

# Using survey-grade Global Navigation Satellite Systems (GNSS) for referencing recorded stage data to a consistent elevation datum across a fixed station monitoring network.

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# Abstract:

The USGS Estuarine Hydrodynamics Team is currently testing survey-grade Global Navigation Satellite Systems (GNSS) equipment for the purposes of referencing recorded stage data to a consistent elevation datum across a fixed station monitoring network. This equipment will allow us to relate water elevations measured at gaging stations to the North American Vertical Datum of 1988, the USGS-mandated reference datum. Providing all waterelevation data across the Delta (and throughout the larger national network) relative to a consistent vertical datum is a high priority for the USGS and our collaborators and cooperators. Moreover, the equipment will allow us to monitor any longterm elevation changes at our gages.



... are received at the GPS receiver (survey grade, capable of centimeter accuracy) mounted to USGS streamflow monitoring station.

> Approximately twelve hours of continuous position data is collected by the GPS receiver and combined into a single file which is pushed via WiFi to the monitoring stations cellular data connection...

> > ... which is then

uploaded to the

National Geodetic

Surveys Online

**Position User** 

Service (OPUS)...

your

**GPS** data

Global Positioning System (GPS) satellite signals ...

**Transmission** of

Over forty streamflow monitoring stations will be equipped with survey-grade GNSS receivers and antennae utilizing the Global Positioning System constellation and L1/L2 signals. Elevation data will be collected for twelve hours, once a week, every week. The data will be delivered wirelessly to an File Transfer Protocol server that will serve as a temporary repository before it is processed using the NGS (National Geodetic Survey) **Online Position User Service for corrections** (for example: ionospheric and tropospheric conditions, clock corrections, changes in satellite flight path, and datum application). The data will be returned from the NGS via email with a unique elevation (maximum uncertainty allowance of 0.16 foot) for each

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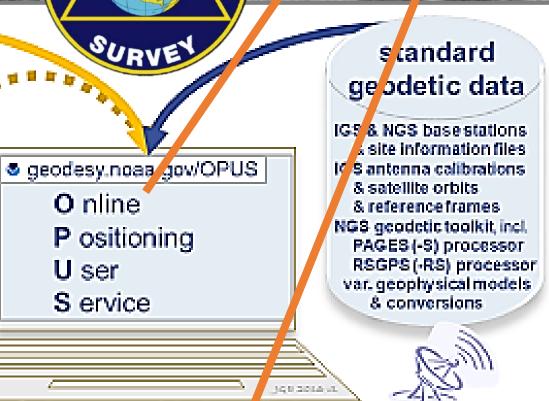
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This station is part of a national network for obtaining water-resources information. The recorded water level and corresponding rate of flow are used for flood forecastin reservoir operations, design of bridges and culverts, interstate and intrastate water rights claims, and many other projects.

... and transported

... where the data is refined – NGS corrects satellite clock offsets, position, ionospheric and tropospheric conditions, and associates position with a vertical datum – ...

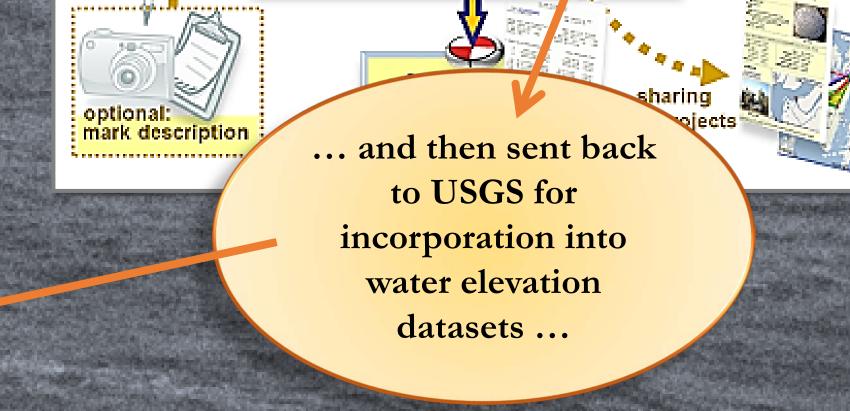
NAVSTAR GP



1925

site that will be applied to the stage data.

via its cellular data connection into a USGS FTP server folder ...



