

# CORS Installation, Operation and Maintenance Best Practices

**John Galetzka**

CORS Branch Chief, Spatial Reference System Division

National Geodetic Survey

john.galetzka@noaa.gov

# NGS CORS Team

## **CORS Analysts**

Mr. Jarir Saleh

Ms. Lijuan Sun

Mr. Don Haw

Ms. Amy Whetter

Ms. Fran Coloma

Ms. Sarah Conway

Ms. Ira Sellars

Dr. Kimber DeGrandpre

# NGS CORS Team

## **Orbiteers**

Dr. Josh Jones

Dr. Rick Bennett

## **CORS Program Manager**

Mr. Will Freeman

## **Program Specialist**

Ms. Jeri Greenwell



### CHOOSE MAP

Sampling Rate Map

Show/Hide

#### Zoom to CORS:

Site ID:

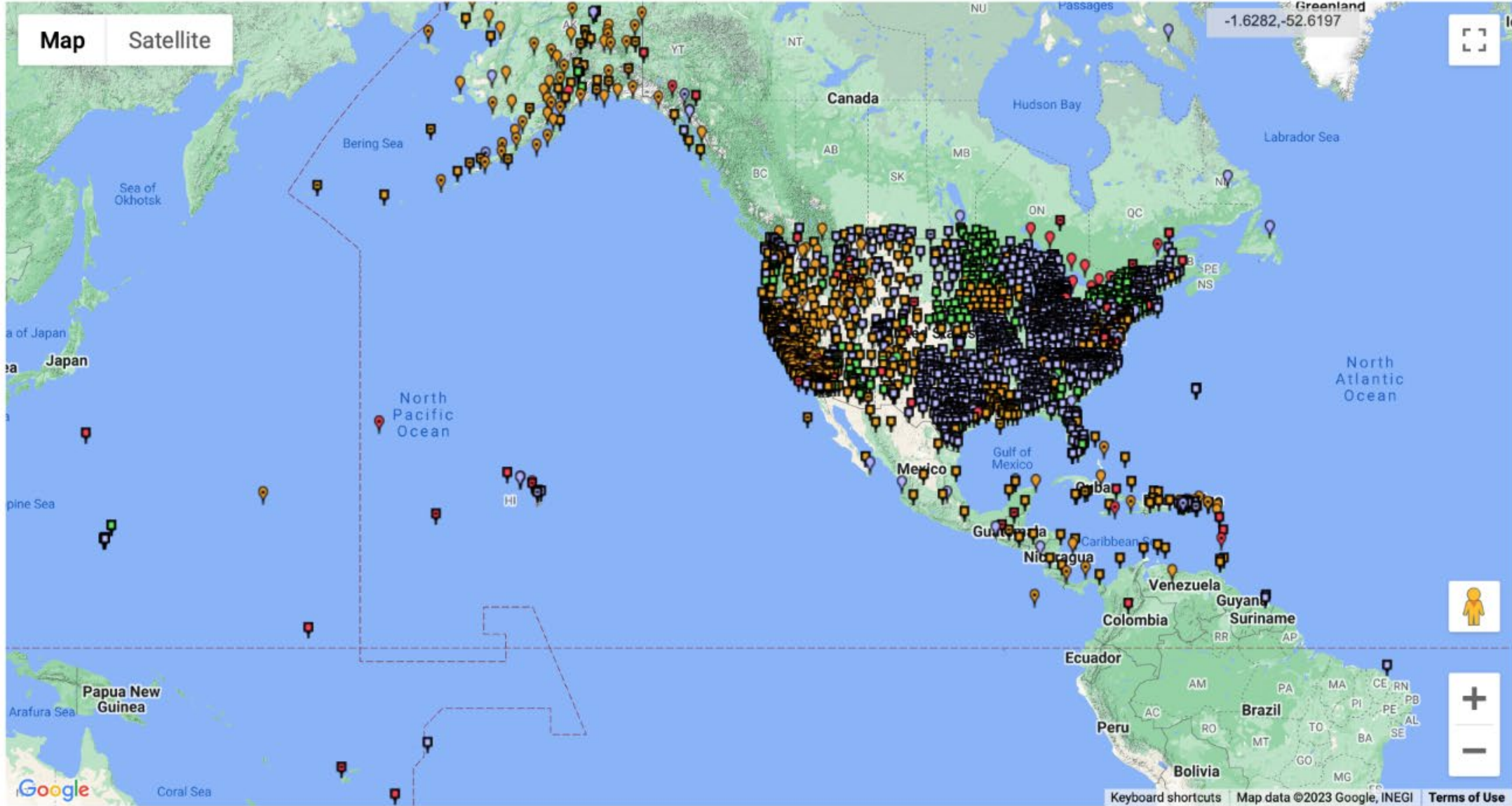
#### Cursor Lat/Lon :

