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INTRODUCTION TO GNSS AND GNSS-IR : DATA AND APPLICATIONS

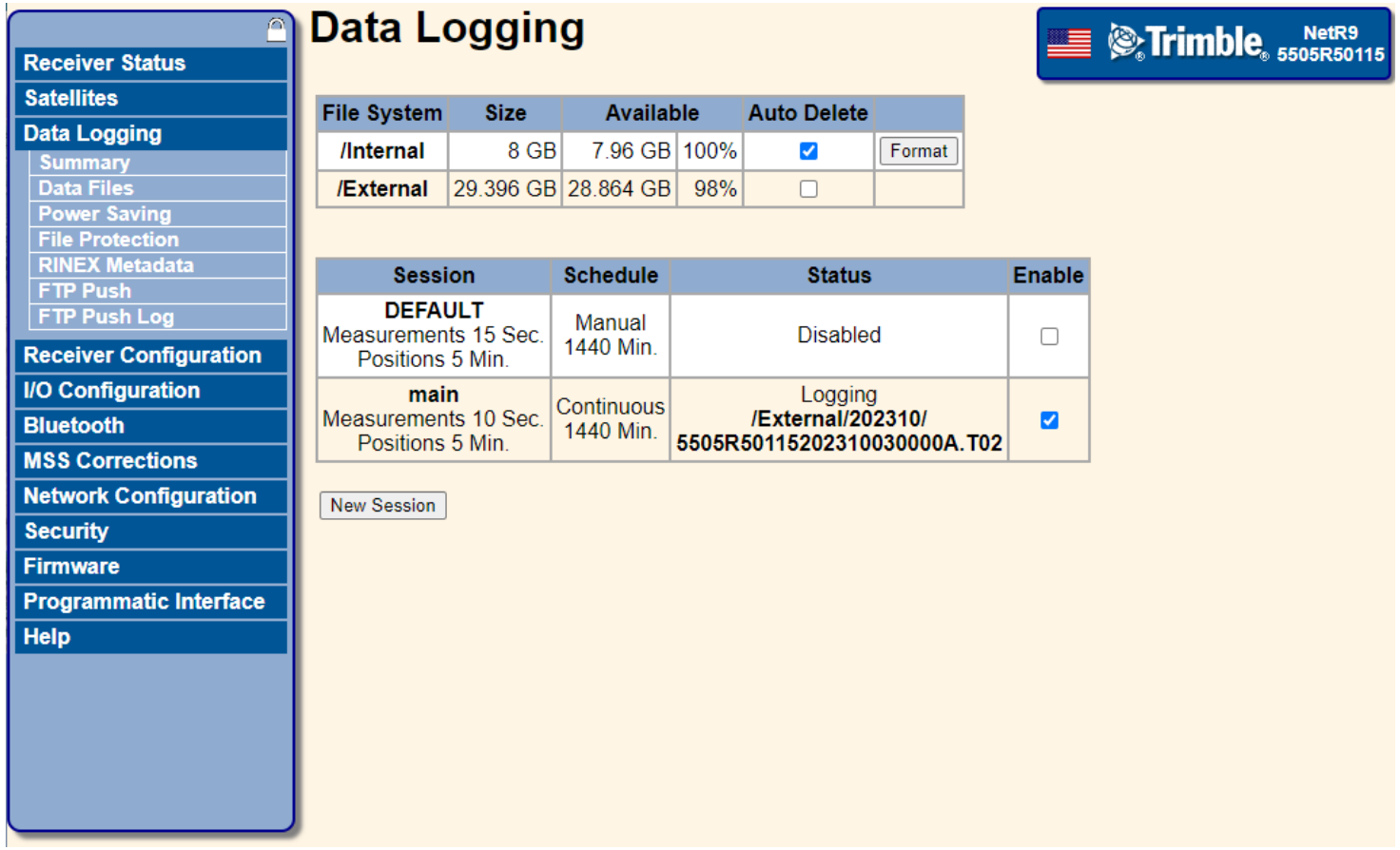
In addition to the radar gauge [3] the portagauge also has a geodetic quality GNSS unit [Trimble Alloy] and GNSS Antenna [1].

The primary purpose of the GNSS system is to record the position of the system and measure the stability of the system over time

The instructions for connecting with the Trimble are in the Portagauge installation and operations instructions

A secondary operations is as a secondary tide gauge channel using GNSS-IR if possible in the location

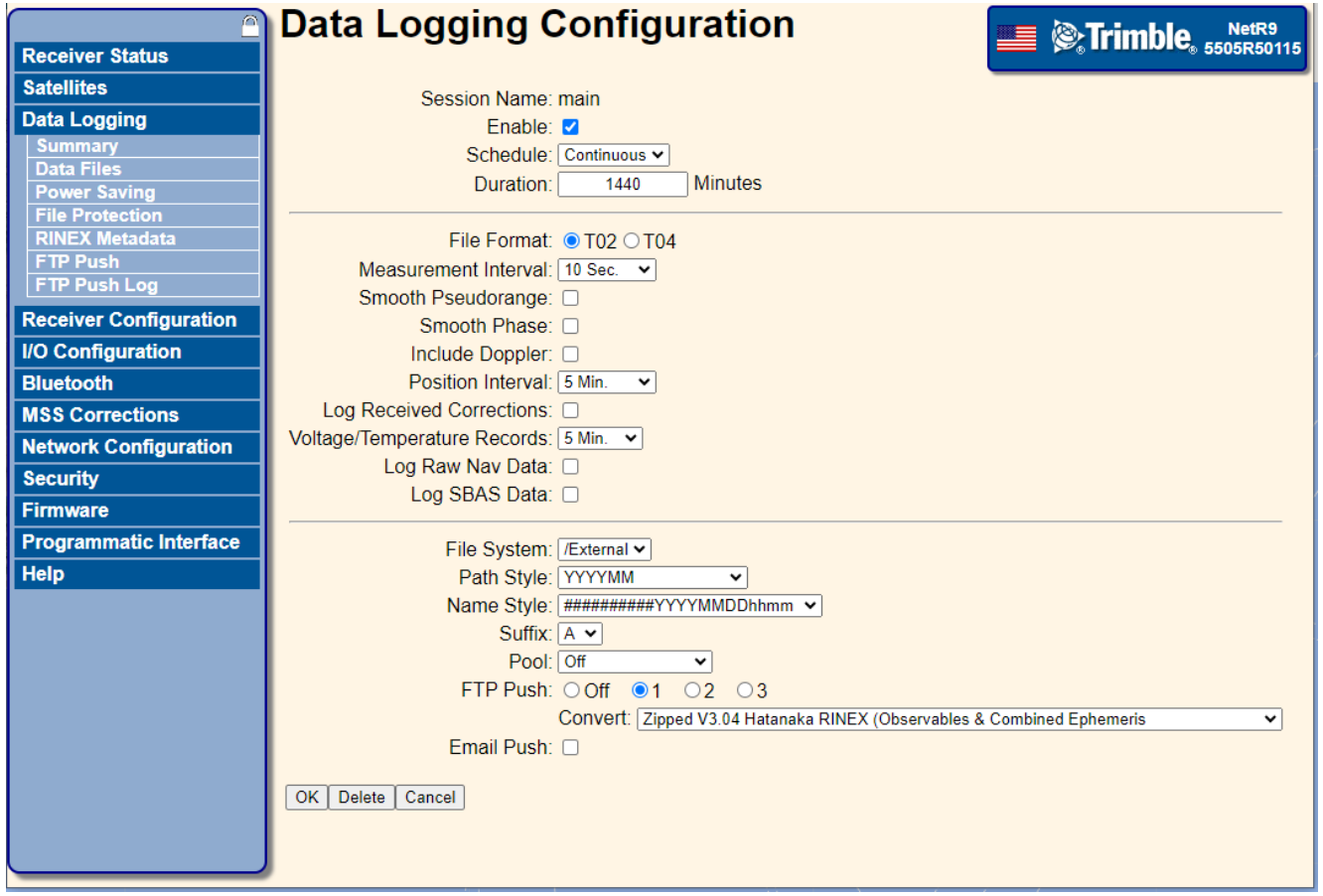
If you needed to access the Trimble via the built in web interface you will see something similar to this..



