



TRANSPORTATION SYMPOSIUM

2019

Comparing OPUS to FPRN for FDOT Project Control

George Massey and Ron Hanson

Upload Criteria

OPUS

Rinex v2, many raw formats, & compressed

L1 / L2 full wavelength

15 mins to 48 hrs of data

2 hrs for Primary Project Control

Multiple occupations

30 second epochs

10° elevation mask

GPS only



FPRN

Rinex v2, 3.02 & 3.03

L1 only or L1 / L2

1 min to 48 hrs of data

30 min for Primary Project Control

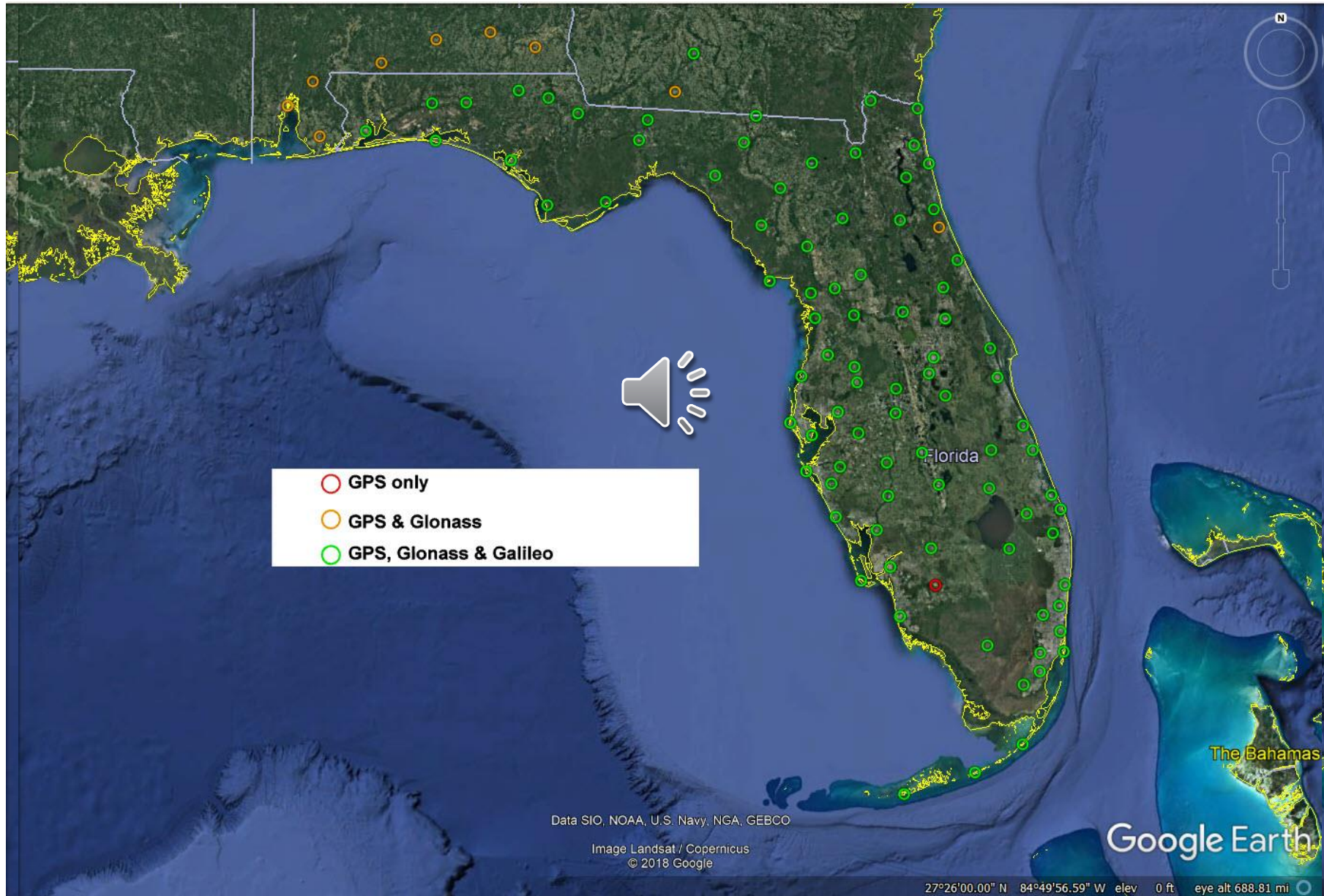
Multiple occupations

1 second epochs

10° elevation mask

GPS, Glonass, & Galileo

FNBS CORSS Stations



Processing

OPUS

Automatically detects suitable reference stations

Uses GPS only signals

Decimates data files to 30 second epochs

2 hr file length for Primary Project Control

Uses 3 reference stations for calculations

Published position is a weighted average of all 3

Ability to “share” your solution with others



FPRN

Automatically detects suitable reference stations

Automatically detects constellations used

Automatically detects observation rates


30 min file length for Primary Project Control

Uses 6 reference stations for calculations

Published position is a weighted average of all 6

Processing with OPUS


Processing using OPUS



OPUS: Online Positioning User Service

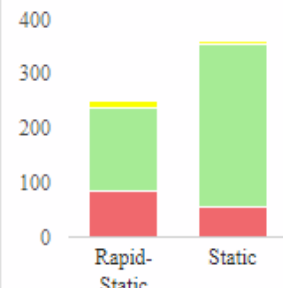
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OPUS Today
as of 2019-05-01T10:25 EDT

ITRF2014 frame now available in BETA

 **Try BETA OPUS** to preview the **new ITRF2014 frame** for **CORS**.

Upload your data file.
Solve your GPS position & tie it to the National Spatial Reference System.

What is OPUS? [FAQs](#)

No file chosen
*** data file** of dual-frequency GPS observations. [sample](#)

antenna - choosing wrong may degrade your accuracy.

meters above your mark.
antenna height of your antenna's reference point.

*** email address** - your solution will be sent here. [Privacy Act Statement](#)

to **customize** your solution.

for data 15 min. - 2 hrs. for data 2 hrs. - 48 hrs.

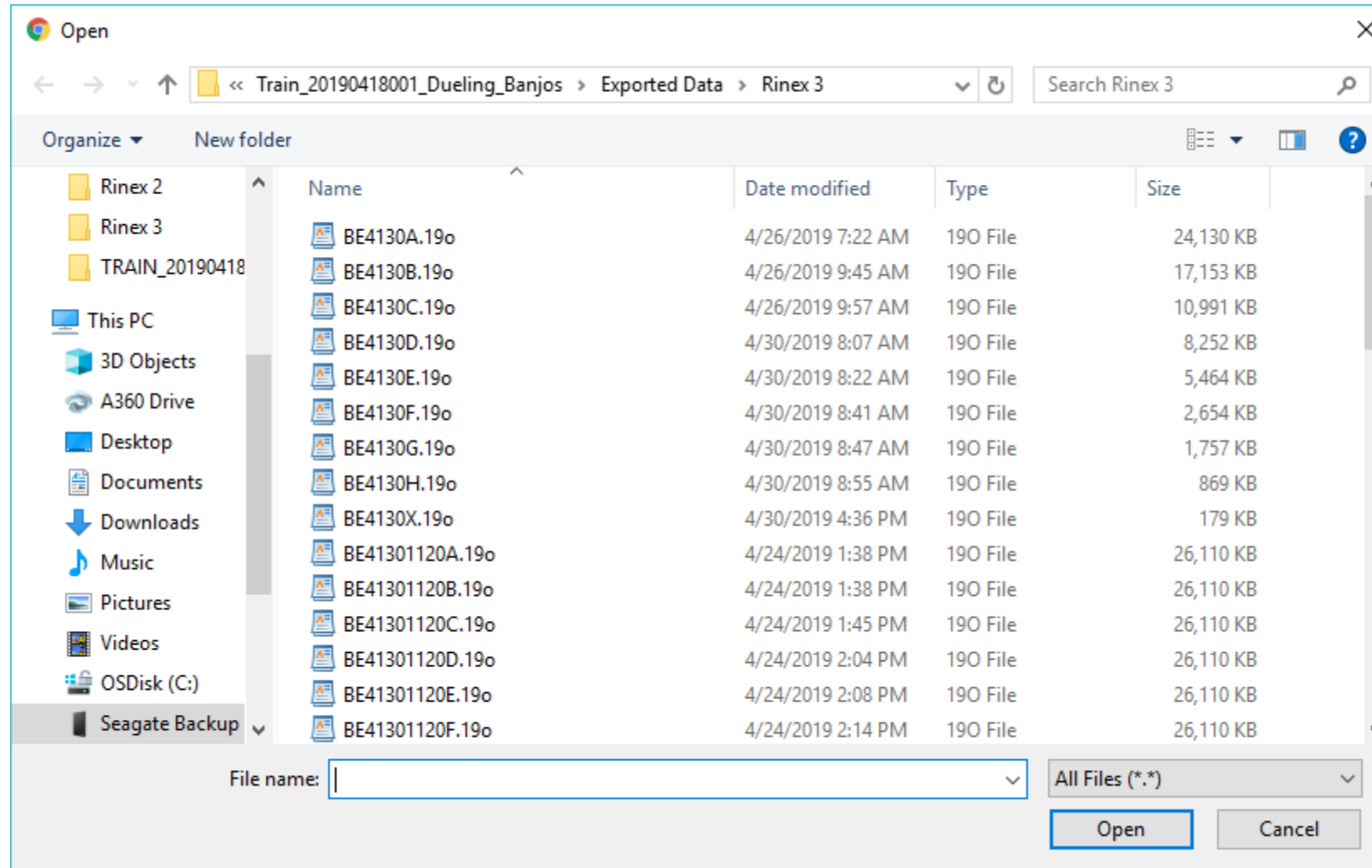
*** required fields**
We may use your data for internal evaluations of OPUS use, accuracy, or related research.