-1.62821 , -52.61972

#### Three Nearest Sites :

SRZN 839.24 km  
PMB1 876.20 km  
BRFT 1597.92 km

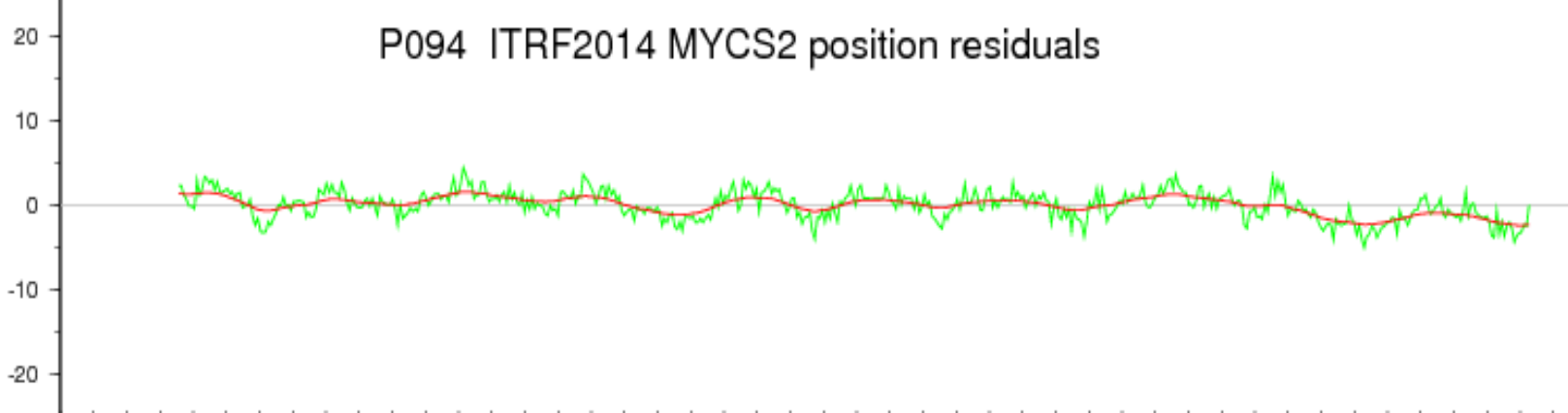
Enter a location



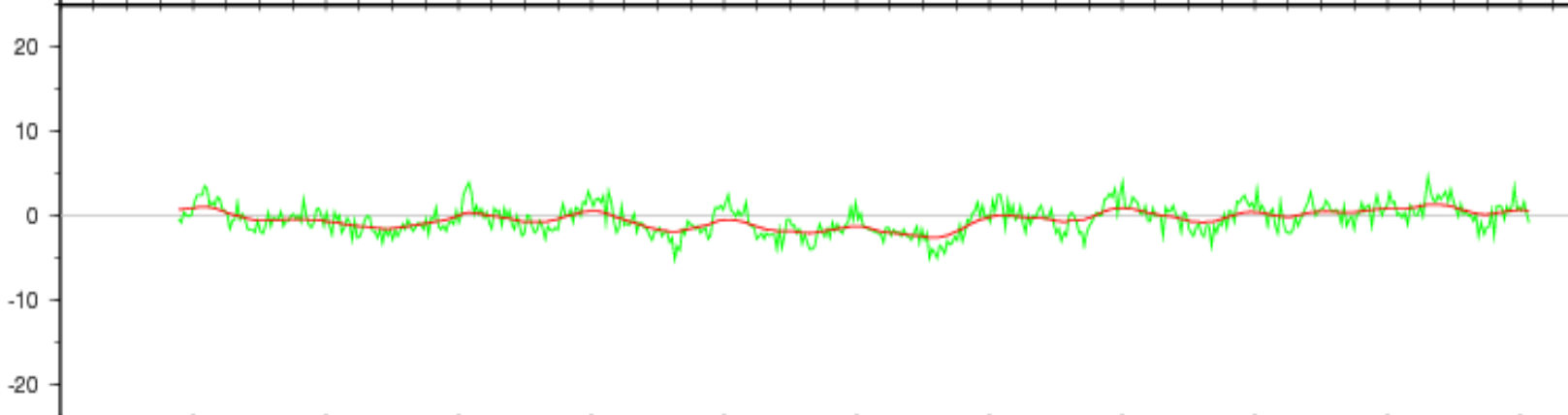


# P094 ITRF2014 MYCS2 position residuals

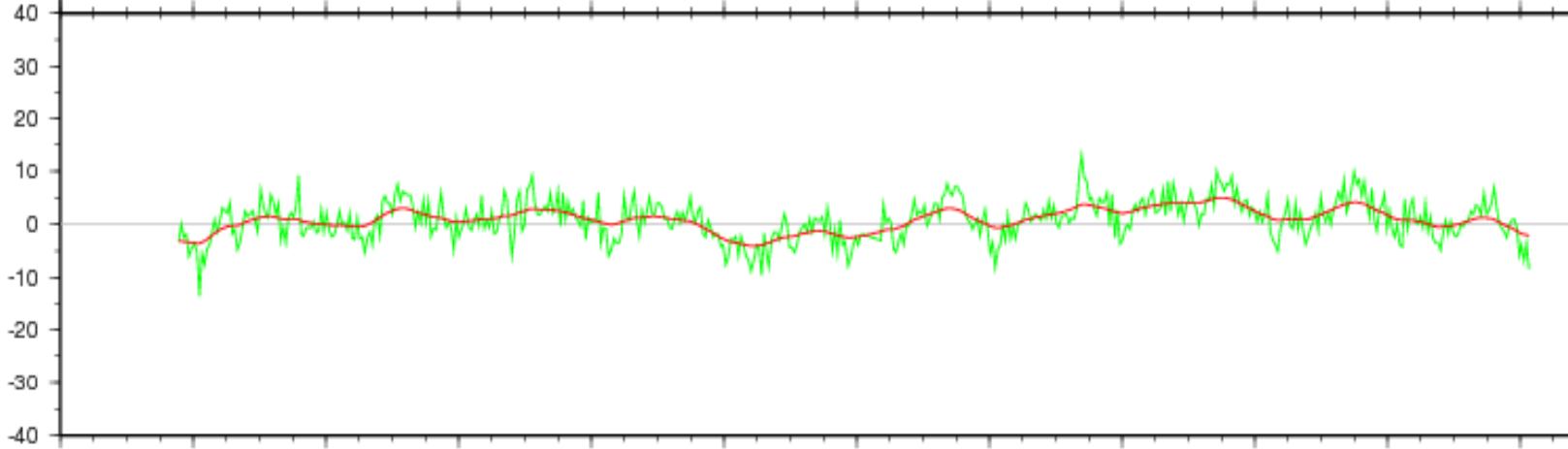
North (mm)



East (mm)



Up (mm)



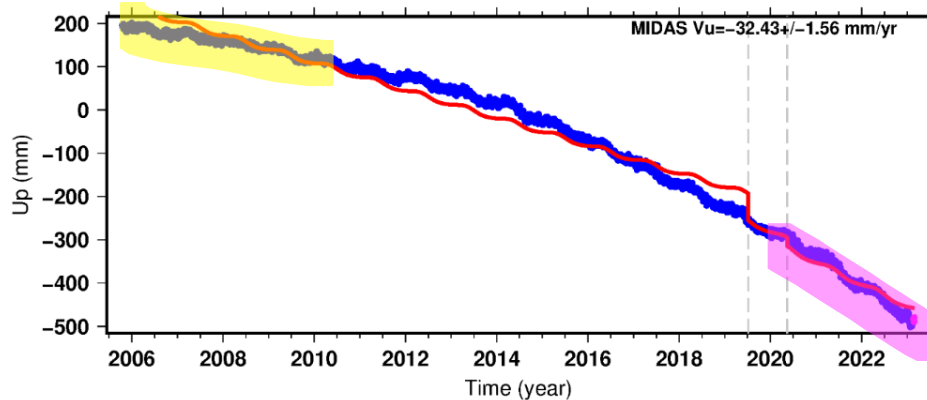
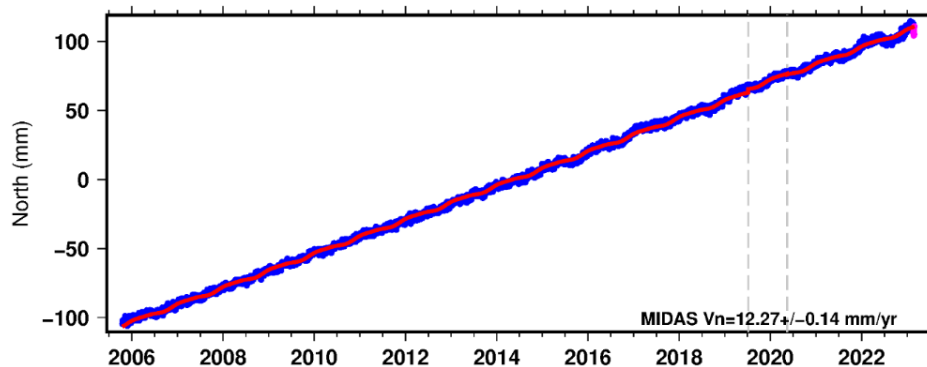
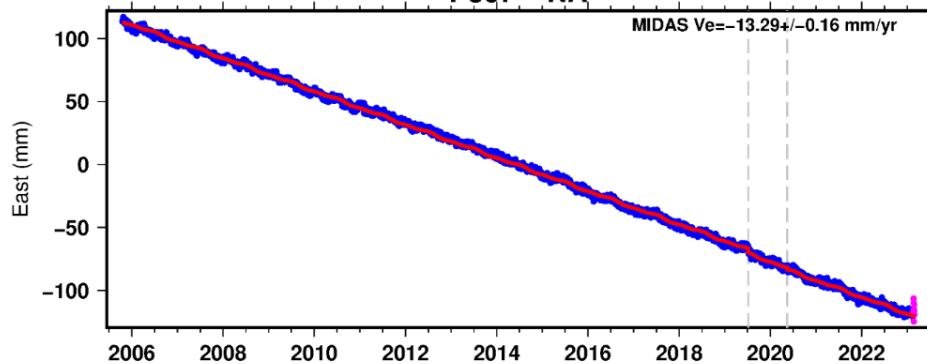
Year



