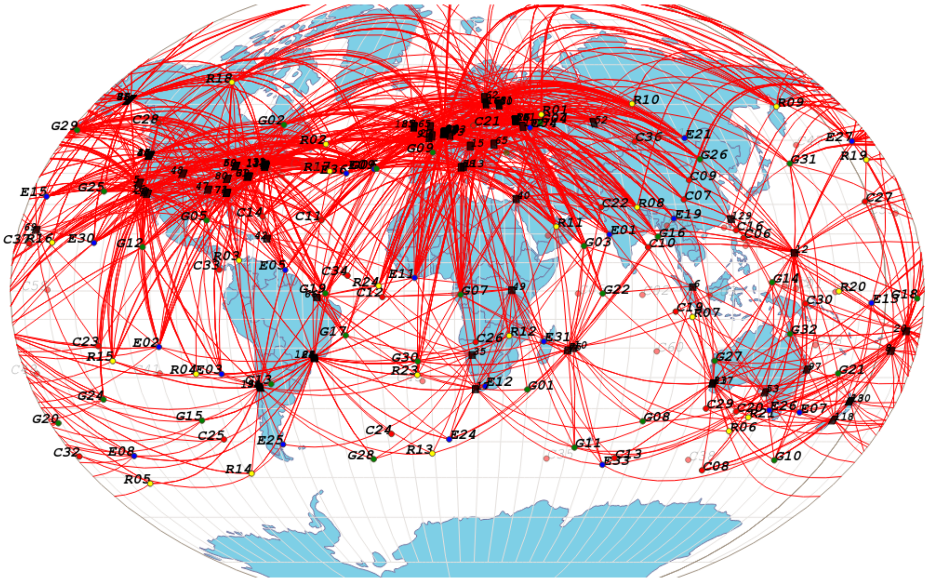
The *unofficial* Galileo Weekly Performance Report
29th of June - 5th of July

The galmon.eu project



Monday 6th July, 2020

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Contents

Chapter 1

Introduction

The galmon.eu project strives to publish a weekly unofficial Galileo Performance Report every week. In good weeks, this report will have been processed manually, removing measurement anomalies and other oddities. If we are too busy, there will be an automated report that might for example show bad behaviour of satellites undergoing planned maintenance.

Automated reports will clearly be flagged as such.

Despite this, it should be noted that even manually processed reports only show what we can see. If we report on a problem, it is entirely possible we are misunderstanding a situation.

In addition, even when we show problems for individual Galileo satellites, this in no way means Galileo performance was impaired. We have separate graphs for that.

Finally, we do report on global metrics such as "x% of the Earth's surface not having Galileo coverage, as defined by being able to see 4 satellites more than 5 degrees above the horizon".

These metrics are defined in the Galileo Service Definition Document, but the SDD also states that the defined Minimum Performance Level is not breaching such a metric for more than 7 days in a row.

Our reports only talk about instantaneous breaches of such performance levels. Readers can determine for themselves if a 6 day breach of a performance level also constitutes a breach of the Minimum Performance Levels.

Official Galileo Performance Reports are published on the site of the Galileo Service Centre.

1.1 Intended use

These reports are provided in the hope that these will be useful for the Galileo project. The same goes for our live dashboard.

If anything in these reports is found to be incorrect, or in need of explanation, feedback is most welcome (bert@hubertnet.nl). Similarly, suggestions for additional graphs or metrics are much appreciated.

1.2 Data sources, acknowledgments

This report is based on many data sources, and we are very grateful for all the data that is being made public. Such transparency enables great reporting.

We specifically acknowledge the following great data sources:

- DLR and Spaceopal provide a realtime RTCM State Space Representation feed, which we use to plot orbit errors
- CNES provides a similar but independent feed, which makes it possible to separate measurement problems from Galileo problems
- GFZ Potsdam provides excellent post-processed orbit data (SP3) which provide even more authoritative orbit data

- ESA/ESOC provides similar data, calculated independently
- The International GNSS Service (IGS) who distribute and coordinate a vast network of files and realtime streams
- The galmon.eu volunteer receiver network, using over 80 stations around the world to receive each and every Galileo (and BeiDou, GLONASS and GPS) message

Galmon.eu would not be possible without the many many volunteer station operators around the world.

In addition, we thank the Galileo Service Centre and the Spaceopal NAVCAST helpdesks for patiently answering our many questions.