Note that this system is taking a measurement every 10 second continuously over 24 hours.

It stores it on the file system as a Trimble Native Binary file : T02

You might want to change the duration and measurement interval.



You get to that by clicking on the session name on the previous data logging page

Note here we are telling the ftp system to push

Zipped V3.04 Hatanaka RINEX

THIS IS IMPORTANT IF YOU WANT THE DATA TO BE PROCESSED FOR POSITIONING AND GNSS-IR

You can convert afterwards but this is the easiest option

DOWNLOAD GNSS DATA FROM PORTAGAUGE

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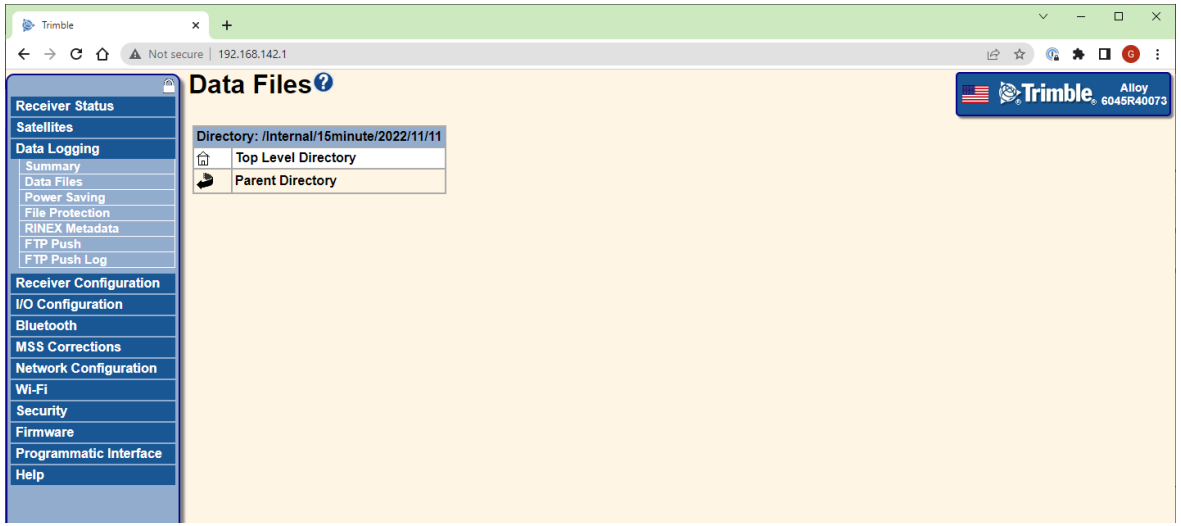
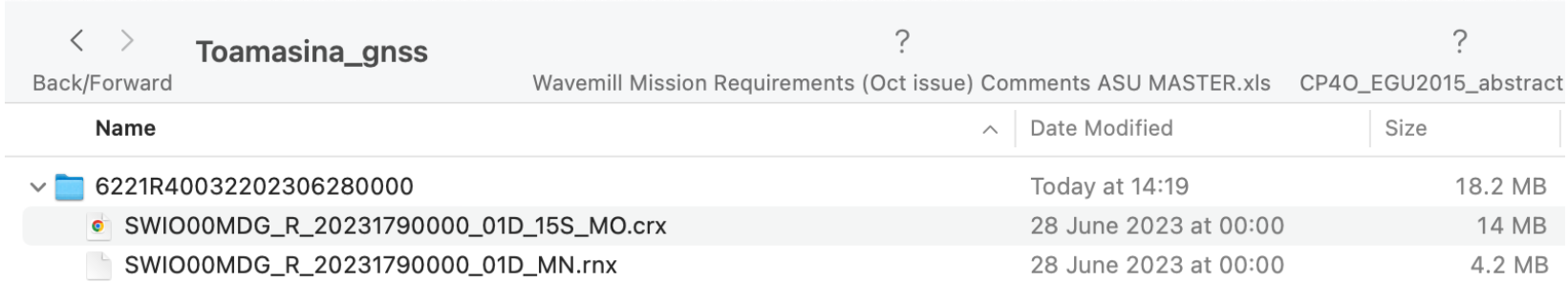
- Either using wifi or ethernet cable



Identify the wanted files (named *6221R40032<YYYYMMDD>0000*) and transfer to laptop

DOWNLOAD GNSS DATA FROM PORTAGAUGE

- Either using wifi or ethernet cable
- Downloaded files should be 6221R40032<YYYYMMDD>0000
  - Inside SWIO00MDG_R_YYYYDDD0000_01D_15S_MO.crx and SWIO00MDG_R_YYYYDDD0000_01D_MN.rnx



HOW DO I GET DAILY POSITION DATA (E.G. FOR LAND MOVEMENT)?

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RINEX V3 files are the world standard for post-processing GNSS data.

There a many software packages available to process GNSS data

Some are commercial, some research grade and some hobbyist packages

Whatever software package you have to have some prior knowledge of GNSS positioning in order to get a "correct" result.