2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018

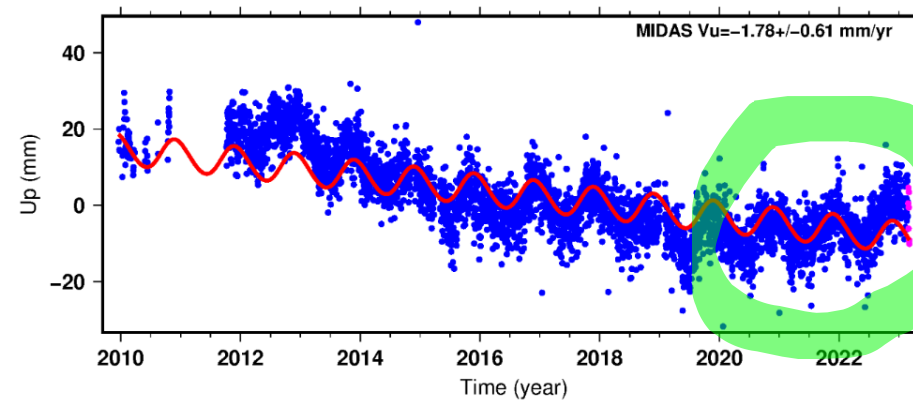
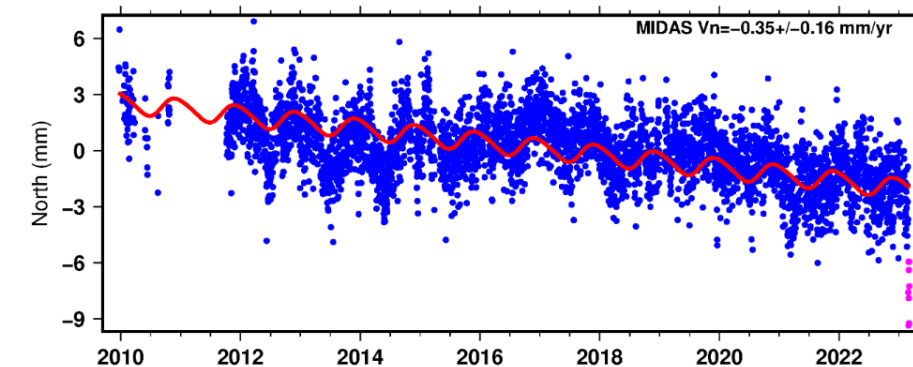
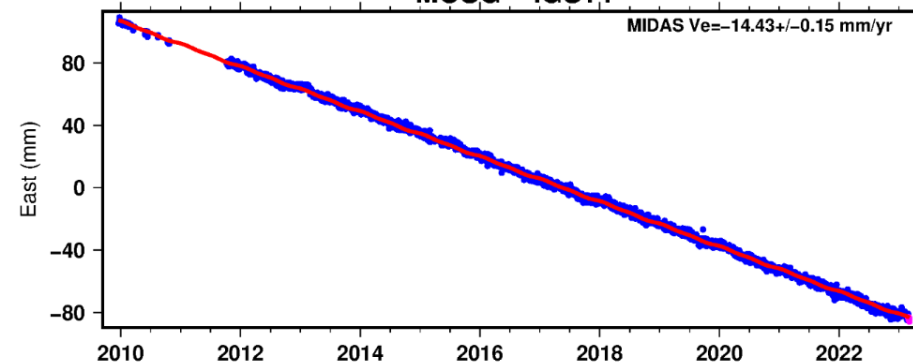


### P307 - NA



24 Hour Positions Using Final Orbits (blue) and Rapid Orbits (magenta).  
 Processed by the Nevada Geodetic Laboratory.  
 Plotted on 2023-Mar-2. Last data on 2023-Feb-27.

### MOSG - IGS14



24 Hour Positions Using Final Orbits (blue) and Rapid Orbits (magenta).  
 Processed by the Nevada Geodetic Laboratory.  
 Plotted on 2023-Mar-6. Last data on 2023-Mar-05.

# CORS Installation Best Practices

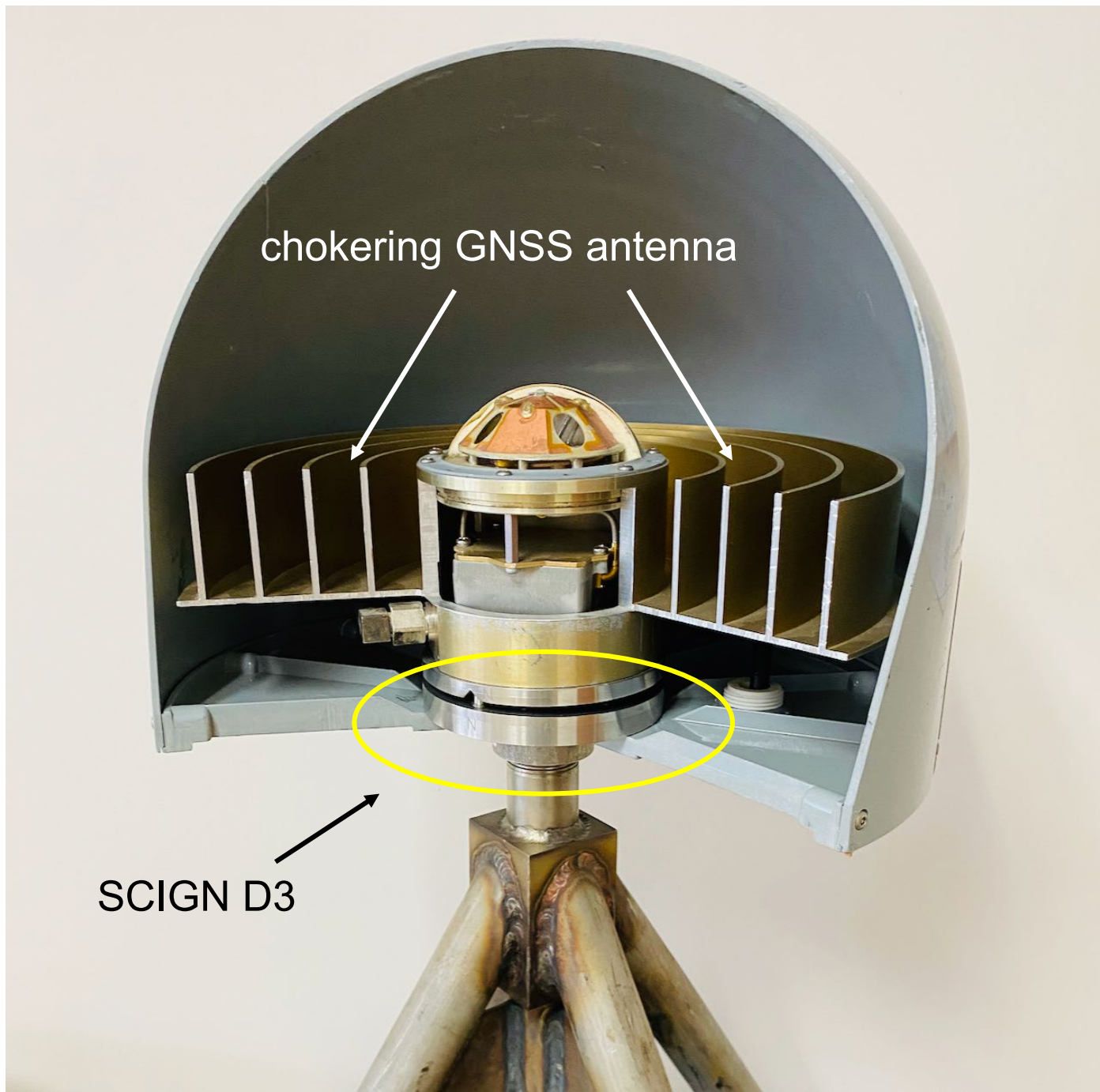


WITG Tigerton, Wisconsin





GUAX Guadalupe Island, Mexico







Trimble

GNSS



AXIS  
0.0330



## Comments on NGS Proposed CORS Monumentation

*Duncan Carr Agnew, Yehuda Bock, Frank Wyatt*

Institute of Geophysics and Planetary Physics  
Scripps Institution of Oceanography  
University of California, San Diego

### 1. Introduction

The National Geodetic Survey (NGS) Process Action Team 20 has developed a design for site monumentation for Continuously Operating Reference Stations (CORS) of a national GPS network. This design is described in admirable detail in the Team's final report of 20 December 2000 (hereafter the "Report"). It does not appear that any input from outside of NGS was sought during the development of the design; this note is an attempt to offer such input, with the perspective of a long involvement with issues of stable monumentation, and particularly close knowledge of the monumentation adopted for the Southern California Integrated GPS Network (SCIGN).