Finally, a large cast of mostly anonymous engineers, researchers, scientists, operators and Galileo customers have provided very valuable insights that made this report possible, and hopefully useful.

1.3 About us

We are an independent project, not affiliated with any Galileo vendor or organization.

The galmon.eu network is described in this post by Bert Hubert.

A presentation about our technologies is here.

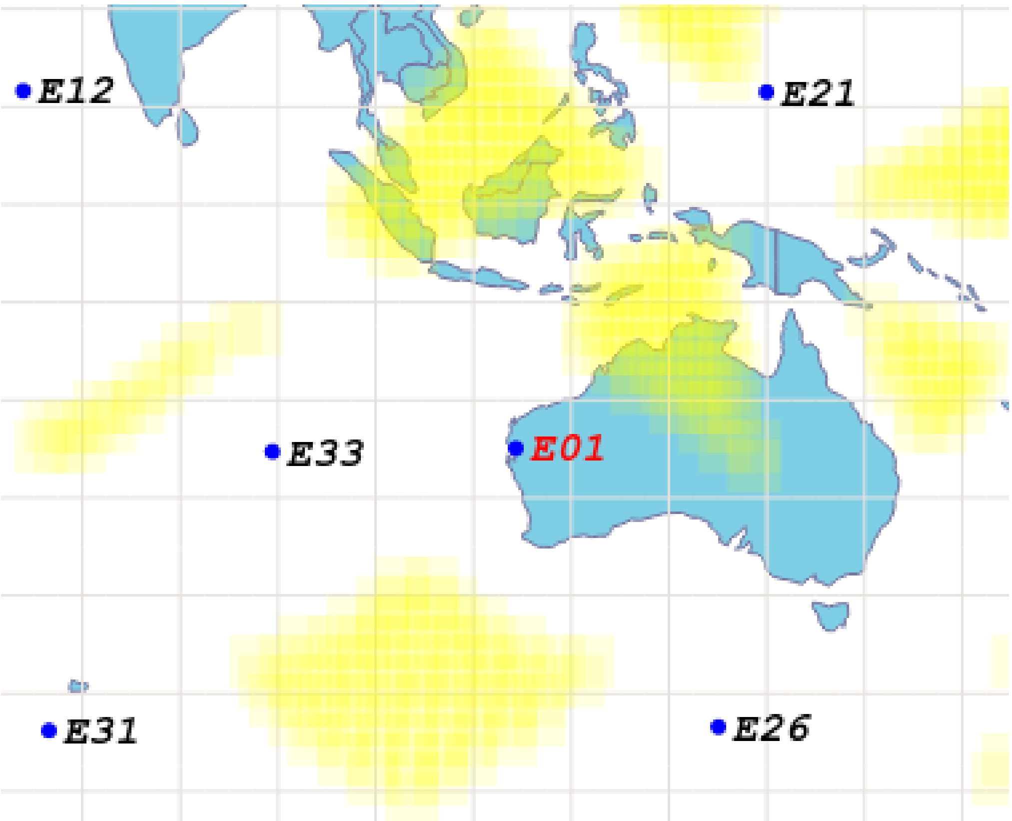
The source code to our project can be found on GitHub.

Chapter 2

Weekly summary

The only thing of note this week was a brief NAPA episode for E01. During this period, no odd clock behaviour was observed. The short duration of the disruption indicates that this may have been a true 'No Accuracy Prediction Available' situation: nothing really happened, except there briefly may not have been an observation to confirm the accuracy.

In addition, the brief marginal period for E01 occurred at a time of favourable geometry:

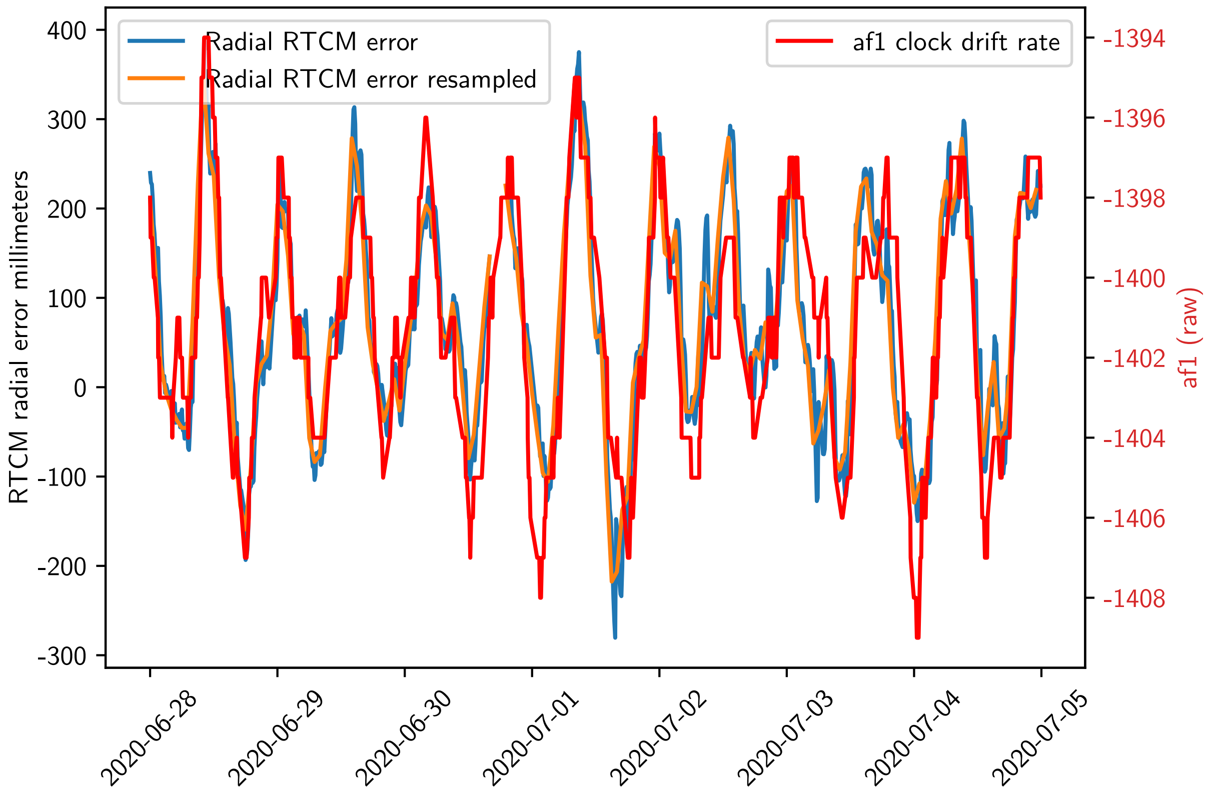


Because many other satellites were in view over the affected area, there was no measurable impact on PDOP or coverage metrics globally.