However there are also several on-line systems that do the work for you, such as

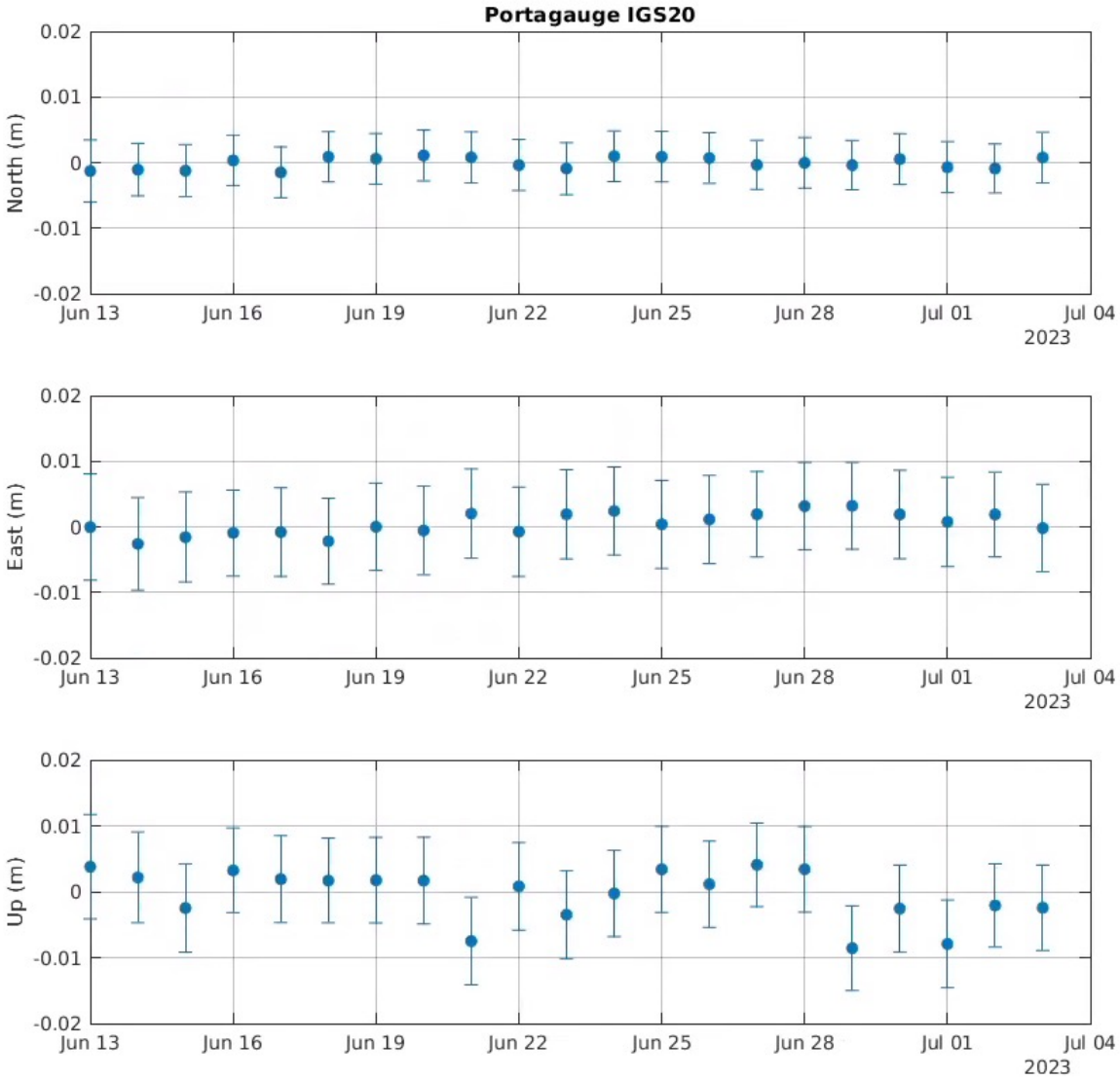
JPL APPS http://pppx.gdgps.net

AUSPOS http://gnss.ga.gov.au/auspos

CSRS-PPP https://webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/tools-outils/ppp.php

You generally just submit the RINEX file and your e-mail address and it returns the result

Canadian CSRS-PPP system



Processing mode

Static Kinematic

NAD83 ITRF

- The epoch will be the same as the GPS data.
- A UTM zone will be calculated from the longitude.

You want it in Static mode and in ITRF

RINEX observation file(s), 300 MB max (.zip, .gz, .Z, .tar, .??O)