[sample solutions](#)


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Processing using OPUS




Processing using OPUS



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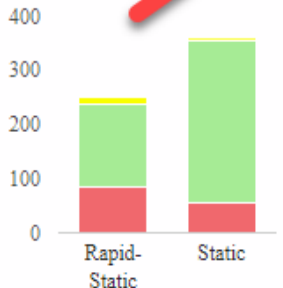
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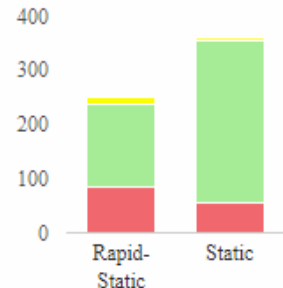
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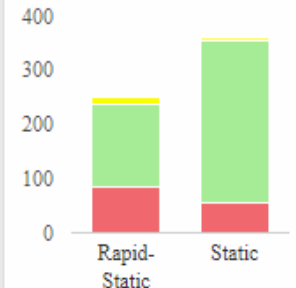
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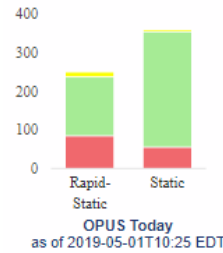
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to customize your solution.

formats

base stations

state plane your **SPCS zone**

project identifier

my profile

share my solution

[formats explained](#)

identify any CORS you wish to explicitly include or exclude from your solution by typing in 4-char site IDs separated with line break
-- sample
-- find site IDs


enter the id provided by your project manager

customize OPUS defaults for future solutions

[sharing explained](#)

for data 15 min. - 2 hrs. for data 2 hrs. - 48 hrs.

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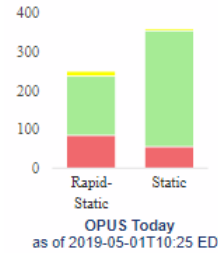
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Upload your data file.

Solve your GPS position & tie it to the National Spatial Reference System.

What is OPUS? [FAQs](#)

No file chosen

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antenna height of your antenna's reference point.

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to customize your solution.

formats

base stations

Use:

Exclude:

state plane

project identifier

my profile

share my solution

formats explained

identify any CORS you wish to explicitly include or exclude from your solution by typing in 4-char site IDs separated with line break

- sample
- find site IDs

your SPCS zone

enter the id provided by your project manager

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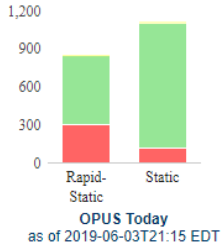
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OPUS Today
as of 2019-06-03T21:15 EDT

ITRF2014 frame and GEOID18 now available in BETA

Try **BETA OPUS** to preview **BETA GEOID18** and the new **ITRF2014 frame** for **CORS**.

Upload your data file.
Solve your GPS position & tie it to the National Spatial Reference System.

What is OPUS? [FAQs](#)

T7371360D.19o

* **data file** of dual-frequency GPS observations. [sample](#)

INTERNAL GEODETIC ANTENNA, SMARTTRACK+, GPS L1/L2/L5, GLONASS, GALILEO, BEIDOU

antenna - choosing wrong may degrade your accuracy.

meters above your mark.

antenna height of your antenna's reference point.

* **email address** - your solution will be sent here. [Privacy Act Statement](#)

to **customize** your solution.

formats

base stations

Use:

Exclude:

formats explained

Identify any CORS you wish to explicitly include or exclude from your solution by typing in 4-char site IDs separated with line break

sample

find site IDs

state plane

let OPUS choose

your **SPCS zone**

project identifier

enter the id provided by your project manager

my profile

customize OPUS defaults for future solutions

share my solution

No, don't share

sharing explained

for data 15 min. - 2 hrs.

for data 2 hrs. - 48 hrs.


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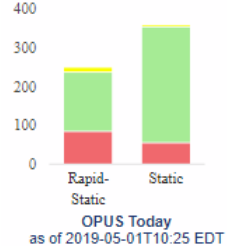
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| Mode | Count |
|--------------|-------|
| Rapid-Static | ~250 |
| Static | ~350 |

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antenna height of your antenna's reference point.

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to customize your solution.

formats

base stations

Use:

Exclude:

state plane

project identifier

my profile

share my solution

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-- [sample](#)
-- [find site IDs](#)

your SPCS zone


enter the id provided by your project manager

customize OPUS defaults for future solutions

sharing explained


for data 15 min. - 2 hrs. for data 2 hrs. - 48 hrs.

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**sample solutions**

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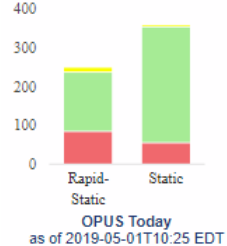
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| Category | Count |
|--------------|-------|
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-- sample

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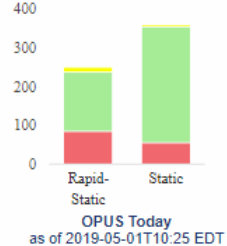
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-- [find site IDs](#)

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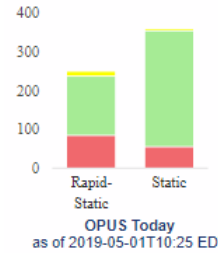
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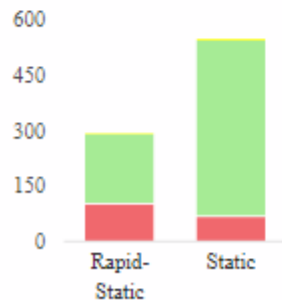
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OPUS Today
as of 2019-05-01T11:35 EDT



Upload successful!
You will receive an email when processing is complete.

uploaded:

| | |
|----------------|-------------------------------|
| data file | BE4130A.19o |
| converted to | be41112n.19o (RINEX format) |
| antenna | LEIGS15 NONE |
| antenna height | 2.00 meters |
| email address | ronald.hanson@dot.state.fl.us |
| processor | Rapid-Static |

Solving with:

| | |
|--------------------|------------------------|
| solution format | Standard + XML (DRAFT) |
| base sta. used | -- |
| base sta. excluded | -- |
| state plane zone | -- |
| project ID | -- |

[return to OPUS](#)

Thank you for using OPUS!