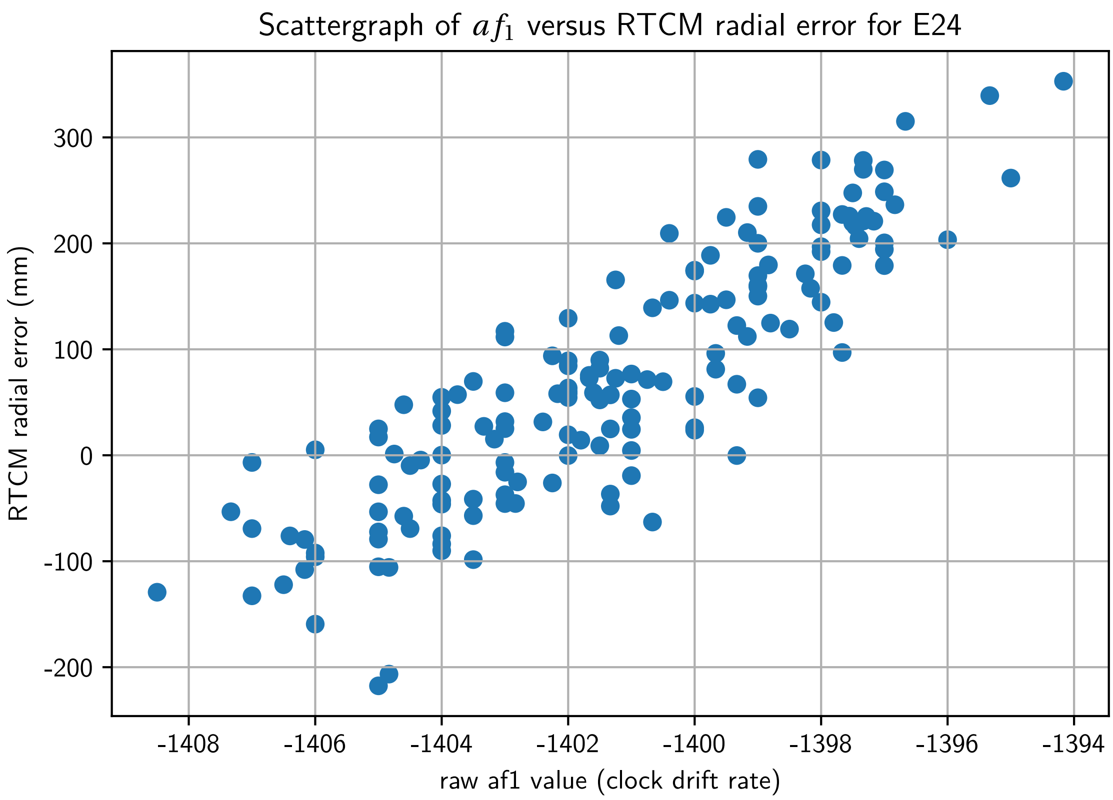
2.1 Ongoing oscillatory oddity

As observed in the rest of this report, most measured errors show an oscillation with a period that seems similar to the Galileo orbital period.

Here is a graph of the E24 RTCM radial error (left axis) and the raw af_1 clock drift parameter (right axis).



There appears to be a strong correlation between these two metrics:



This correlation is strong enough that Galileo orbit errors can meaningfully be improved by applying a correction based on the reported af_1. We also observe however that there is a corresponding and inverse signal in the clock error. As such the impact on the SISE (see below) is not as pronounced.

The oscillation may indicate a transfer of uncertainty from the space to the time component.

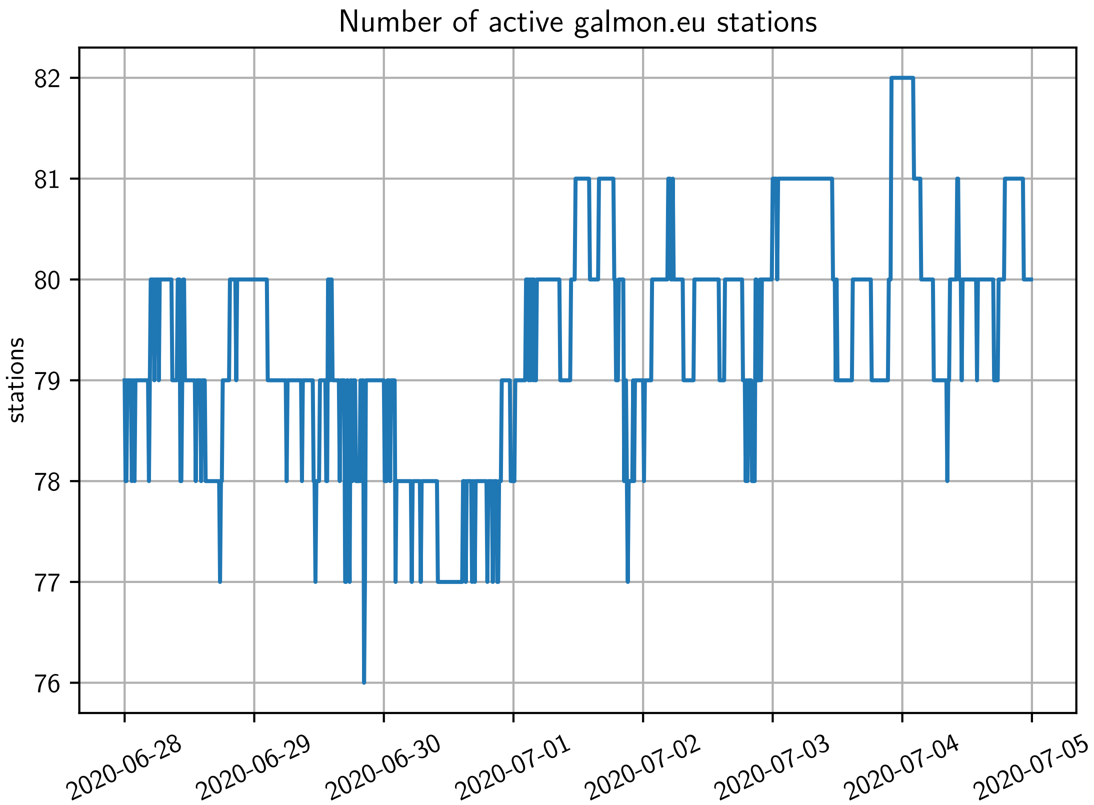
Chapter 3

Availability

3.1 The galmon.eu network

Nominally there are around 80 stations active in the galmon.eu network. Because many of our stations are in faraway places, connectivity and power sometimes suffer. This graph shows if we had any problems over the reporting period.