Note: You may submit multiple RINEX files in a single .zip or .tar archive

Choose File No file chosen

PROCESSING GNSS FILES USING CANADIAN SYSTEM: CSRS-PPP

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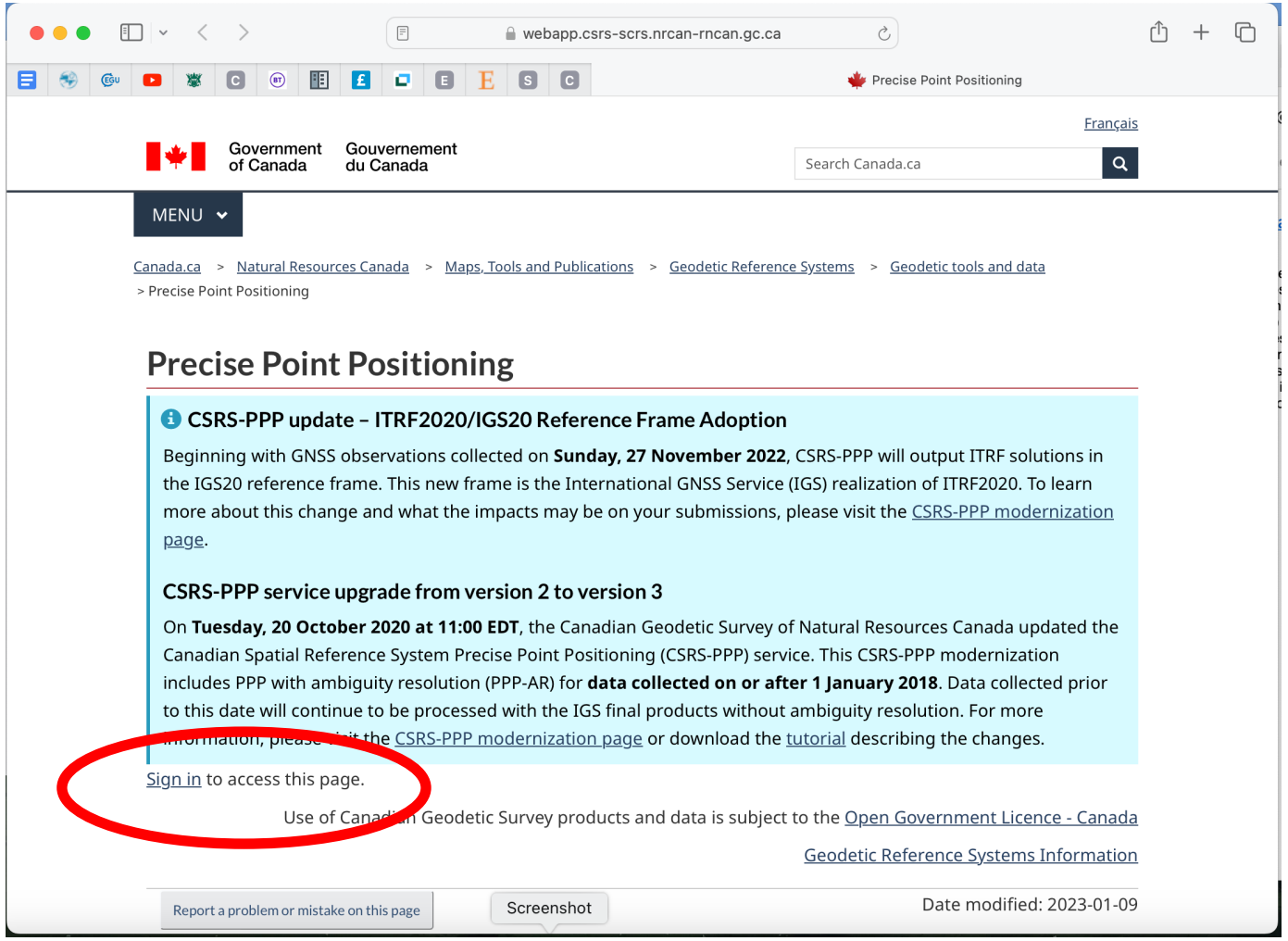
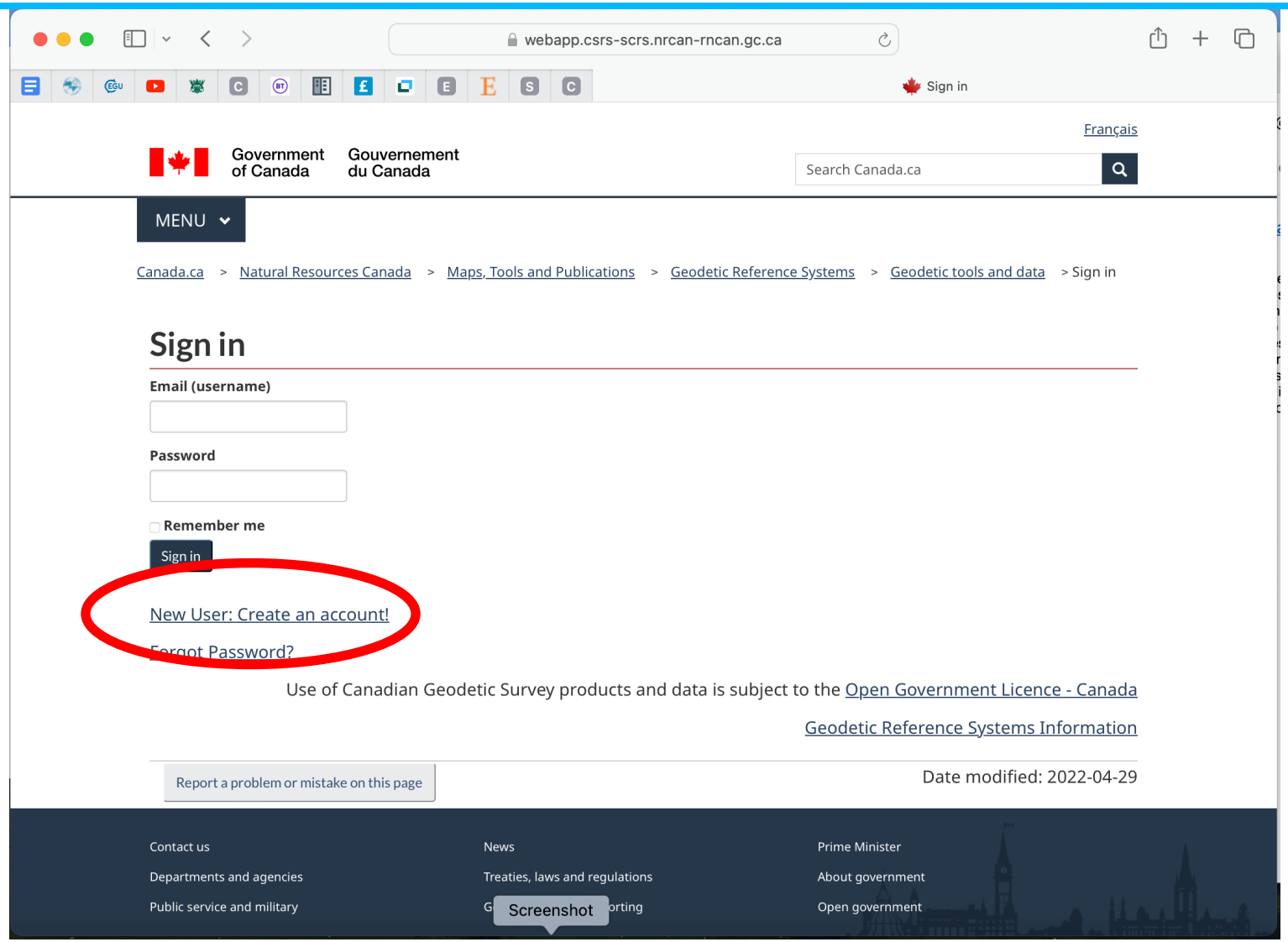
- https://webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/tools-outils/ppp.php
- NB – you can choose to select French Language option!
- Click on “Sign in to access this page”