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Processing with FPRN

Processing using FPRN



English

Ron Hanson

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Shop

Post Processing

Account Details

Contact

FPRN Products

FPRN Training

FPRN News

Emler



Shop



NAD83 Corrections

NAD83 GNSS real-time corrections

Subscription Period: Unlimited
Consumption Limit: Flatrate
Working Area: Unlimited
Article No:

Already Subscribed



Rinex 3

Access to Rinex Module

Subscription Period: Unlimited
Consumption Limit: Flatrate
Working Area: Unlimited
Article No:

Already Subscribed



Coordinate Computations

Access to computation modules

Subscription Period: Unlimited
Consumption Limit: Flatrate
Working Area: Unlimited
Article No:

Already Subscribed



[No Title]


V Rinex

Access to Virtual Rinex Module

Subscription Period: Unlimited
Consumption Limit: Flatrate
Working Area: Unlimited
Article No:

Already Subscribed

Processing using FPRN



English

Ron HansonHome / Shop

Shop

Post Processing

RINEX Data

Computation

Results

Account Details

Contact

Dynamic Map

FPRN Products


FPRN Training

FPRN News

Emailer

Shop

NAD83 Corrections



NAD83 GNSS real-time corrections

Subscription Period:Unlimited


Consumption Limit:Flatrate

Working Area:Unlimited

Article No:

Already Subscribed

Rinex 3



Access to Rinex Module

Subscription Period:Unlimited


Consumption Limit:Flatrate

Working Area:Unlimited

Article No:

Already Subscribed

Coordinate Computations



Access to computation modules

Subscription Period:Unlimited


Consumption Limit:Flatrate

Working Area:Unlimited

Article No:

Already Subscribed

V Rinex



Access to Virtual Rinex Module

Subscription Period:Unlimited

Consumption Limit:Flatrate

Working Area:Unlimited

Article No:

Already Subscribed

FPRN Home

Rinex 2 FTP

Goggle Earth Overlay

Florida Custom Geoid

Data Sheets & Superseded Coordinates

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TRANSPORTATION

SYMPOSIUM

Processing using FPRN

Computation

DATA AVAILABILITY

Period: 30 Days

95.14 %

This service allows to trigger GNSS coordinate computations. Based on uploaded rover files, precise coordinates will be computed and delivered in the selected target coordinate system. Maximum upload size is 150 mb. Processing with the Virtual RINEX option enabled will use virtual reference stations placed at a distance of about 50cm from rover location.

(Project name)

Add Rover Data

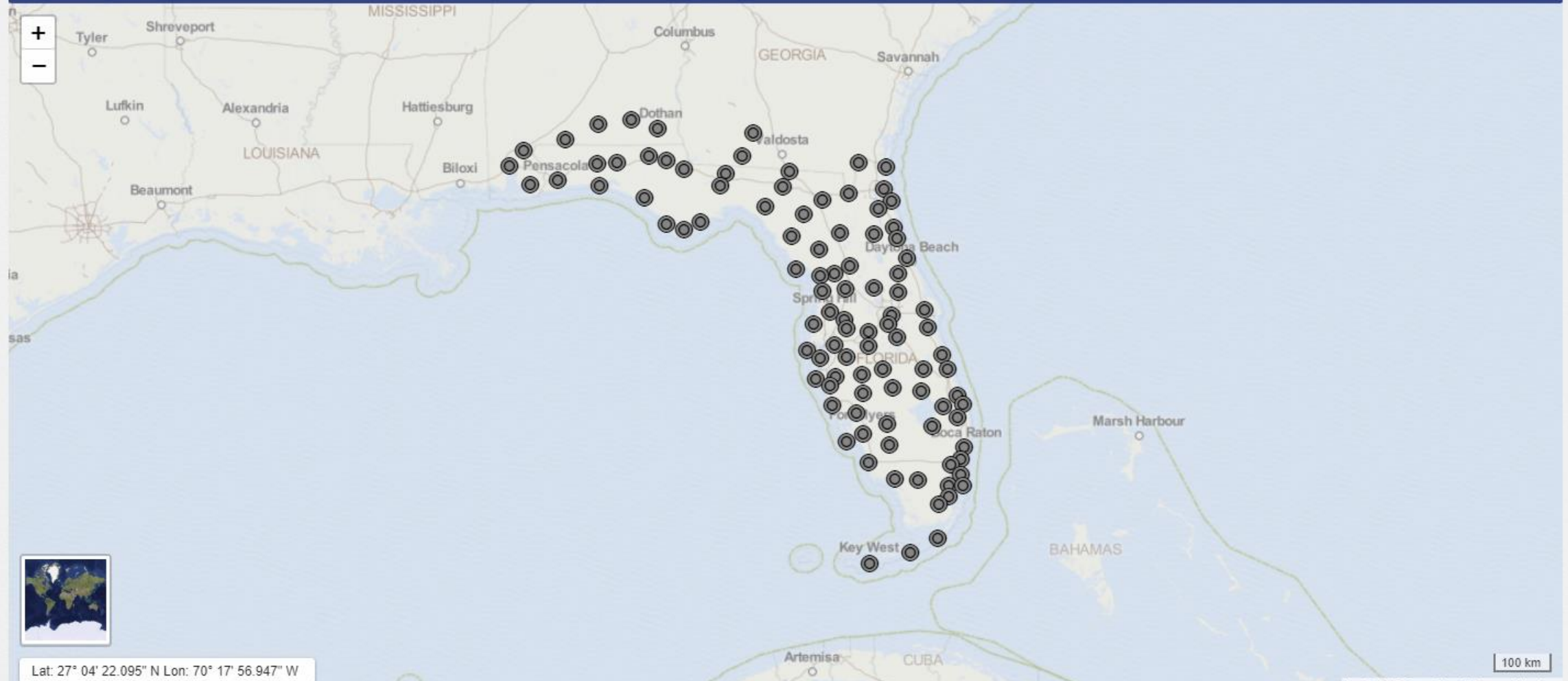
☐ Use Virtual RINEX

Target System:

FL N NAD83 2011 FPRN

Selected: 0 Marker(s), 0 File(s) (0)

Submit



Processing using FPRN

Computation

DATA AVAILABILITY
Period: 30 Days
95.14 %

This service allows to trigger GNSS coordinate computations. Based on uploaded rover files, precise coordinates will be computed and delivered in the selected target coordinate system. Maximum upload size is 150 mb. Processing with the Virtual RINEX option enabled will use virtual reference stations placed at a distance of about 50cm from rover location.

