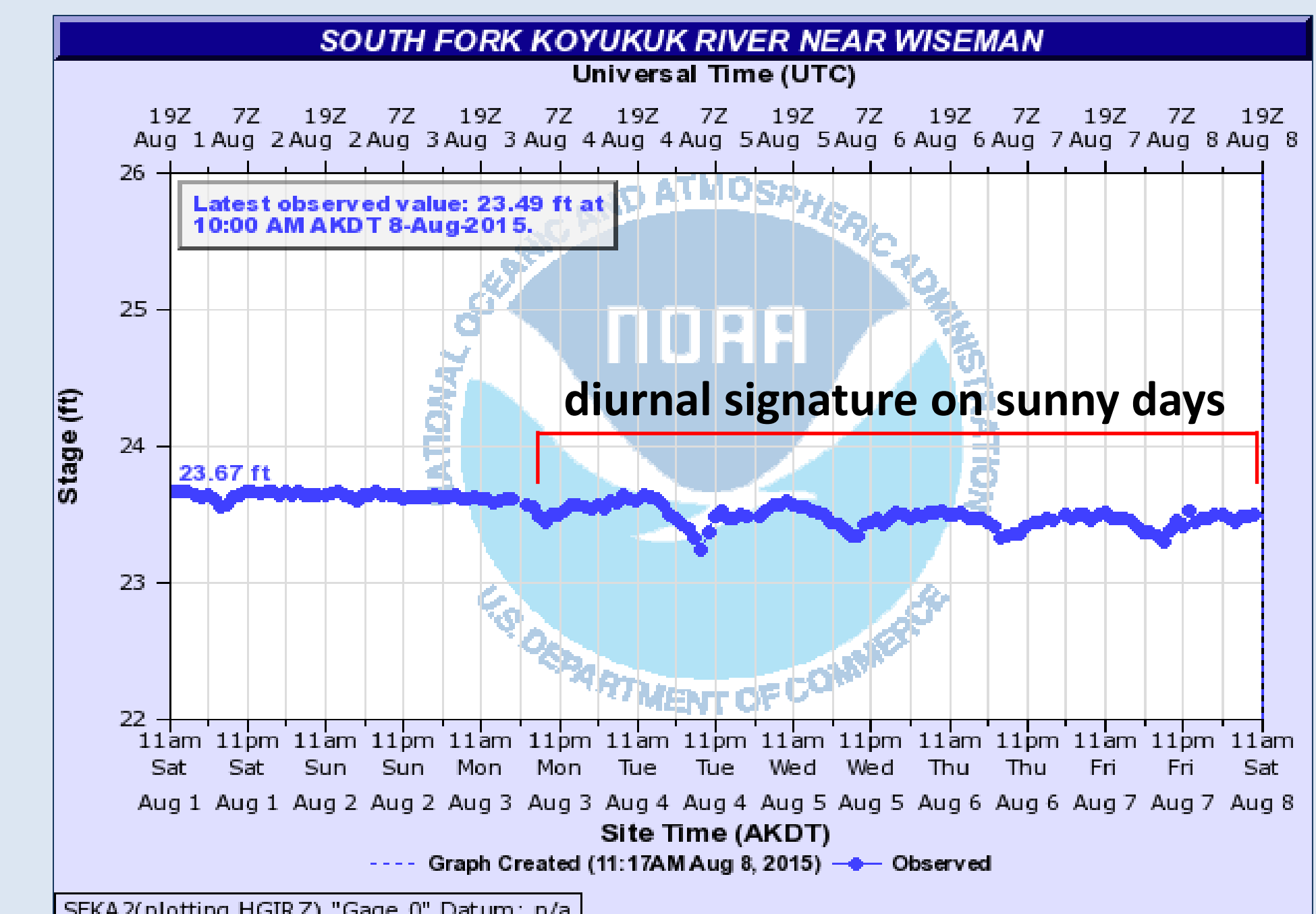


Figure 4. The iGage can be sensitive to diurnal temperature changes. An artifact of this results in a misleading (and inaccurate) diurnal signature in the river stage data. Recent improvements have reduced this error by roughly 50% by improving the temperature compensation algorithm.