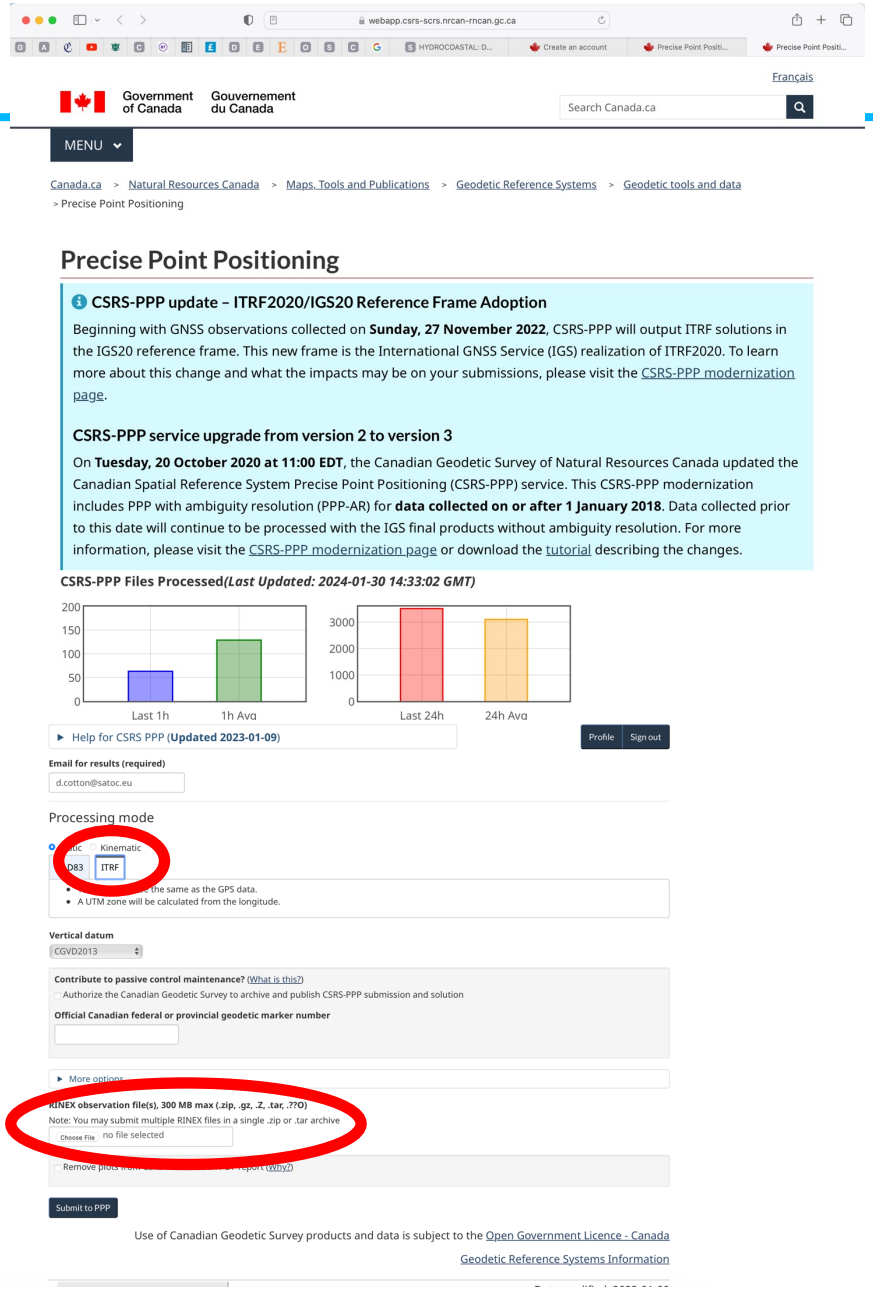
PROCESSING GNSS FILES CONT. (2)

- New User: Create an account!
  - enter details and submit
  - receive email with link to activate your account



PROCESSING GNSS FILES CONT. (3)

- Sign in
- Under “Access the tools”, click on Canadian Spatial Reference System Precise Point Positioning (???? – check)
- Scroll down
  - Click on ITRF
  - Under “RINEX observation file(s) – choose file to upload from your laptop
  - Click on Submit to PPP
- Wait for email with results



PROCESSING GNSS FILES CONT. (4)

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Do Not Reply / Ne Pas Répondre <DoNotReply-NePasRepondre@nrcan-rncan.gc.ca> Inbox - mac pop account
CSRS-PPP SPARK Results for SWIO00MDG_R_20231790000_01D_15S_MO
To: Home <d.cotton@satoc.eu>

CSRS-PPP SPARK Latest update: **2023-01-09**
CSRS-PPP SPARK Latest news

Software Version: **3.54.2**

CSRS-PPP SPARK Results for **SWIO00MDG_R_20231790000_01D_15S_MO.crx.gz** full_output.zip

SWIO00MDG_R_20231790000_01D_15S_MO.crx summary graphics residuals *GPS & GLONASS NRCan/IGS Final*

Warning : Your high-rate static dataset has been decimated to 30 seconds. For more information, please visit the CSRS-PPP update page

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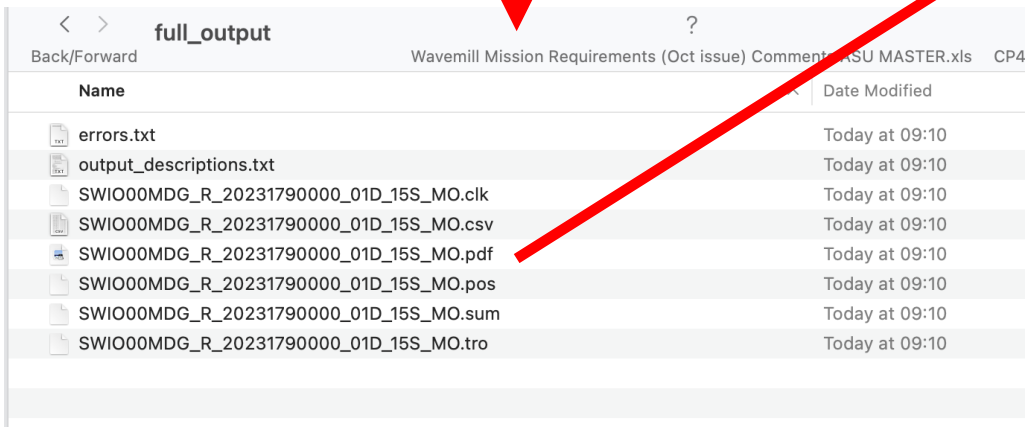
To contact us
geodeticinformation-informationgeodesique@nrcan-rncan.gc.ca



CSRS-PPP 3.54.2 (2022-11-10)

SWIO00MDG_R_20231790000_01D_15S_MO.rnx
SWIO00MDG

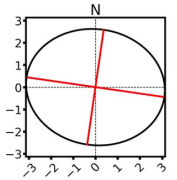
Data Start	Data End	Duration of Observations
2023-06-28 00:00:00.00	2023-06-28 23:59:30.00	23:59:30
Processing Time		**Product Type**
14:10:47 UTC 2024/01/30		NRCan/IGS Final
Observations	**Frequency**	**Mode**
Phase and Code	Double	Static
Elevation Cut-Off	**Rejected Epochs** / **Fixed Ambiguities**	**Estimation Steps**
7.5 degrees	0.00 % / 99.20 %	30.00 sec
Antenna Model	**APC to ARP**	**ARP to Marker**
TRM57971.00 NONE	L1 = 0.064 m L2 = 0.058 m	H:0.000m / E:0.000m / N:0.000m

(APC = antenna phase center; ARP = antenna reference point)

Estimated Position for SWIO00MDG_R_20231790000_01D_15S_MO.rnx

	Latitude (+n)	Longitude (+e)	Ell. Height
ITRF20 (2023.5)	-18° 9' 26.00982"	49° 25' 27.37289"	-4.316 m
Sigmas(95%)	0.002 m	0.003 m	0.010 m
A priori*	-18° 9' 26.00200"	49° 25' 27.34829"	-5.877 m
Estimated – A priori	-0.240 m	0.723 m	1.561 m

95% Error Ellipse (mm)
semi-major: 3 mm
semi-minor: 3 mm
semi-major azimuth: -81° 10' 24.99"



UTM (South)
Zone 39

7991705.190 m (N)
333320.527 m (E)

Scale Factors
0.99994348 (point)
0.99994416 (combined)

*(Coordinates from RINEX header used as a priori position)

GNSS-INTERFEROMETRIC REFLECTOMETRY (GNSS-IR)