FTS

Add Rover Data

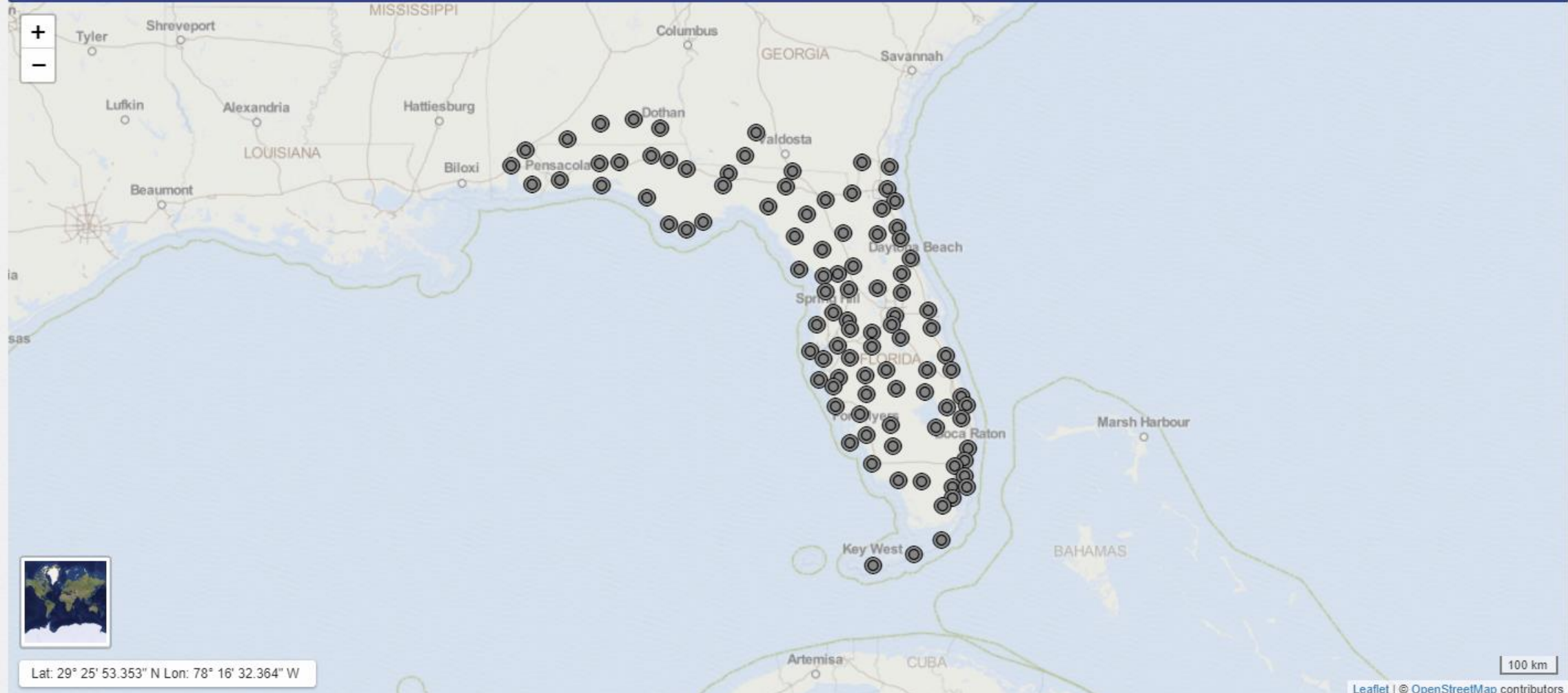
☐ Use Virtual RINEX

Target System:

FL N NAD83 2011 FPRN

Selected: 0 Marker(s), 0 File(s) (0)

Submit



Processing using FPRN

Computation

DATA AVAILABILITY
Period: 30 Days
95.14 %

This service allows to trigger GNSS coordinate computations. Based on uploaded rover files, precise coordinates will be computed and delivered in the selected target coordinate system. Maximum upload size is 150 mb. Processing with the Virtual RINEX option enabled will use virtual reference stations placed at a distance of about 50cm from rover location.

FTS

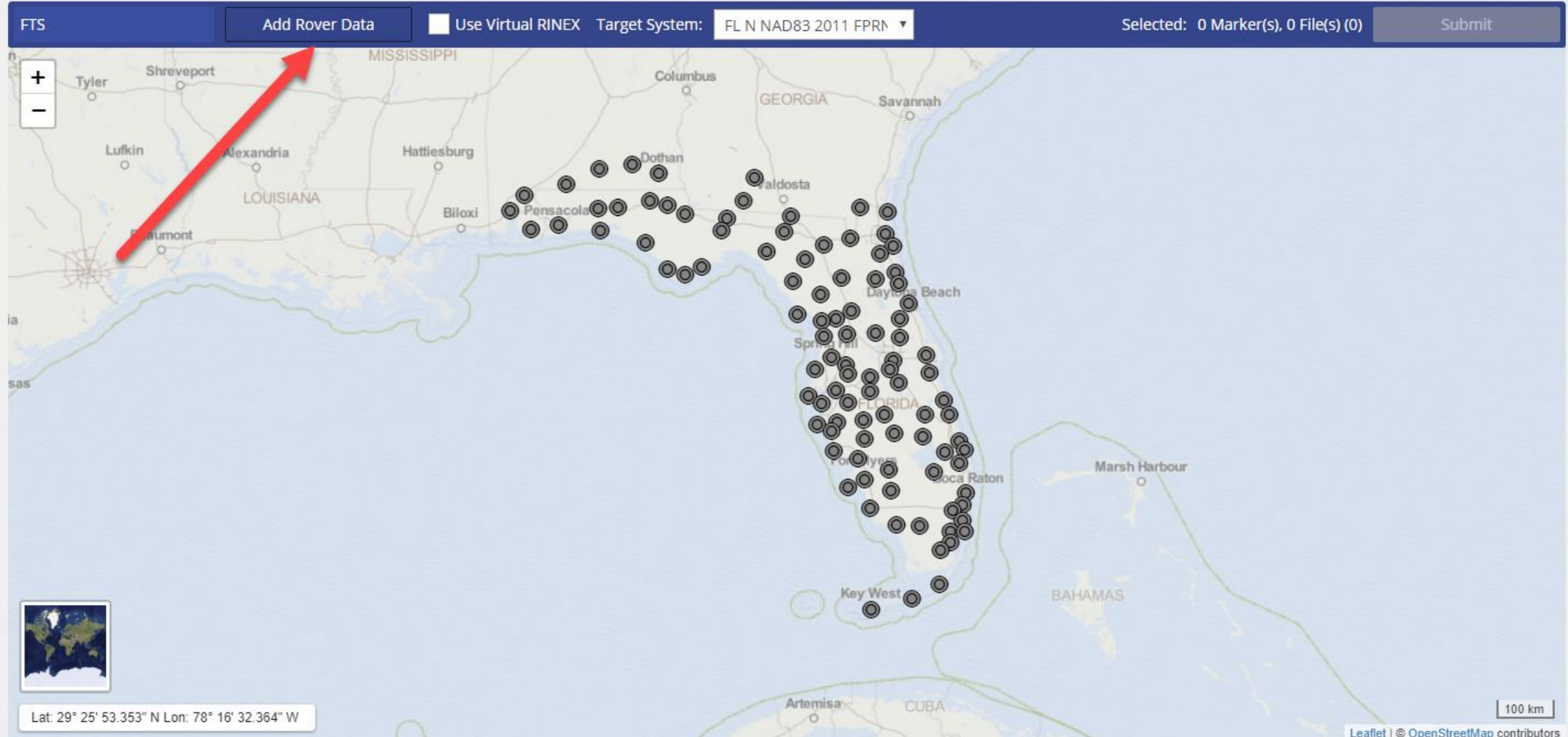
Add Rover Data

☐ Use Virtual RINEX

Target System: FL N NAD83 2011 FPRN

Selected: 0 Marker(s), 0 File(s) (0)