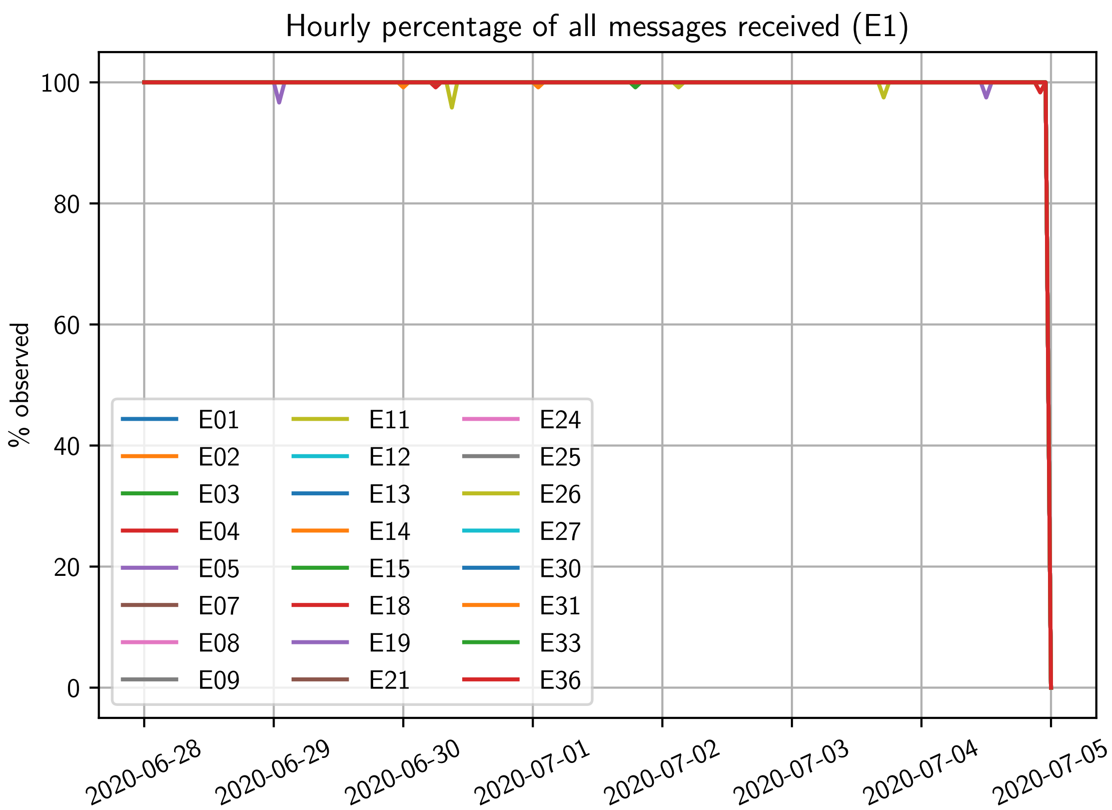
Note that most stations only see the E1 band, some see E5b and none see E5a. We're working on it.