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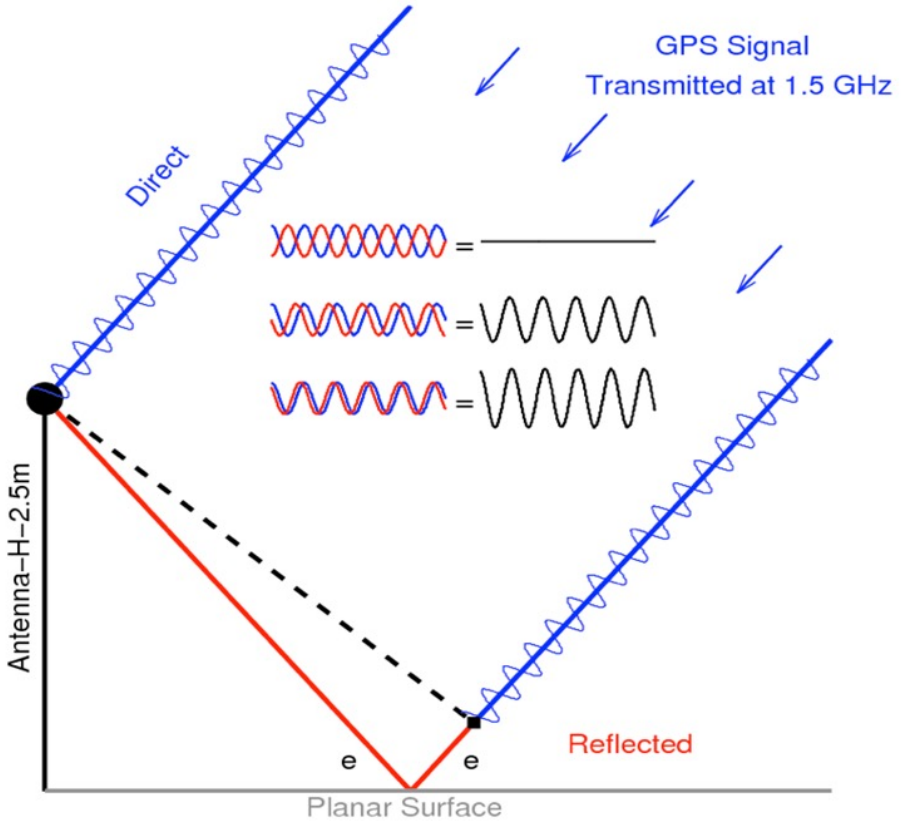


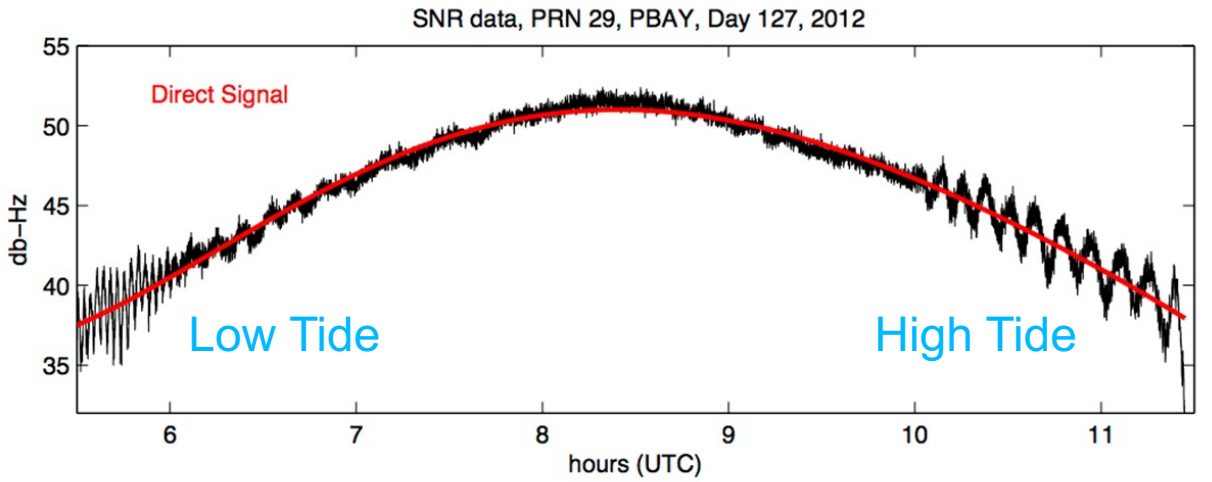
GNSS signals suffer from reflections from surfaces near to the antenna. This is called multipath and interference occurs between the direct and reflected signal

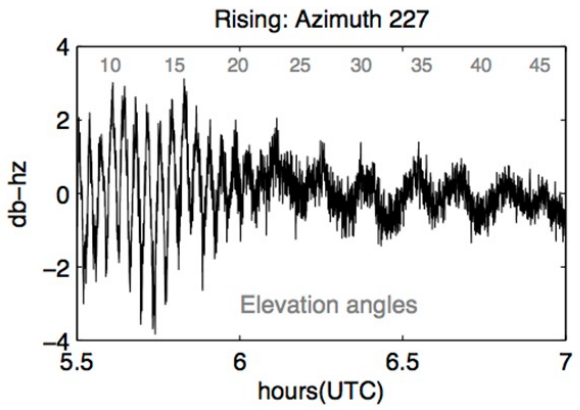
If we understand the interference effects on the signal for instance when the reflection is off a flat surface such as a body of water then we can use this to extract information about these surfaces.

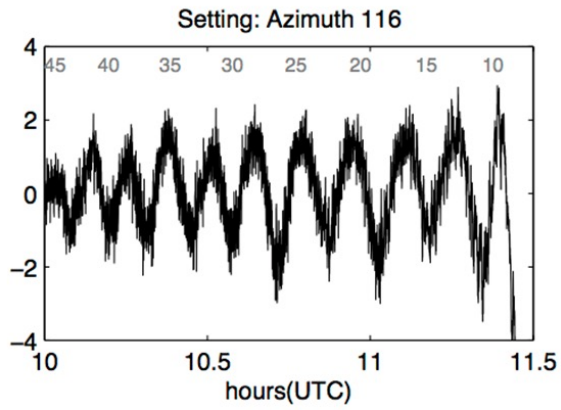
Therefore we can measure the height of the antenna above the water

GNSS-INTERFEROMETRIC REFLECTOMETRY (GNSS-IR)