Submit



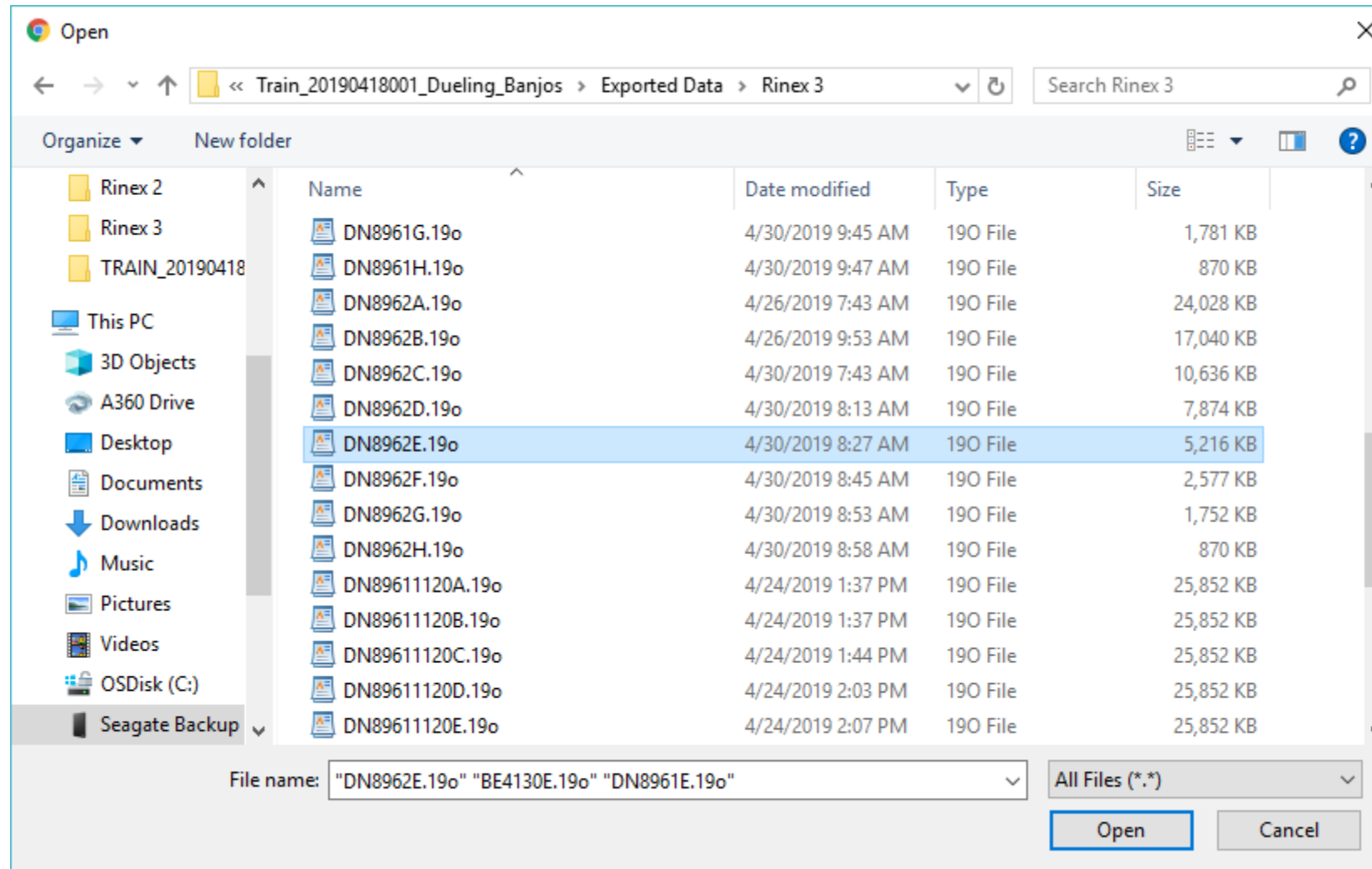
Lat: 29° 25' 53.353" N Lon: 78° 16' 32.364" W

100 km

Leaflet | © OpenStreetMap contributors

TRANSPORTATION
SYMPOSIUM

Processing using FPRN



Processing using FPRN

Computation

DATA AVAILABILITY

Period: 30 Days

95.14 %

This service allows to trigger GNSS coordinate computations. Based on uploaded rover files, precise coordinates will be computed and delivered in the selected target coordinate system. Maximum upload size is 150 mb. Processing with the Virtual RINEX option enabled will use virtual reference stations placed at a distance of about 50cm from rover location.

FTS

Add Rover Data



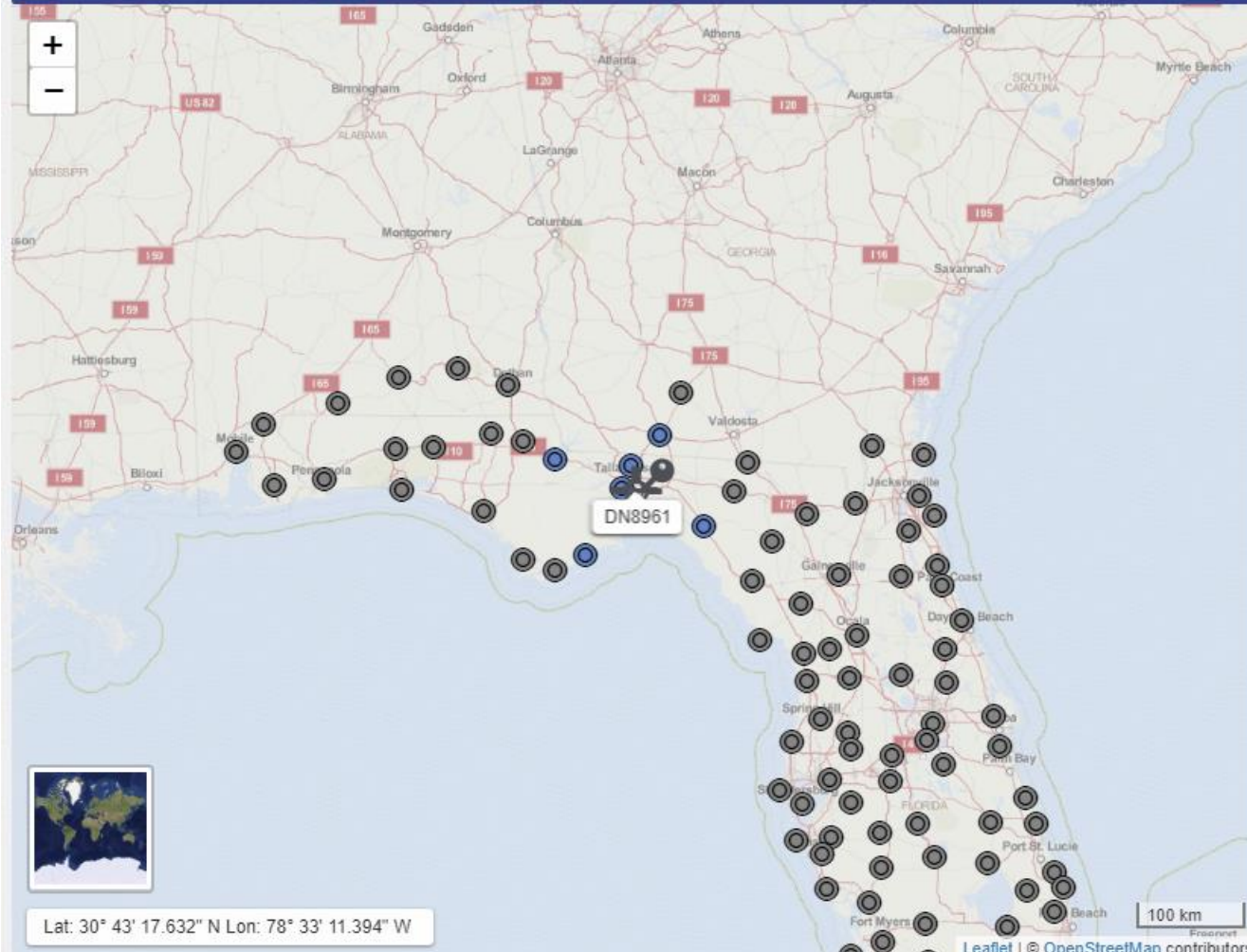
Use Virtual RINEX

Target System:

FL N NAD83 2011 FPRN

Selected: 3 Marker(s), 3 File(s) (15.94 MB)

Submit



BE4130E.19o 5.34 MB ✓
Static
LEIGS15 NONE
LEICA GS15
2019-04-22 13:35:00 (GPS)
2019-04-22 09:34:42 (Local)



BE4130 - BE4130

DN8961E.19o 5.51 MB ✓
Static
LEIGS15 NONE
LEICA GS15
2019-04-22 13:35:00 (GPS)
2019-04-22 09:34:42 (Local)



DN8961 - DN8961

DN8962E.19o 5.09 MB ✓
Static
LEIGS15 NONE
LEICA GS15
2019-04-22 13:35:00 (GPS)
2019-04-22 09:34:42 (Local)



DN8962 - DN8962

Processing using FPRN

Computation

DATA AVAILABILITY

Period: 30 Days

95.14 %

This service allows to trigger GNSS coordinate computations. Based on uploaded rover files, precise coordinates will be computed and delivered in the selected target coordinate system. Maximum upload size is 150 mb. Processing with the Virtual RINEX option enabled will use virtual reference stations placed at a distance of about 50cm from rover location.