Since much of this note will raise some objections to the NGS Report, it should be said at the outset that it represents a step towards an important goal, namely better CORS monumentation. Certainly, this design is likely to be an improvement over some of the systems now in use (for example, mounting the antenna on a roof). Also, it can be installed at relatively low cost.

A summary of the comments made in more detail below would include the following points:

- The aim of a single design does not seem appropriate, given the range of geology in which a monument may need to be set.
- The criteria for monument stability used in the Report do not match those determined from other studies.
- The design given requires drilling a relatively large hole. Such drilling (unless done with fairly massive equipment) is likely to stop at the first moderately hard material (probably not "bedrock"), thus ensuring that the monument will not be coupled to stable material.
- The emphasis put on avoiding all metal in construction is not justified. Concrete also will scatter the signal, and tests of metallic monuments show that they can be built to have no significant effect on GPS positions.
- The Report does not include any discussion of the desirability of a stable electromagnetic environment.
- The cost estimate for the CORS monument does not show the total cost; when all costs are included the cost ratio between this and other monuments is not large, especially given the long lifetime expected for a geodetic monument.



FLF1, Florida



TMG2, Colorado



Carlsbad Caverns National Park, February 2023





Sarasota County, Florida, February 2023



Parkfield, California, August, 2001



Parkfield, California, August, 2001





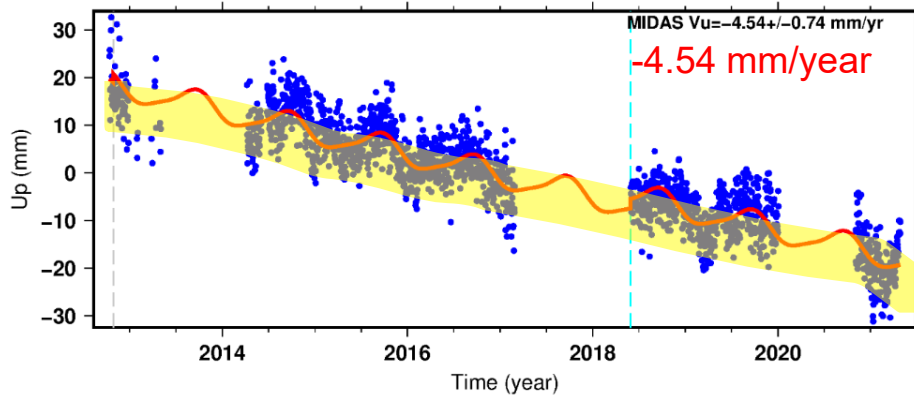
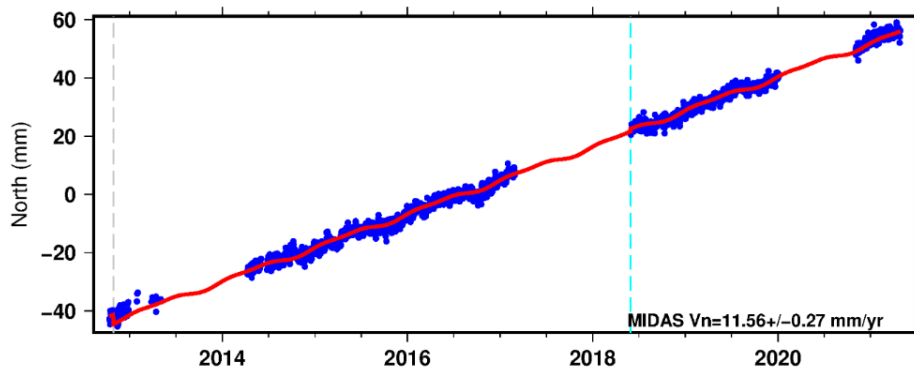
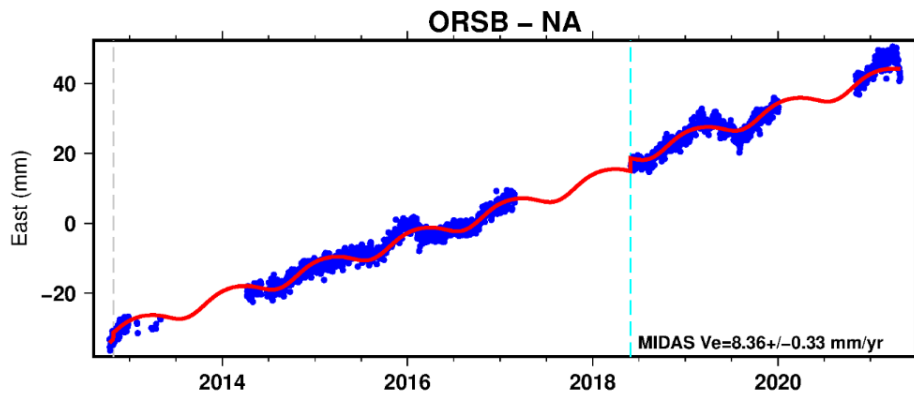
Fan Mountain, Virginia, April, 2021



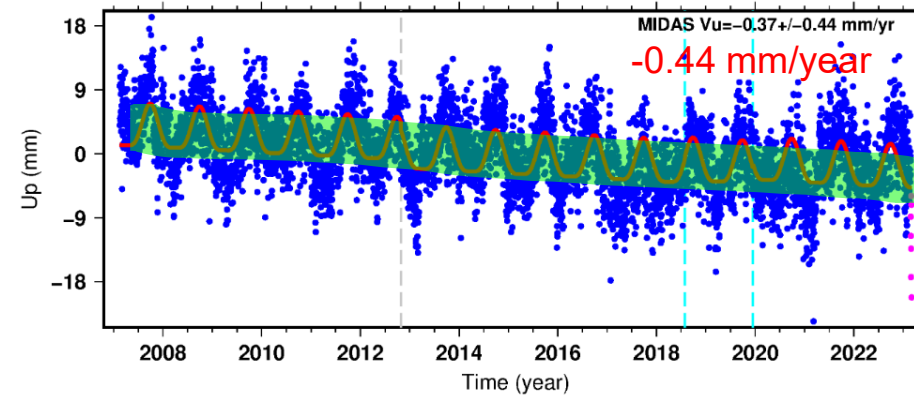
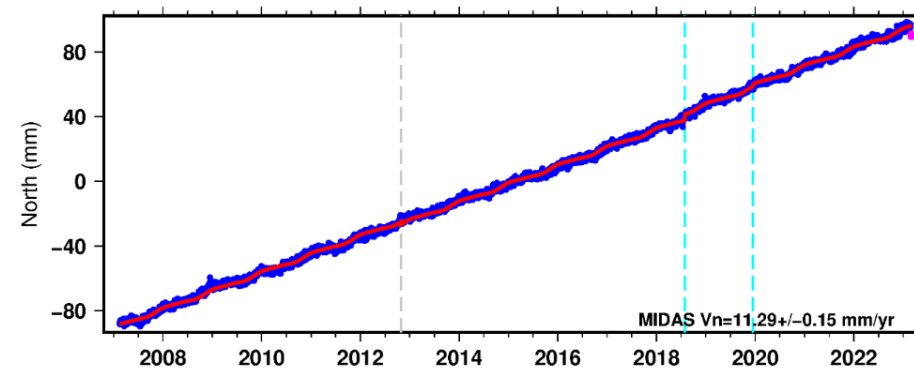
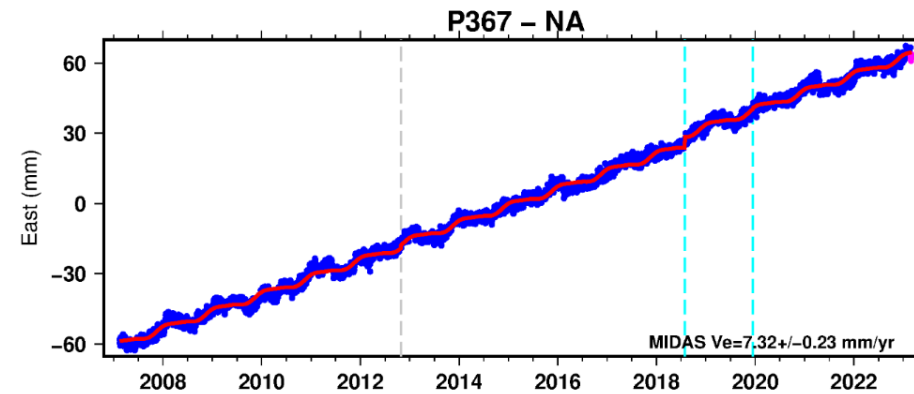
ORSB