National Oceanography Centre







GNSS-IR from the Portagauge at Toamasina

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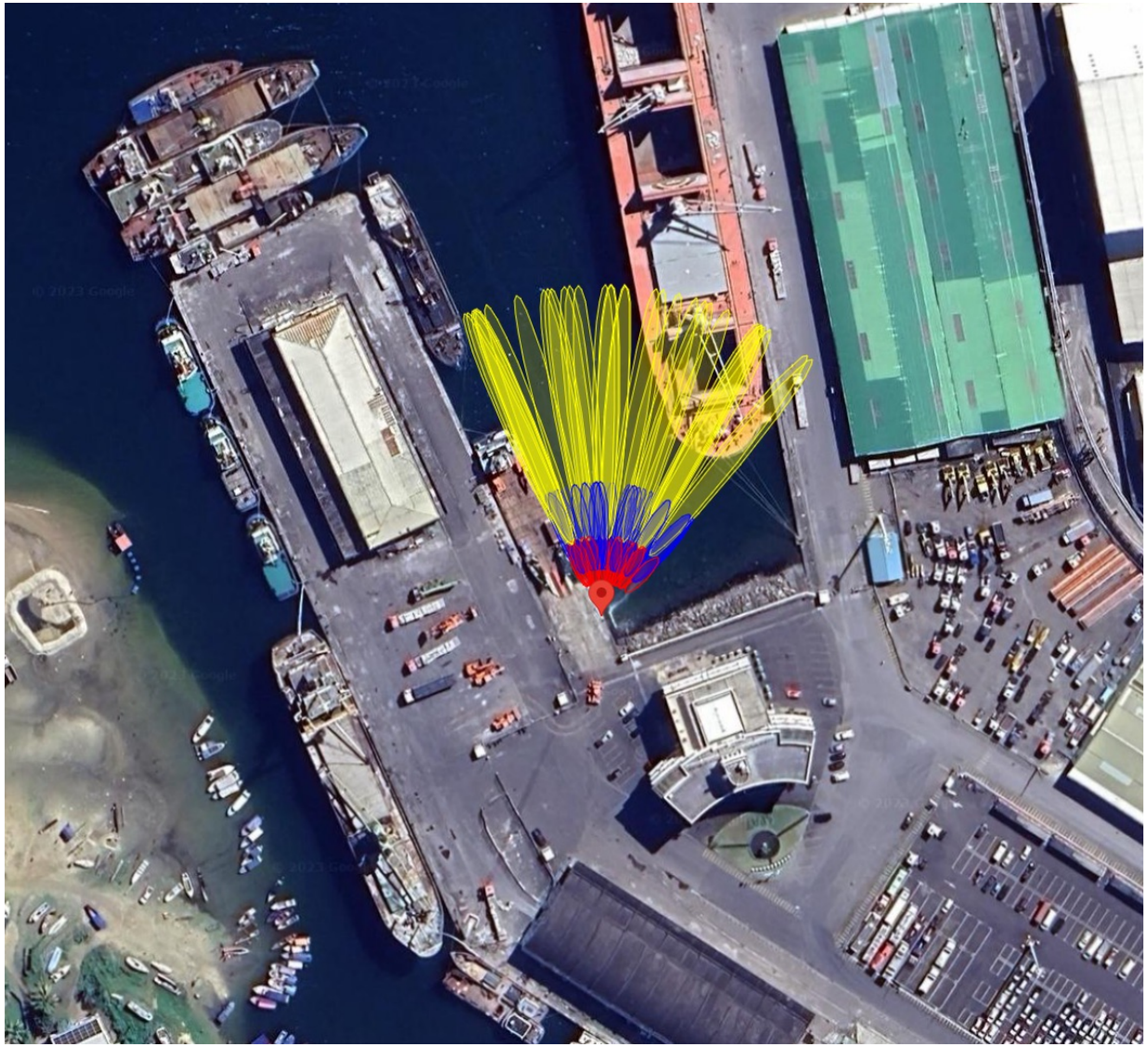