RATE OF CHANGE

free, fast, easy, consistent coo dinates



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# **USGS Water Data for the Nation**

### Search for Sites With Data



Introduc These pages provide access to waterapproximately 1.9 million sites in all 50 Sto Columbia, Puerto Rico, the Virgin Islands, Gua and the Commonwealth of the Northern Mariana is access to this data is organized around the catego

The USGS investigates the occurrence, quantity, quality, distribution, and movement of surface and underground waters and disseminates the data to the public, State and local governments, public and private utilities, and other Federal agencies involved with managing our water resources.

## **Frequent Searches By Data Category**

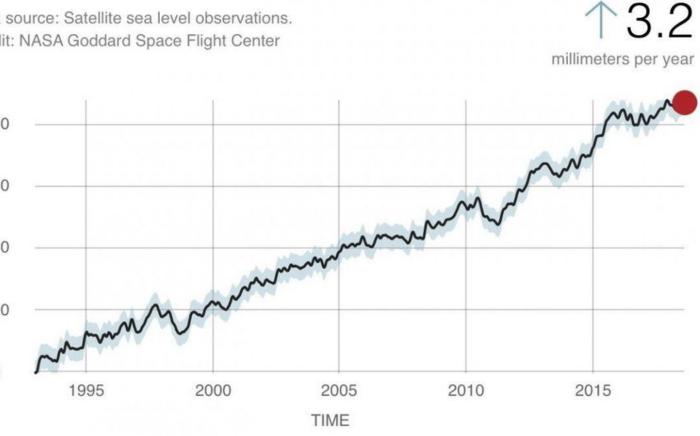
Stream water level elevation above NAVD 1988, in feet

Most recent instantaneous value: 3.55 02-11-2020 12:30 PST

... which are pushed to the public-facing website, <u>https://waterdata.usgs.gov/</u> <u>nwis</u>, in both the local datum of the gage and the

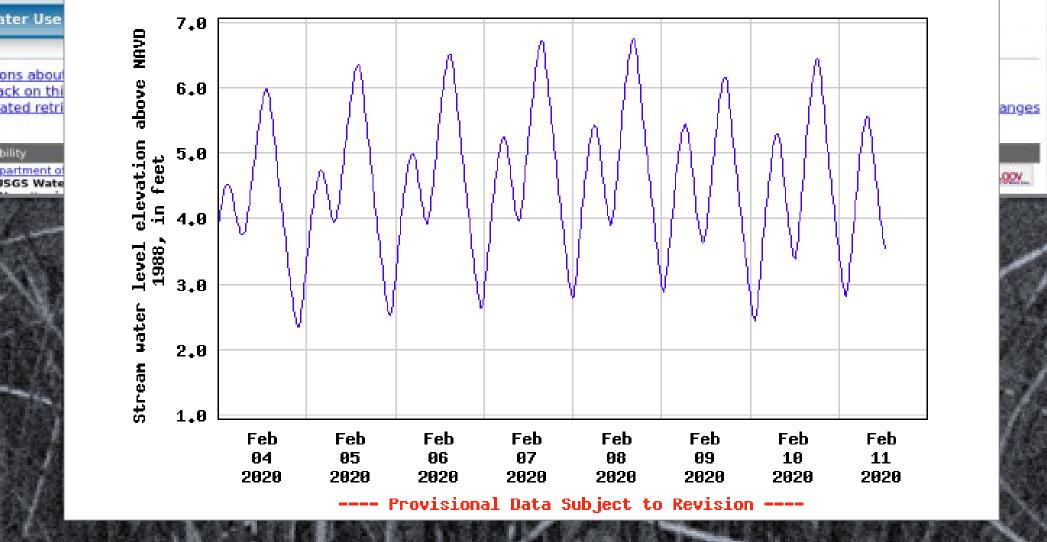
national vertical datum, NAVD88. Data source: Satellite sea level observations. Credit: NASA Goddard Space Flight Center

SATELLITE DATA: 1993-PRESEN



Sep 18, 2019 1981-2010 Avg Min





As the natural world changes around us accounting for these changes quickly and accurately is important for managing water resources, responding to natural disasters, and shaping policy. Aligning our data to a nationally recognized datum checked in near realtime intervals, made widely available and simple to integrate, improves and enhances the ability to respond to our changing world.

U.S. Department of the Interior U.S. Geological Survey