3.2 Percentage observed

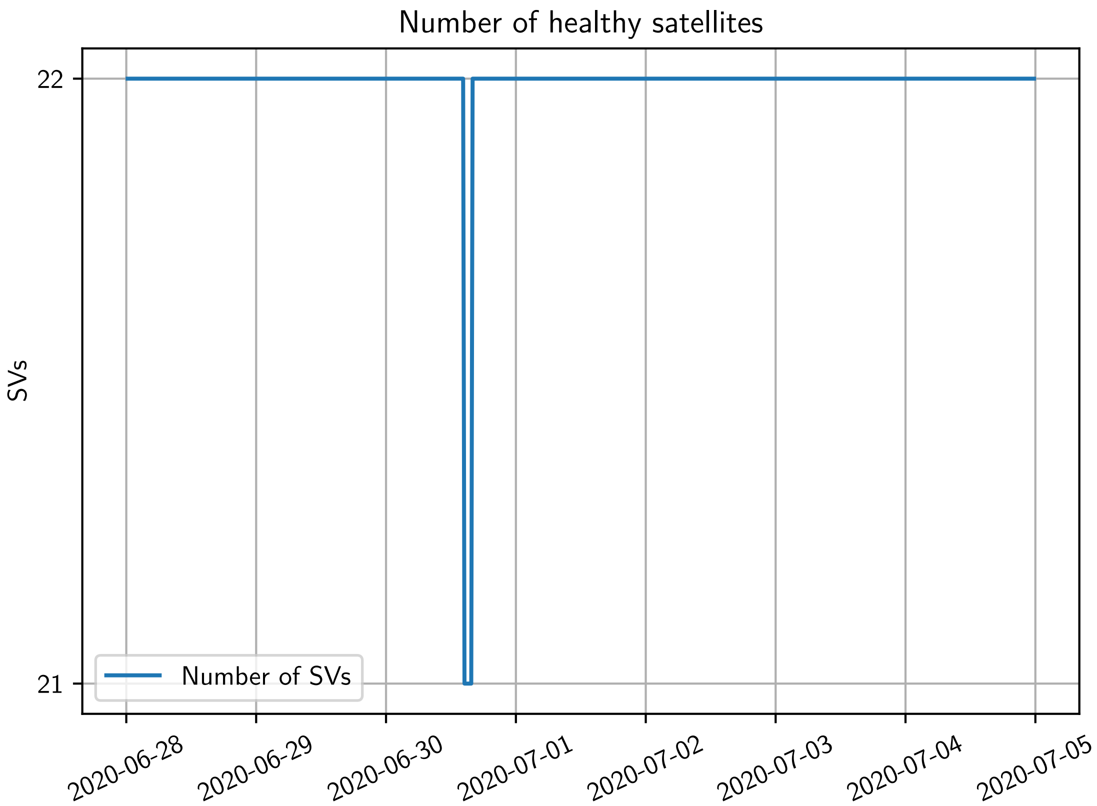
The galmon.eu network strives for 100% coverage of all Galileo transmissions. This is not an easy bar to reach since many receivers will miss double percentage fractions of transmissions. We compensate for this by having a large number of receivers.

Despite this, some messages are not received. If some messages are missed briefly, this likely indicates a deficiency of the galmon.eu network. If there is a more prominent dip, this likely indicates a problem with the satellite.



3.3 Healthy satellites

Satellites can be healthy, unhealthy or marginal. The difference between the last two categories is academic since no marginal satellites should be used.



In the following table, the distribution of status of all non-testing SVs can be observed:

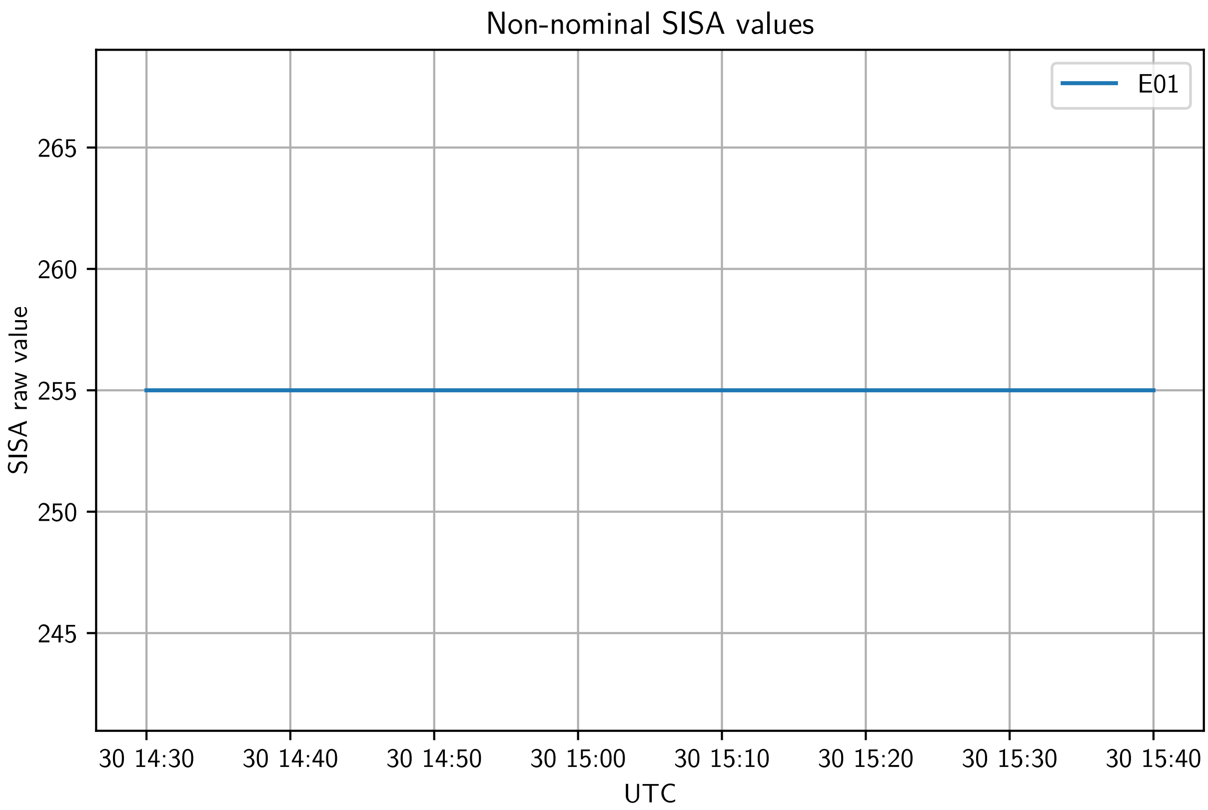
SV	unobserved	unhealthy	healthy	testing	napa	ripe	expired
E01	0.00%	0.00%	99.31%	0.00%	0.69%	0.00%	0.00%
E02	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E03	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E04	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E05	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E07	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E08	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E09	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E11	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E12	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E13	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E15	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E19	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E21	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E24	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E25	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E26	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E27	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E30	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E31	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E33	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
E36	0.00%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%
Tot	0.00%	0.00%	99.97%	0.00%	0.03%	0.00%	0.00%