FTS

Add Rover Data

☐ Use Virtual RINEX

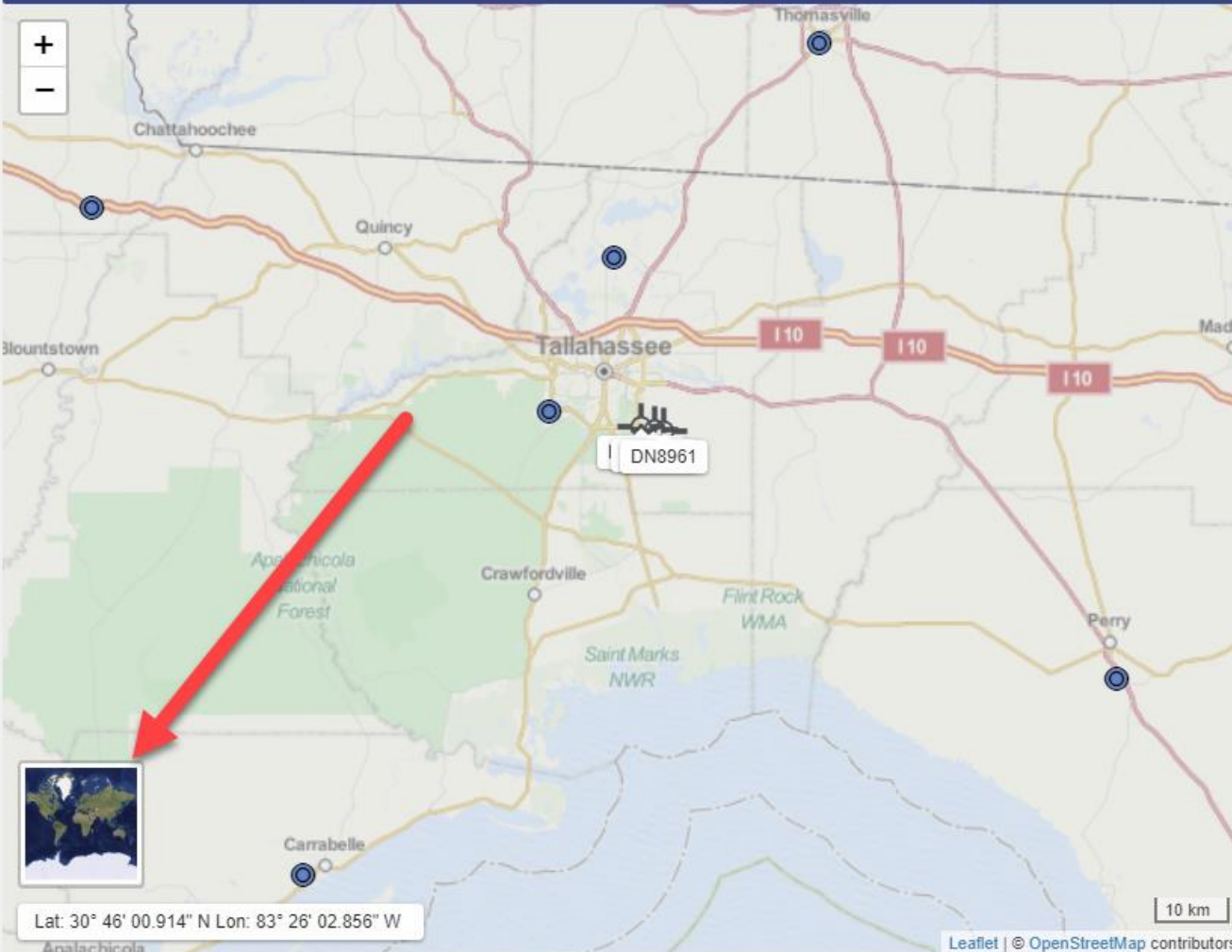
Target System: FL N NAD83 2011 FPRN

Selected: 3 Marker(s), 3 File(s) (15.94 MB)

Submit

+

-



Lat: 30° 46' 00.914" N Lon: 83° 26' 02.856" W

Leaflet | © OpenStreetMap contributors

| | | |
|--|----|-------------------|
| BE4130E.19o 5.34 MB ✓ ● Static 📡 LEIGS15 NONE 🕒 LEICA GS15 🕒 2019-04-22 13:35:00 (GPS) 🕒 2019-04-22 09:34:42 (Local) | 🗑️ | 📍 BE4130 - BE4130 |
| DN8961E.19o 5.51 MB ✓ ● Static 📡 LEIGS15 NONE 🕒 LEICA GS15 🕒 2019-04-22 13:35:00 (GPS) 🕒 2019-04-22 09:34:42 (Local) | 🗑️ | 📍 DN8961 - DN8961 |
| DN8962E.19o 5.09 MB ✓ ● Static 📡 LEIGS15 NONE 🕒 LEICA GS15 🕒 2019-04-22 13:35:00 (GPS) 🕒 2019-04-22 09:34:42 (Local) | 🗑️ | 📍 DN8962 - DN8962 |

Processing using FPRN

Computation

DATA AVAILABILITY
Period: 30 Days

95.14 %

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FTS

Add Rover Data

☐ Use Virtual RINEX

Target System: FL N NAD83 2011 FPRN

Selected: 3 Marker(s), 3 File(s) (15.94 MB)

Submit

+

-

Thomasville

Tallahassee

Apalachicola National Forest

DN8961

Lat: 30° 01' 44.505" N Lon: 83° 24' 17.948" W

10 km

BE4130E.19o 5.34 MB ✓

Static

LEIGS15 NONE

LEICA GS15

2019-04-22 13:35:00 (GPS)

2019-04-22 09:34:42 (Local)

BE4130 - BE4130

DN8961E.19o 5.51 MB ✓

Static

LEIGS15 NONE

LEICA GS15

2019-04-22 13:35:00 (GPS)

2019-04-22 09:34:42 (Local)

DN8961 - DN8961

DN8962E.19o 5.09 MB ✓

Static

LEIGS15 NONE

LEICA GS15

2019-04-22 13:35:00 (GPS)

2019-04-22 09:34:42 (Local)

DN8962 - DN8962

Leaflet | Powered by Esri | Earthstar Geographics, Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