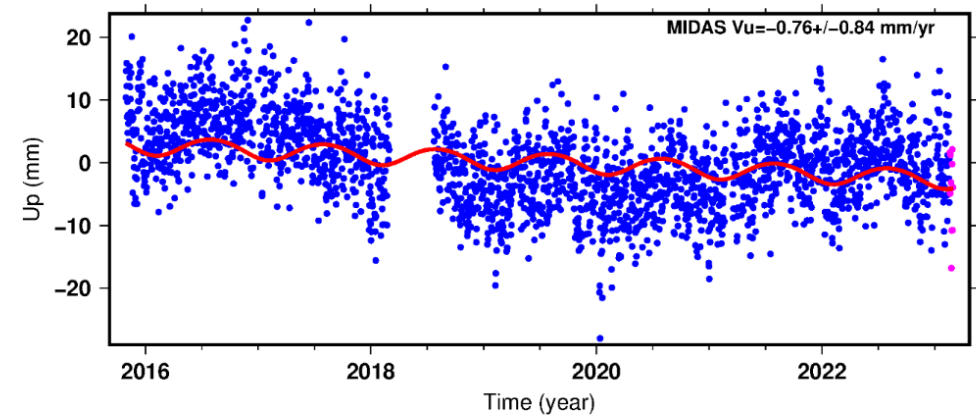
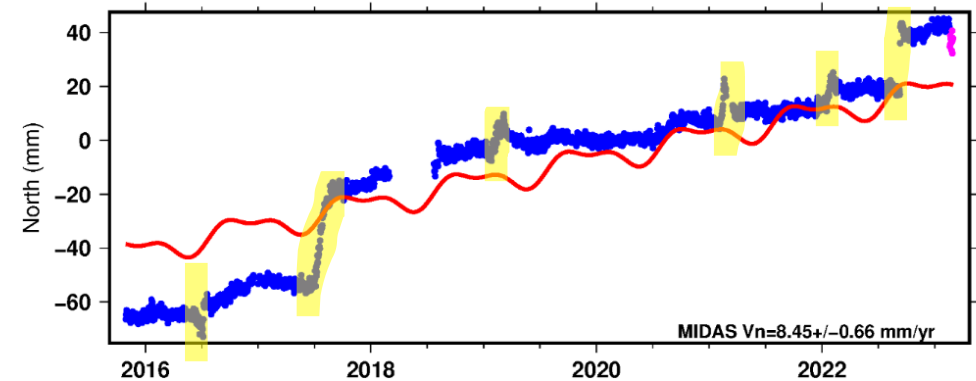
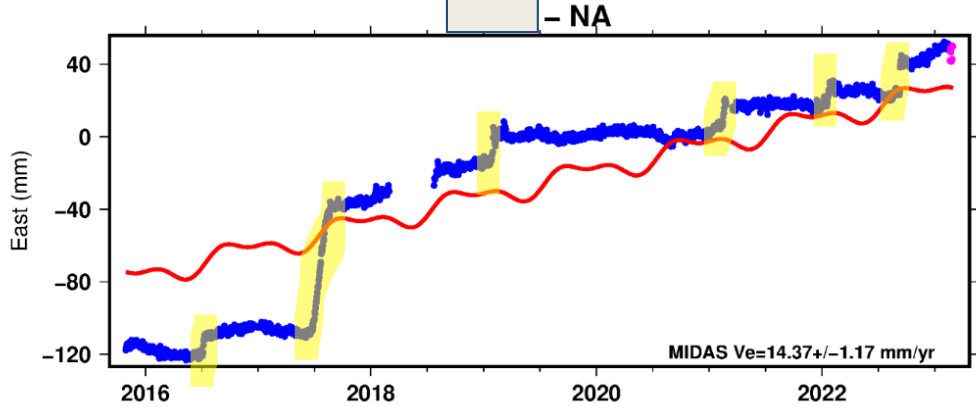
P367



24 Hour Positions Using Final Orbits (blue) and Rapid Orbits (magenta).  
Processed by the Nevada Geodetic Laboratory.  
Plotted on 2023-Mar-5. Last data on 2021-Apr-28.



24 Hour Positions Using Final Orbits (blue) and Rapid Orbits (magenta).  
Processed by the Nevada Geodetic Laboratory.  
Plotted on 2023-Mar-5. Last data on 2023-Mar-04.



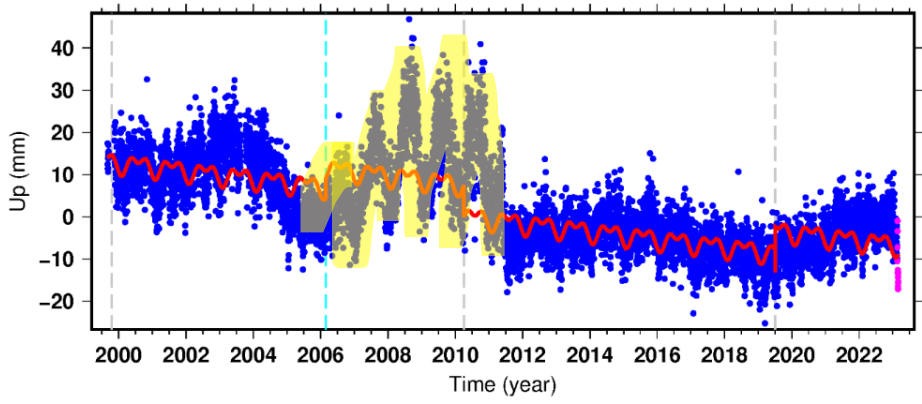
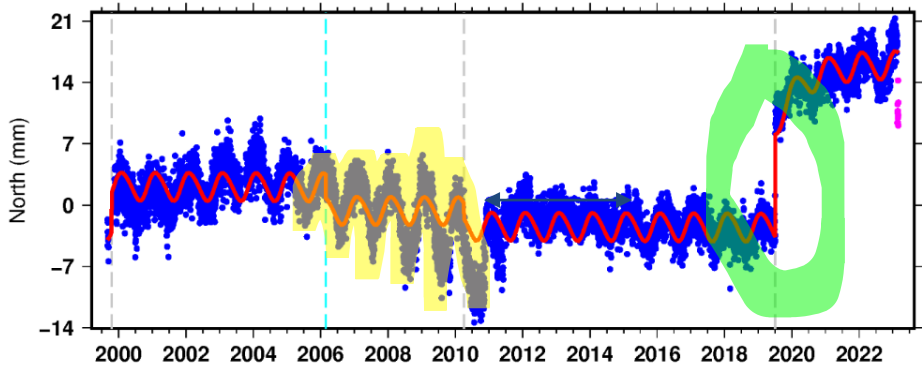
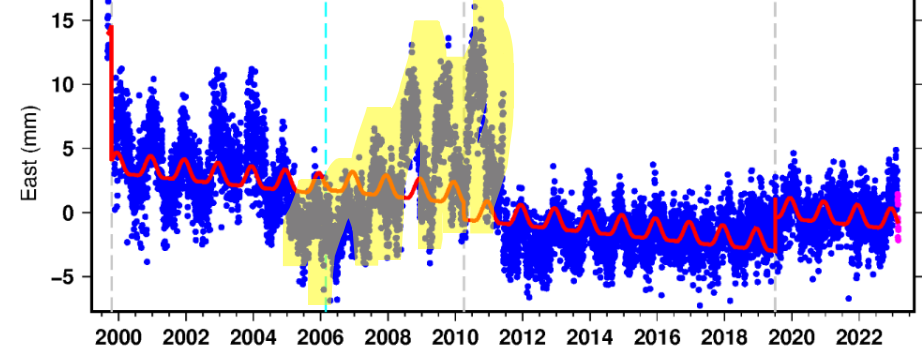
24 Hour Positions Using Final Orbits (blue) and Rapid Orbits (magenta).  
 Processed by the Nevada Geodetic Laboratory.  
 Plotted on 2023-Mar-2. Last data on 2023-Mar-01.