Limitations

The iGage is a low cost instrument that has improved the real-time hydrometeorologic data network across Alaska, but it does have limitations:

- Acoustics sensors are noisier and less accurate than a pressure transducer or radar sensor when measuring water levels.
- Data does not meet US Geological Survey river stage measurement standards (iGage accuracy for river stage is approximately ± 5 cm depending upon the measured distance)
- Gages are fabricated manually in small numbers

Future Work

- Continue testing for durability and software stability
- Improve acoustic sensor accuracy (in-progress)
- Improve air temperature measurement (in-progress)
- Re-design custom circuit board for streamlined production

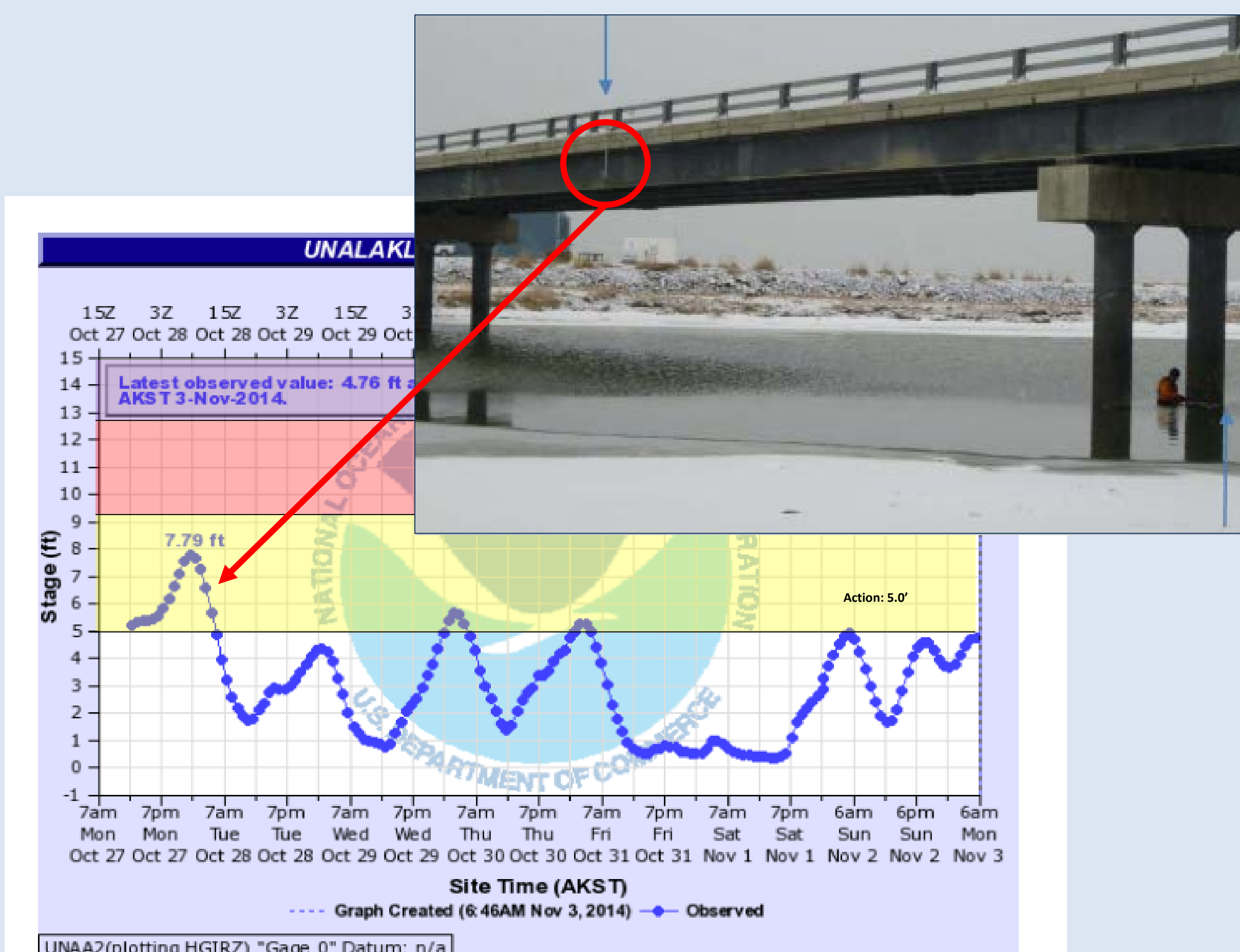


Figure 3. The iGage provided critical tidal and storm surge information at a previously un-gaged community during the 2014 Bering Sea storm season.