PORTATION
POSITUM

Processing using FPRN

Computation

DATA AVAILABILITY
Period: 30 Days
95.14 %

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FTS

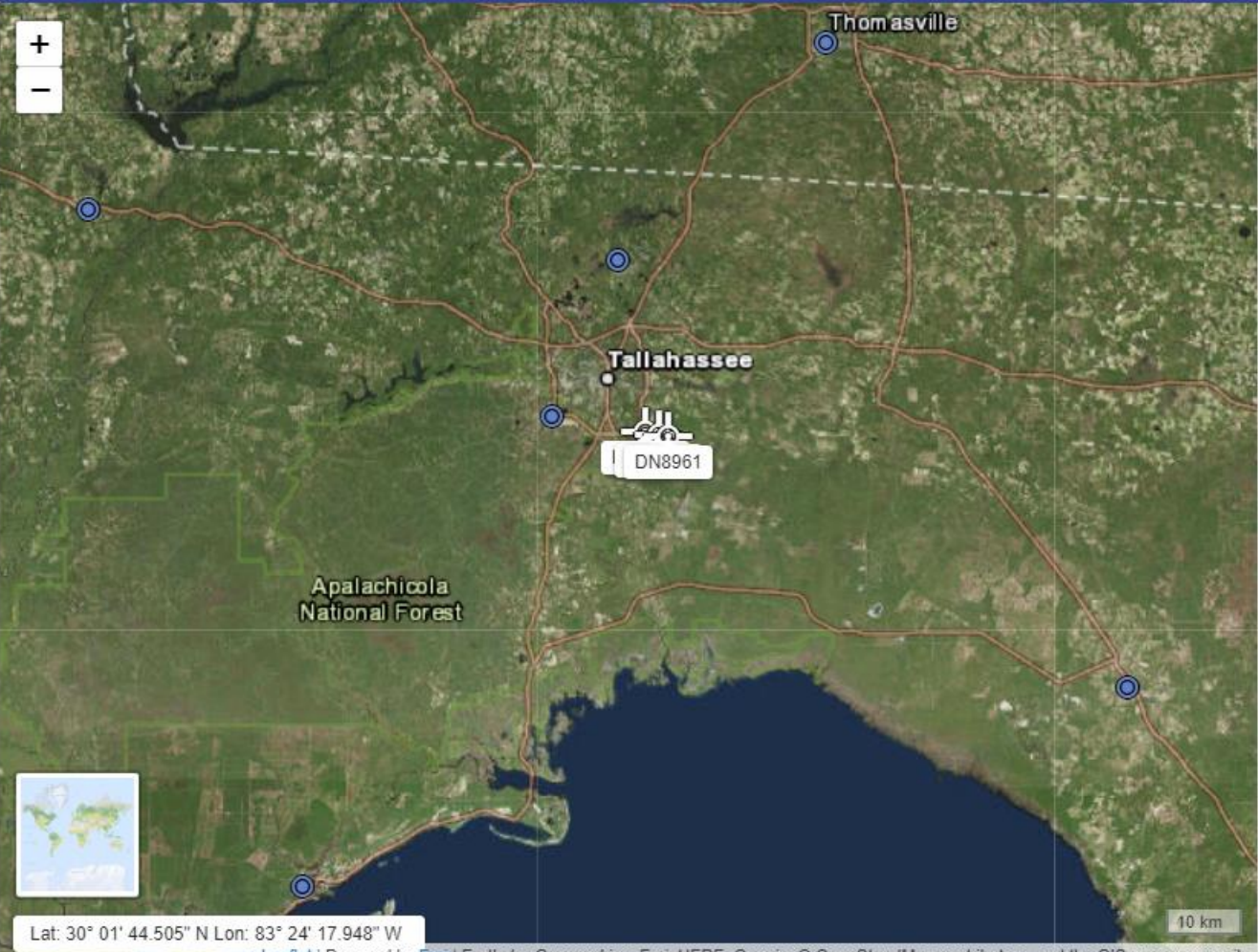
Add Rover Data

☐ Use Virtual RINEX

Target System: FL N NAD83 2011 FPRN

Selected: 3 Marker(s), 3 File(s) (15.94 MB)

Submit



BE4130E.19o 5.34 MB ✓

Static

LEIGS15 NONE

LEICA GS15

2019-04-22 13:35:00 (GPS)

2019-04-22 09:34:42 (Local)

BE4130 - BE4130

DN8961E.19o 5.51 MB ✓

Static

LEIGS15 NONE

LEICA GS15

2019-04-22 13:35:00 (GPS)

2019-04-22 09:34:42 (Local)

DN8961 - DN8961

DN8962E.19o 5.09 MB ✓

Static

LEIGS15 NONE

LEICA GS15

2019-04-22 13:35:00 (GPS)

2019-04-22 09:34:42 (Local)

DN8962 - DN8962

Lat: 30° 01' 44.505" N Lon: 83° 24' 17.948" W
Leaflet | Powered by Esri | Earthstar Geographics, Esri, HERE, Garmin, © OpenStreetMap contributors, and the GIS user community

Processing using FPRN

Computation

DATA AVAILABILITY
Period: 30 Days
95.14 %

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FTS

Add Rover Data

☐ Use Virtual RINEX

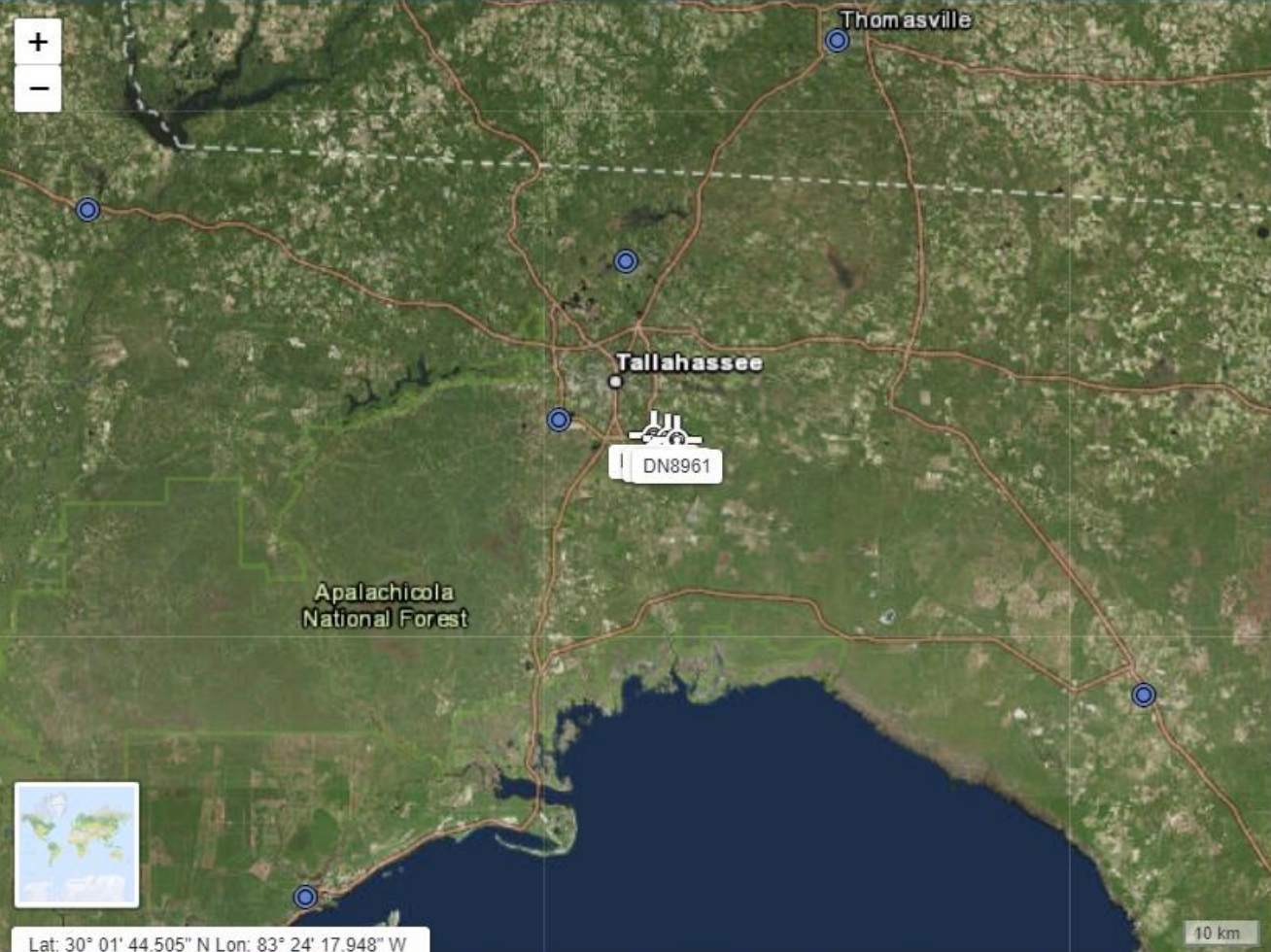
Target System: FL N NAD83 2011 FPRN

Selected: 3 Marker(s), 3 File(s) (15.94 MB)

Submit

+

-



BE4130E.19o 5.34 MB ✓

Static

LEIGS15 NONE

LEICA GS15

2019-04-22 13:35:00 (GPS)

2019-04-22 09:34:42 (Local)

BE4130 - BE4130

DN8961E.19o 5.51 MB ✓

Static

LEIGS15 NONE

LEICA GS15

2019-04-22 13:35:00 (GPS)

2019-04-22 09:34:42 (Local)

DN8961 - DN8961

DN8962E.19o 5.09 MB ✓

Static

LEIGS15 NONE

LEICA GS15

2019-04-22 13:35:00 (GPS)

2019-04-22 09:34:42 (Local)

DN8962 - DN8962

Processing using FPRN

Computation

DATA AVAILABILITY
Period: 30 Days
95.14 %

This service allows to trigger GNSS coordinate computations. Based on uploaded rover files, precise coordinates will be computed and delivered in the selected target coordinate system. Maximum upload size is 150 mb. Processing with the Virtual RINEX option enabled will use virtual reference stations placed at a distance of about 50cm from rover location.