# CORS Operation and Maintenance Best Practices

# CHMS - IGS14 - Detrended



1999



2006



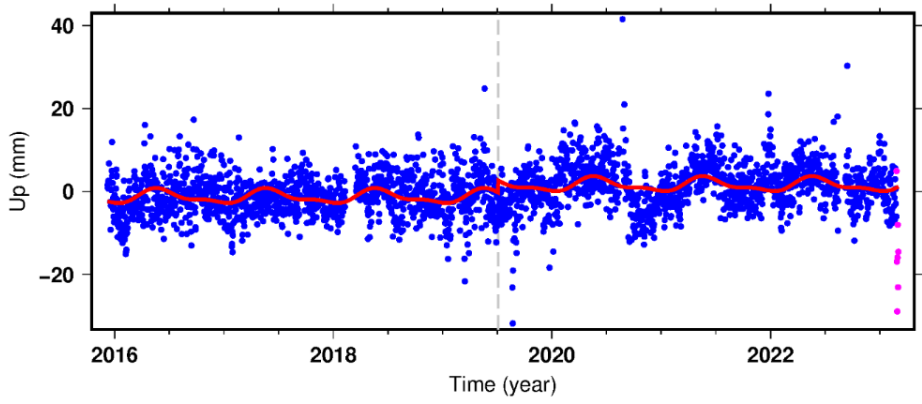
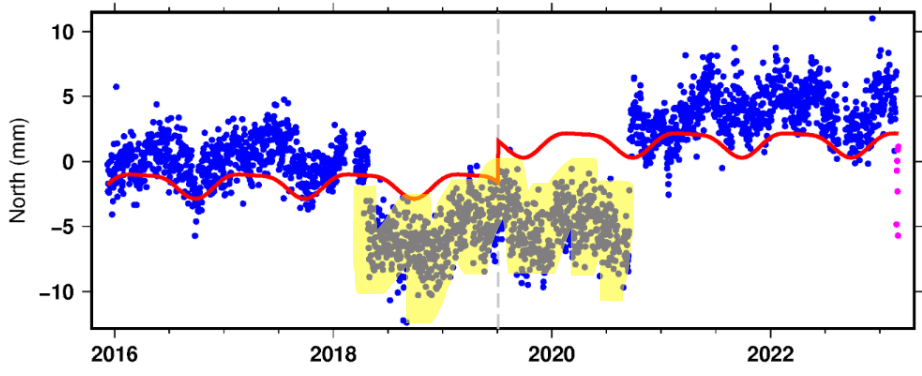
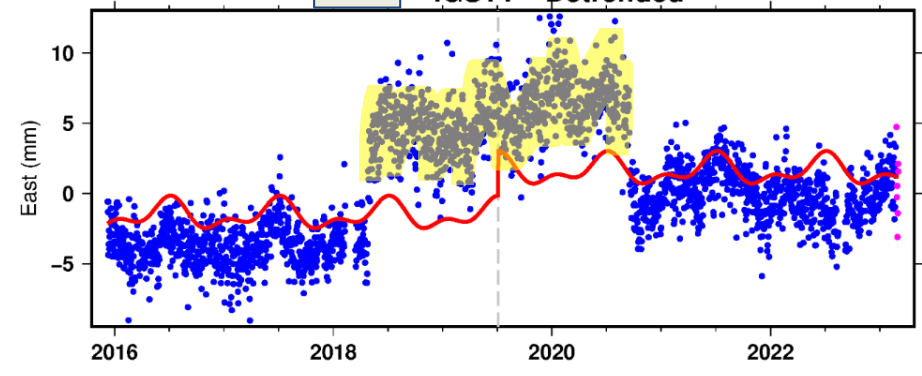
2009



24 Hour Positions Using Final Orbits (blue) and Rapid Orbits (magenta).  
Processed by the Nevada Geodetic Laboratory.  
Plotted on 2023-Mar-3. Last data on 2023-Mar-02.



- IGS14 - Detrended



24 Hour Positions Using Final Orbits (blue) and Rapid Orbits (magenta).  
 Processed by the Nevada Geodetic Laboratory.  
 Plotted on 2023-Mar-5. Last data on 2023-Mar-04.



August 2020



March 2022



You are here: home > data > gnssir >

GNSS-IR Portal

- Portal homepage
- Site map
- Site list
- Site page example (Newlyn)
- Other useful files

About GNSS-IR

- Introduction
- Processing procedures
- Data file format
- Metadata explanation
- GNSS shadow widget

Example Notebooks

- What's in the file?
- Calculating daily means

Donate

Donate to PSMSL

# Puerto Peñasco

Information

ID: 10317  
 IGS type code: tnpp  
 Latitude: 31.335520°  
 Longitude: -113.631640°  
 Ellipsoidal Height: 27.641 m  
 Ellipsoidal Height Epoch: 2017.0000  
 Reflector Height: 62.713 m  
 Provider: UNAVCO  
 Alternative Providers:  
 SONEL Link: tnpp  
 NGL Link:

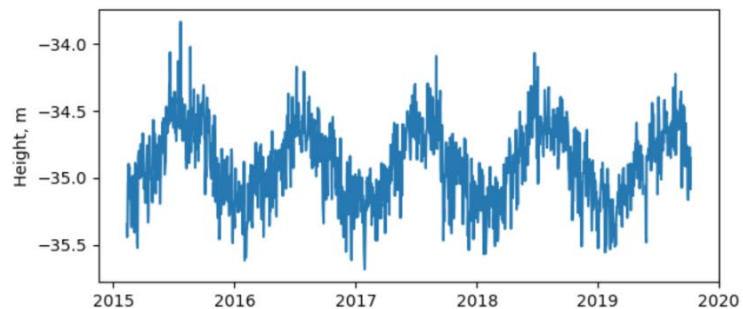


GNSS Receiver  
 Mask used

Data

Zipped data file

Plot of daily data



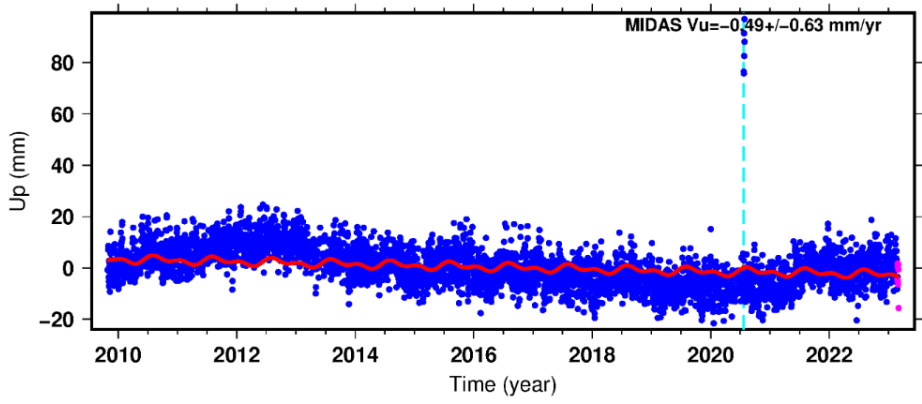
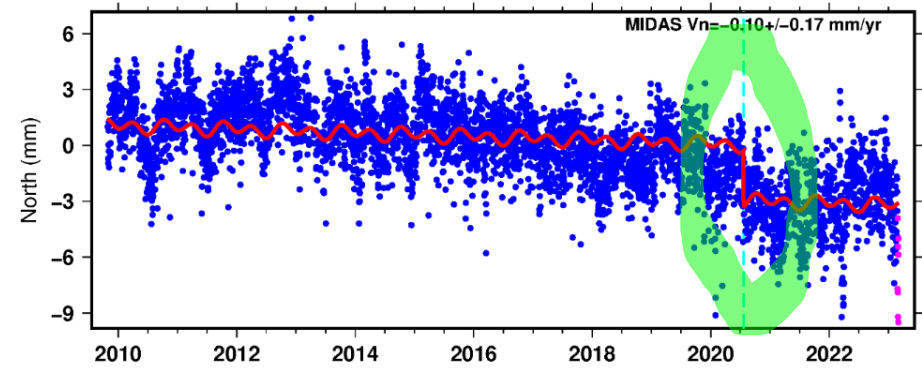
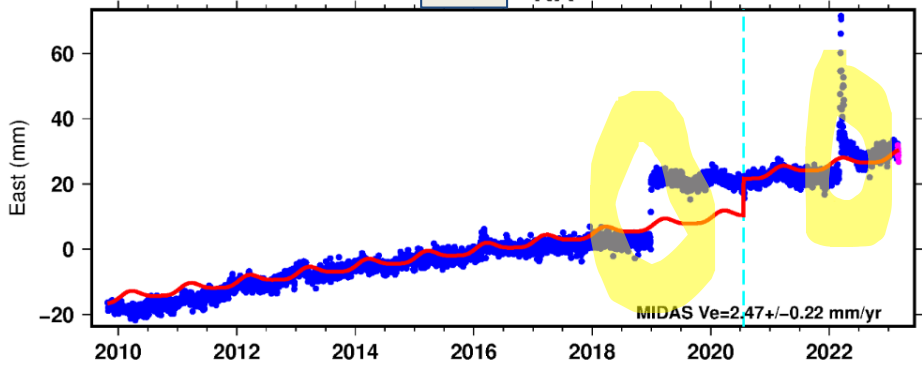
Blue: GNSS-IR Data, Orange: Nearby tide gauge data

Inventory





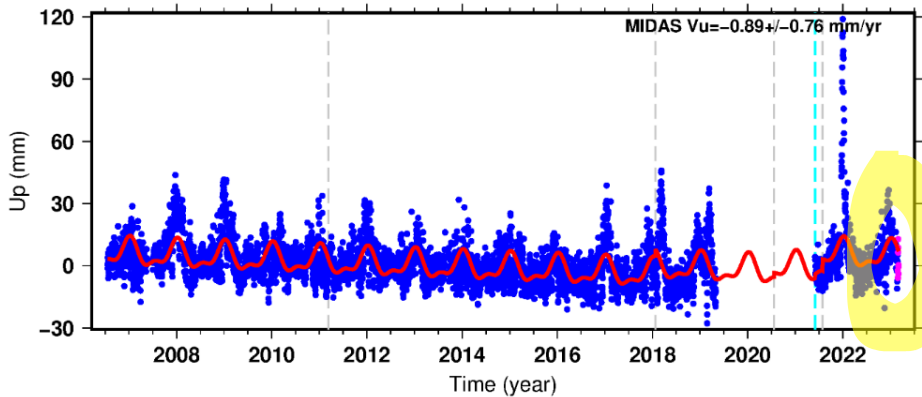
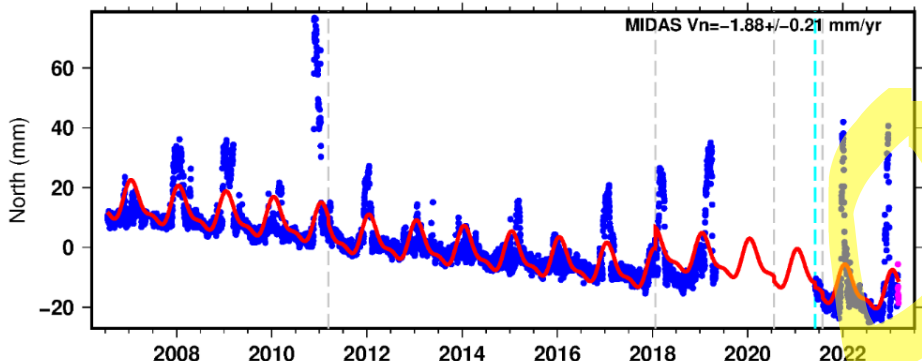
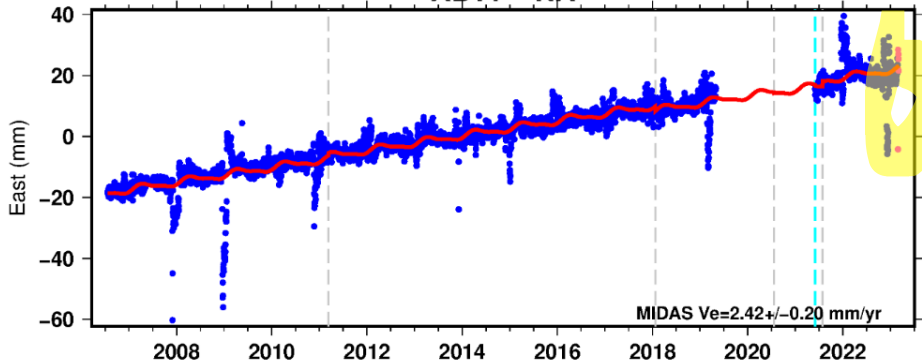
- NA



24 Hour Positions Using Final Orbits (blue) and Rapid Orbits (magenta).  
 Processed by the Nevada Geodetic Laboratory.  
 Plotted on 2023-Mar-6. Last data on 2023-Mar-05.



# AB11 - NA



24 Hour Positions Using Final Orbits (blue) and Rapid Orbits (magenta).  
 Processed by the Nevada Geodetic Laboratory.  
 Plotted on 2023-Mar-6. Last data on 2023-Mar-05.