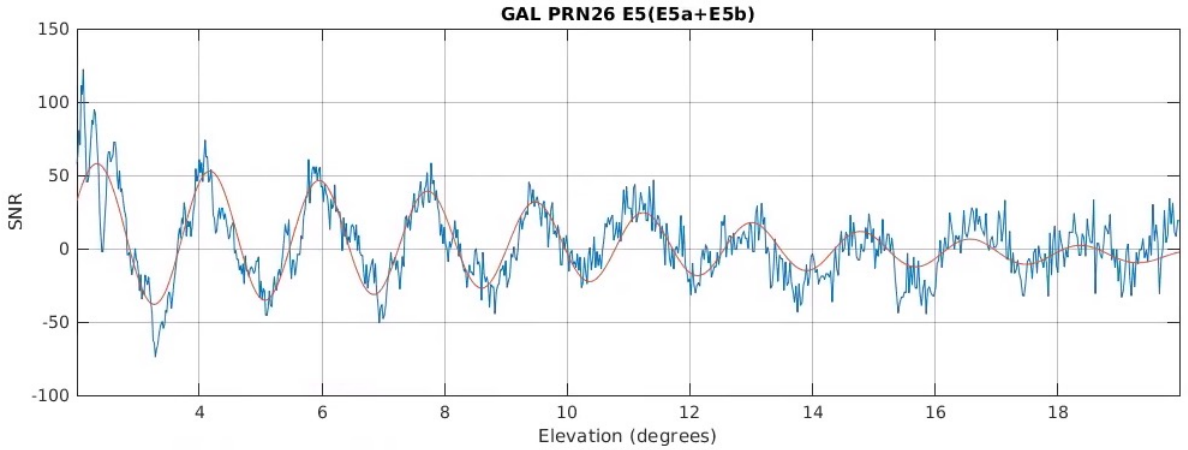

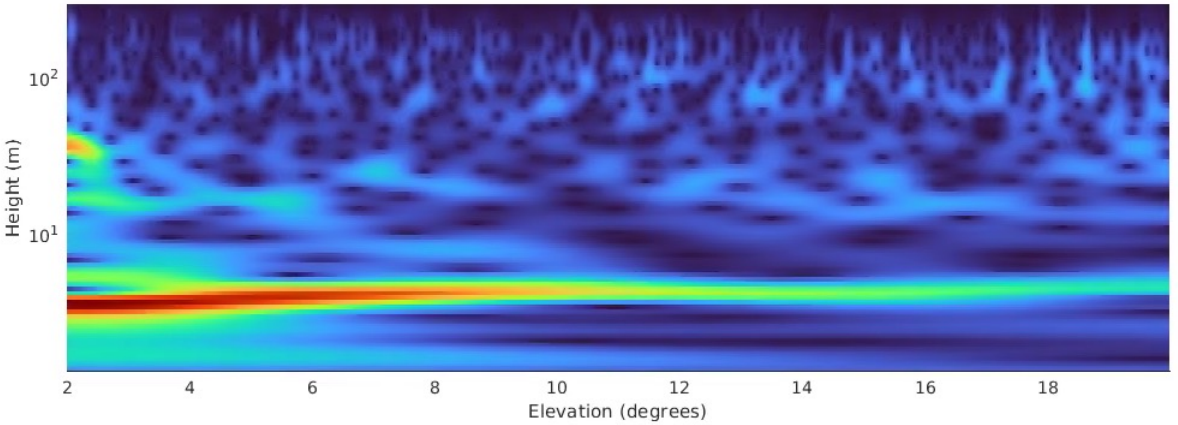

GNSS-IR from the Portagauge at Toamasina

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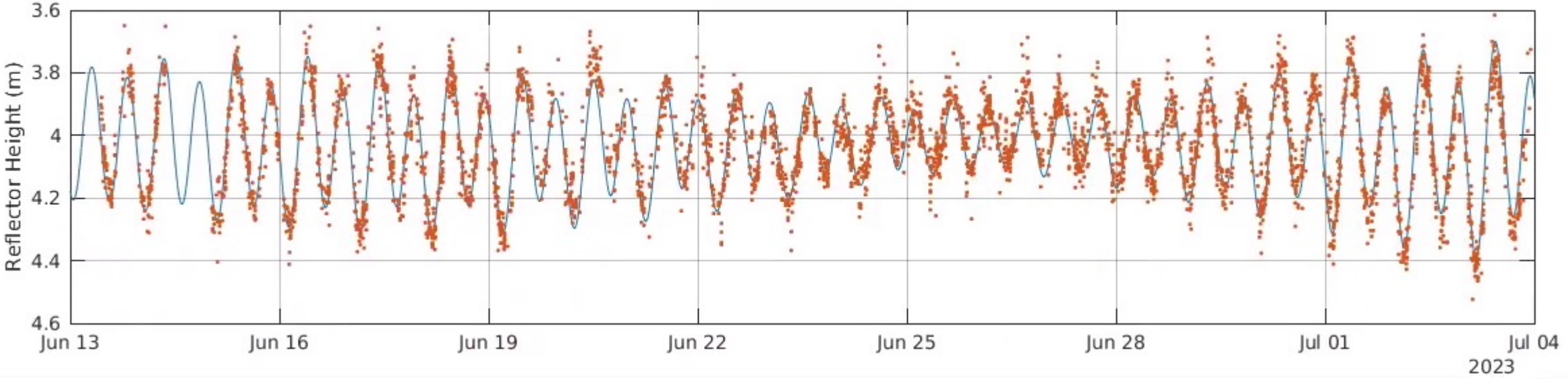
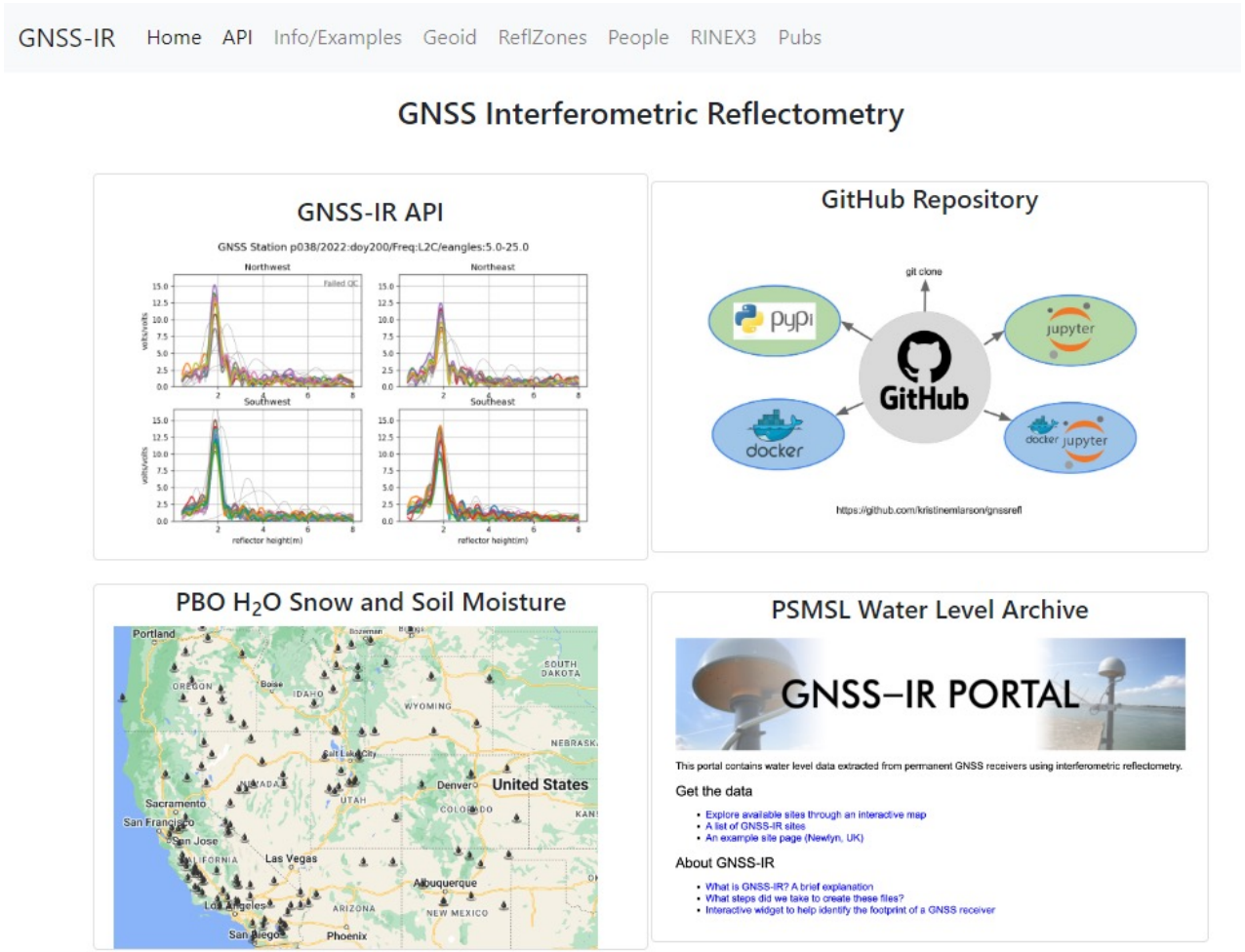
Results from 21 days….

Black line is from a tidal prediction



GNSS-IR



GNSS-IR is still very much “in development” but if you want more information and software then the best web site is

https://gnss-reflections.org/

There is software (python based), a link to the GNSS-IR portal at PSMSL, and examples and links

This link

https://www.earthscope.org/event/2023-gnss-ir-short-course/

Takes you to a course on GNSS-IR with presentations and videos

DIRECTLY DOWNLOADED FILES

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- Directly Downloaded files are in a different format and must be converted to RINEX
  - 6221R40032YYYYMMDDHHHH.T02

- You need to download the RINEX conversion utility
  - https://forms.trimble.com/support_trl.aspx?Nav=Collection-40773&pt=Trimble%20RINEX
  - After installation it advises you must install the Trimble Configuration Utility, but that is not needed

- Open Convert to RINEX Utility
  - On tools / options select default format to be RINEX 3.04, and select input folder
  - On File, click open
    - Then after it has read the file, click on convert.
    - There are 5 output files, only the .23o file is needed