FTS

Add Rover Data

☐ Use Virtual RINEX

Target System: FL N NAD83 2011 FPRN

Selected: 3 Marker(s), 3 File(s) (15.94 MB)

Submit

+

-

Thomasville

Tallahassee

Apalachicola National Forest

Lat: 30° 10' 36.095" N Lon: 83° 35' 39.854" W

10 km

Coordinate Computation "FTS"

3 File(s), 15.94 MB

Requested by Ron Hanson on 2019-05-01 13:04:13

Confirm

Cancel












| | |
|--|-----------------|
| BE4130E.19o 5.34 MB ✓ Static LEIGS15 NONE LEICA GS15 | BE4130 - BE4130 |
| LEIGS15 NONE LEICA GS15 2019-04-22 13:35:00 (GPS) 2019-04-22 09:34:42 (Local) | DN8961 - DN8961 |
| DN8962E.19o 5.09 MB ✓ Static LEIGS15 NONE LEICA GS15 2019-04-22 13:35:00 (GPS) 2019-04-22 09:34:42 (Local) | DN8962 - DN8962 |

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Processing using FPRN

Results

On this page, all results related to any SBC post-processing service are displayed, divided by category.

| RINEX Data | | Virtual RINEX Data | Coordinate Computations | |
|---|--|---------------------------------------|---|---|
| 32. Processed at 2019-05-01 13:06:04 Project: FTS | 3 File(s), 0 Point(s) Use Virtual RINEX: No | Target System: FL N NAD83 2011 FPRN16 |  |   |
| 31. Processed at 2019-04-30 16:37:06 Project: Minimum | 1 File(s), 1 Point(s) Use Virtual RINEX: No | Target System: FL N NAD83 2011 FPRN16 | ✓ |  ▼ |
| 30. Processed at 2019-04-30 09:55:33 Project: 8962-5 | 1 File(s), 1 Point(s) Use Virtual RINEX: No | Target System: FL N NAD83 2011 FPRN16 | ✓ |  ▼ |
| 29. Processed at 2019-04-30 09:55:19 Project: 8962-10 | 1 File(s), 1 Point(s) Use Virtual RINEX: No | Target System: FL N NAD83 2011 FPRN16 | ✓ |  ▼ |
| 28. Processed at 2019-04-30 09:54:58 Project: 8962-15 | 1 File(s), 1 Point(s) Use Virtual RINEX: No | Target System: FL N NAD83 2011 FPRN16 | ✓ |  ▼ |
| 27. Processed at 2019-04-30 09:54:34 Project: 8962-30 | 1 File(s), 1 Point(s) Use Virtual RINEX: No | Target System: FL N NAD83 2011 FPRN16 | ✓ |  ▼ |
| 26. Processed at 2019-04-30 09:54:02 Project: 8962-45 | 1 File(s), 1 Point(s) Use Virtual RINEX: No | Target System: FL N NAD83 2011 FPRN16 | ✓ |  ▼ |
| 25. Processed at 2019-04-30 09:53:35 Project: 8962-60 | 1 File(s), 1 Point(s) Use Virtual RINEX: No | Target System: FL N NAD83 2011 FPRN16 | ✓ |  ▼ |
| 24. Processed at 2019-04-30 09:53:12 Project: 8962-90 | 1 File(s), 1 Point(s) Use Virtual RINEX: No | Target System: FL N NAD83 2011 FPRN16 | ✓ |  ▼ |

Processing using FPRN



Results

On this page, all results related to any SBC post-processing service are displayed, divided by category.

RINEX Data

Virtual RINEX Data

Coordinate Computations

32. Processed at **2019-05-01 13:06:04**

3 File(s), 3 Point(s)

Target System: FL N NAD83 2011 FPRN16



Project: [FTS](#)

Use Virtual RINEX: No

[Show File Details](#)

Full Report

| Point | Observation Time | Local Grid (E,N,h,H) FL N NAD83 2011 FPRN16 | WGS84 Geodetic | Quality | |
|--------|-----------------------------|--|---|-------------------------|--|
| BE4130 | 2019-04-22 09:34:41, 30 min | 627721.7478 m \pm 0.0059 m 152473.5778 m \pm 0.0049 m - 20.2920 m | 30° 22' 30.7313" N \pm 0.0059 m 84° 12' 41.6980" W \pm 0.0049 m -7.4440 m \pm 0.0113 m | 0.0136 m Phase Fixed | |
| DN8961 | 2019-04-22 09:34:41, 30 min | 628949.4405 m \pm 0.0044 m 152170.5406 m \pm 0.0028 m - 12.0682 m | 30° 22' 20.7870" N \pm 0.0044 m 84° 11' 55.7457" W \pm 0.0028 m -15.6388 m \pm 0.0098 m | 0.0111 m Phase Fixed | |
| DN8962 | 2019-04-22 09:34:41, 30 min | 626061.3760 m \pm 0.0036 m 152859.6253 m \pm 0.0021 m - 17.3109 m | 30° 22' 43.4005" N \pm 0.0036 m 84° 13' 43.8516" W \pm 0.0021 m -10.4427 m \pm 0.0078 m | 0.0088 m Phase Fixed | |

Processing using FPRN

Results

On this page, all results related to any SBC post-processing service are displayed, divided by category.

RINEX Data

Virtual RINEX Data

Coordinate Computations

32. Processed at **2019-05-01 13:06:04**

3 File(s), 3 Point(s)

Target System: FL N NAD83 2011 FPRN16



Project: [FTS](#)

Use Virtual RINEX: No

[Show File Details](#)

Full Report

| Point | Observation Time | Local Grid (E,N,h,H) FL N NAD83 2011 FPRN16 | WGS84 Geodetic | Quality | |
|--------|-----------------------------|--|---|-------------------------|--|
| BE4130 | 2019-04-22 09:34:41, 30 min | 627721.7478 m \pm 0.0059 m 152473.5778 m \pm 0.0049 m - 20.2920 m | 30° 22' 30.7313" N \pm 0.0059 m 84° 12' 41.6980" W \pm 0.0049 m -7.4440 m \pm 0.0113 m | 0.0136 m Phase Fixed | |
| DN8961 | 2019-04-22 09:34:41, 30 min | 628949.4405 m \pm 0.0044 m 152170.5406 m \pm 0.0028 m - 12.0682 m | 30° 22' 20.7870" N \pm 0.0044 m 84° 11' 55.7457" W \pm 0.0028 m -15.6388 m \pm 0.0098 m | 0.0111 m Phase Fixed | |
| DN8962 | 2019-04-22 09:34:41, 30 min | 626061.3760 m \pm 0.0036 m 152859.6253 m \pm 0.0021 m - 17.3109 m | 30° 22' 43.4005" N \pm 0.0036 m 84° 13' 43.8516" W \pm 0.0021 m -10.4427 m \pm 0.0078 m | 0.0088 m Phase Fixed | |

Conclusion

OPUS vs FPRN

OPUS

- 120 minute file length (minimum)
- 2 Occupations
- 30 second epoch
- GPS

FPRN

- 30 minute file length (minimum)
- 2 Occupations
- 1 second epoch
- GPS, Glonass, Galileo

Now a brief discussion on Networks

Questions?