Date & Time: Thu, Feb 23, 2023 at 16:05:09 MST

Position: +032.173679° / -104.454983° ( $\pm 5.0\text{m}$ )

Altitude: 1371m ( $\pm 3.0\text{m}$ )

Datum: WGS-84

Azimuth/Bearing: 357° N03W 6347mils True ( $\pm 12^\circ$ )

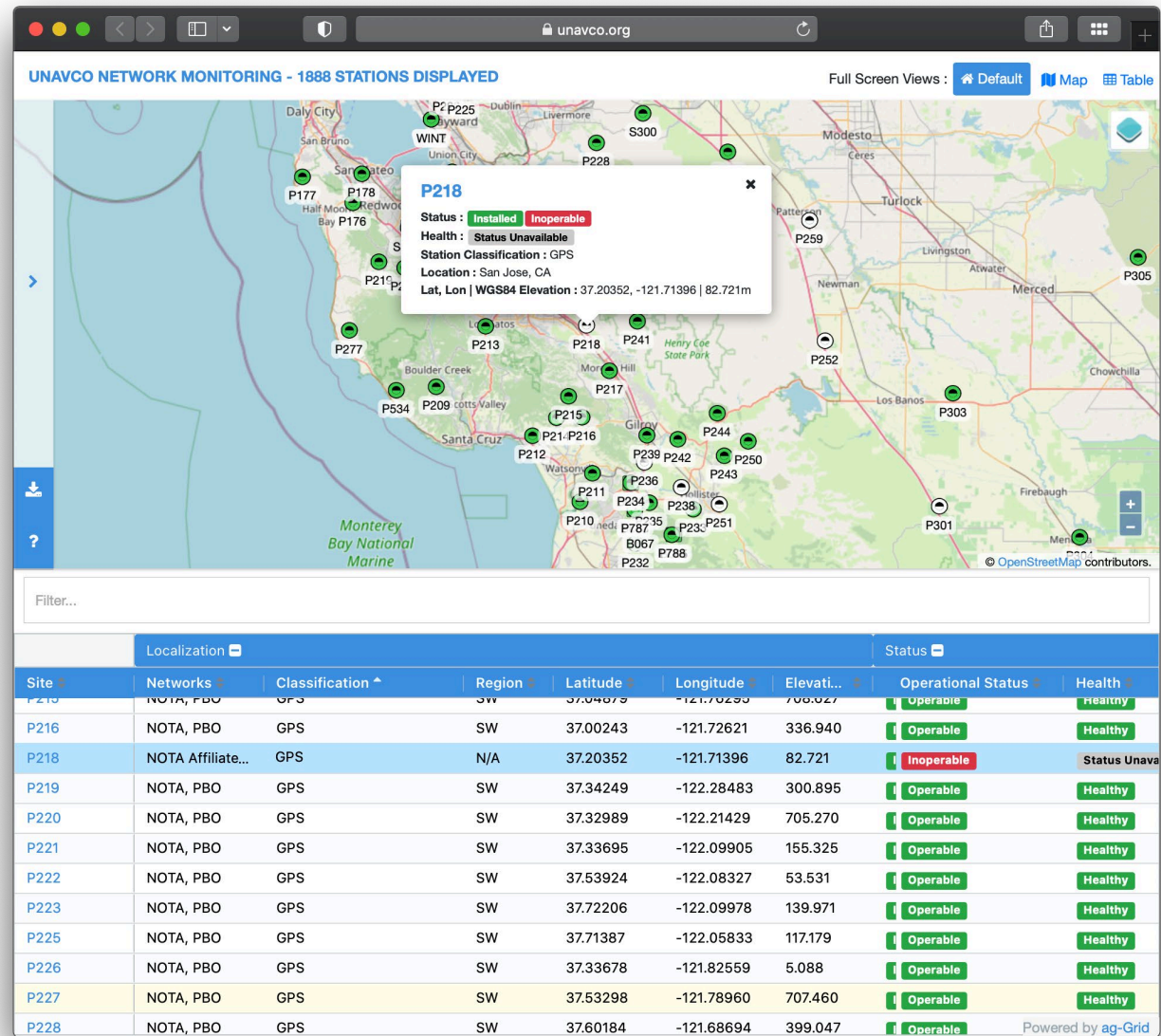
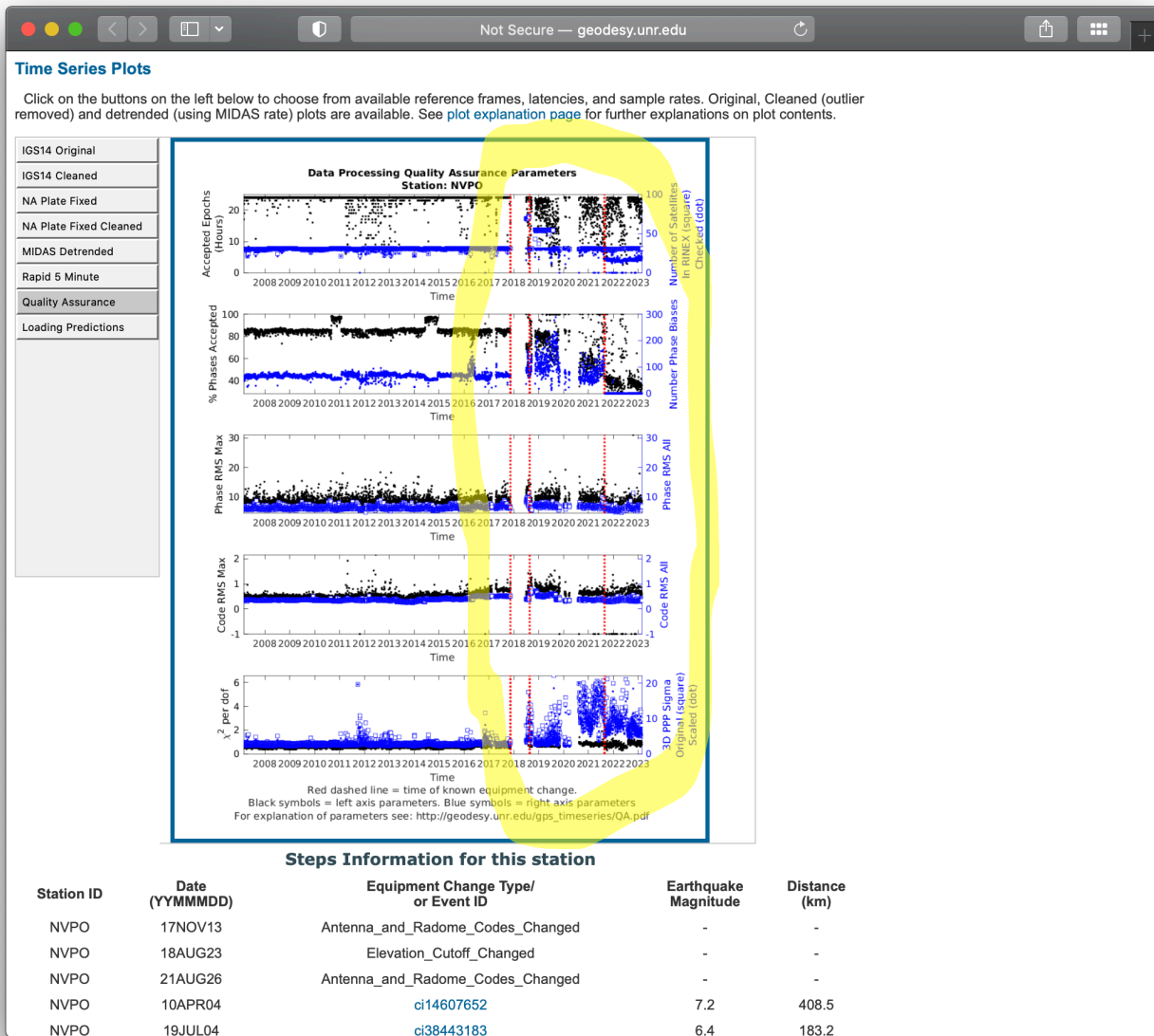
Elevation Angle:  $-11.4^\circ$

Horizon Angle:  $-00.2^\circ$

Zoom: 0.5X

Tick marks every  $5^\circ$







North Carolina, 2022



Michigan, 2022



Arizona, 2022



Florida, 2023



New Mexico, 2023

[john.galetzka@noaa.gov](mailto:john.galetzka@noaa.gov)  
[ngs.cors@noaa.gov](mailto:ngs.cors@noaa.gov)