Table 3.1: Satellite status table

This table defines a "ripe" ephemeris as one older than 100 minutes, and an expired one as older than 4 hours (in accordance with the Galileo Service Definition document).

3.4 Signal In Space Accuracy (SISA) and NAPA

The nominal Signal In Space Accuracy value for Galileo is currently 312 centimeters. This graph shows occasions where Galileo satellites broadcast a different SISA value. If everything is operating as planned, this graph is empty.

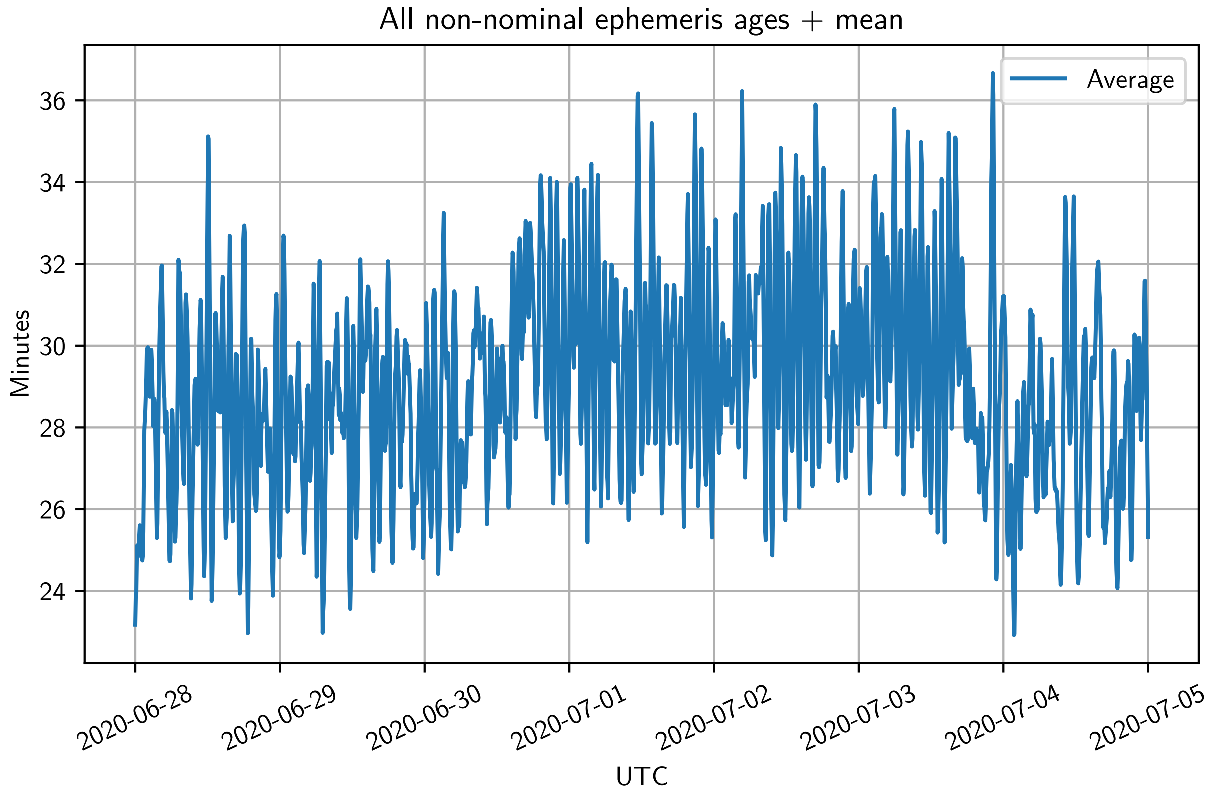


Chapter 4

Ephemerides

4.1 Ephemeris age

This graph shows the average ephemeris age, defined as time passed since t_{0e}. In addition, any non-nominal ephemerides ages, defined as more than 100 minutes old, will also be shown.



Chapter 5

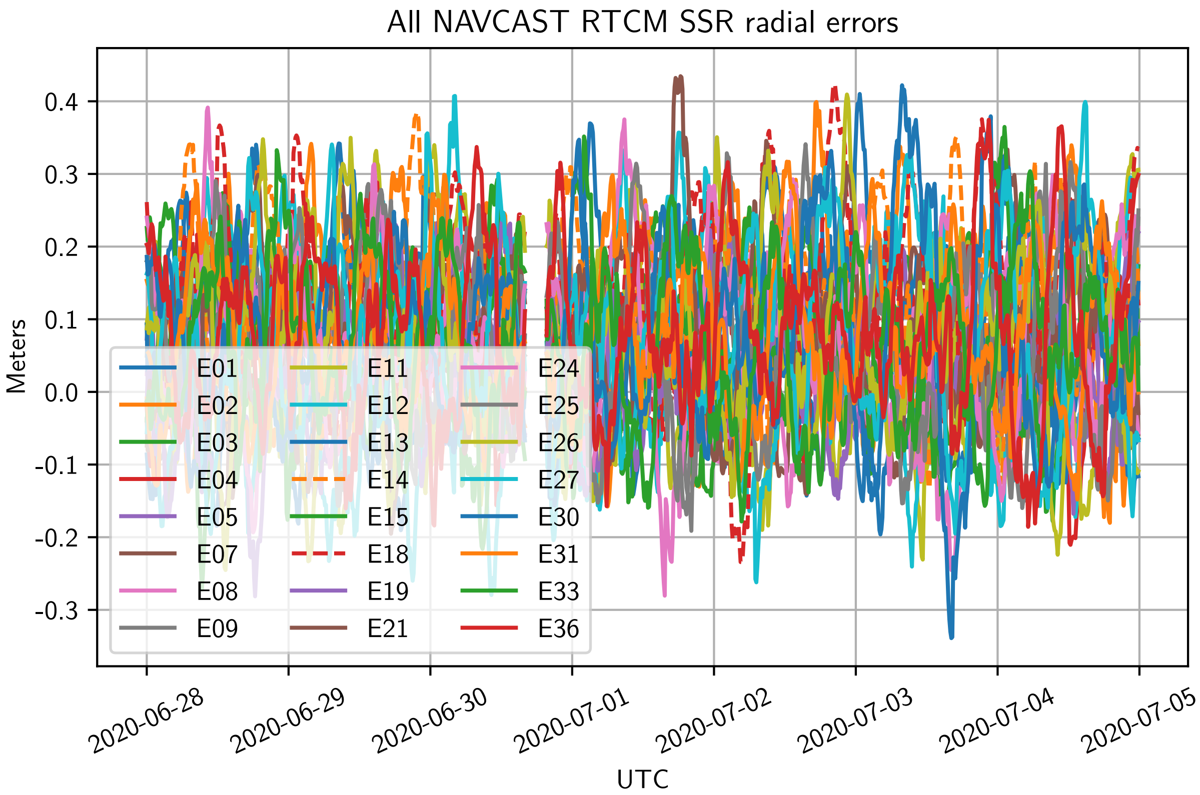
Accuracy

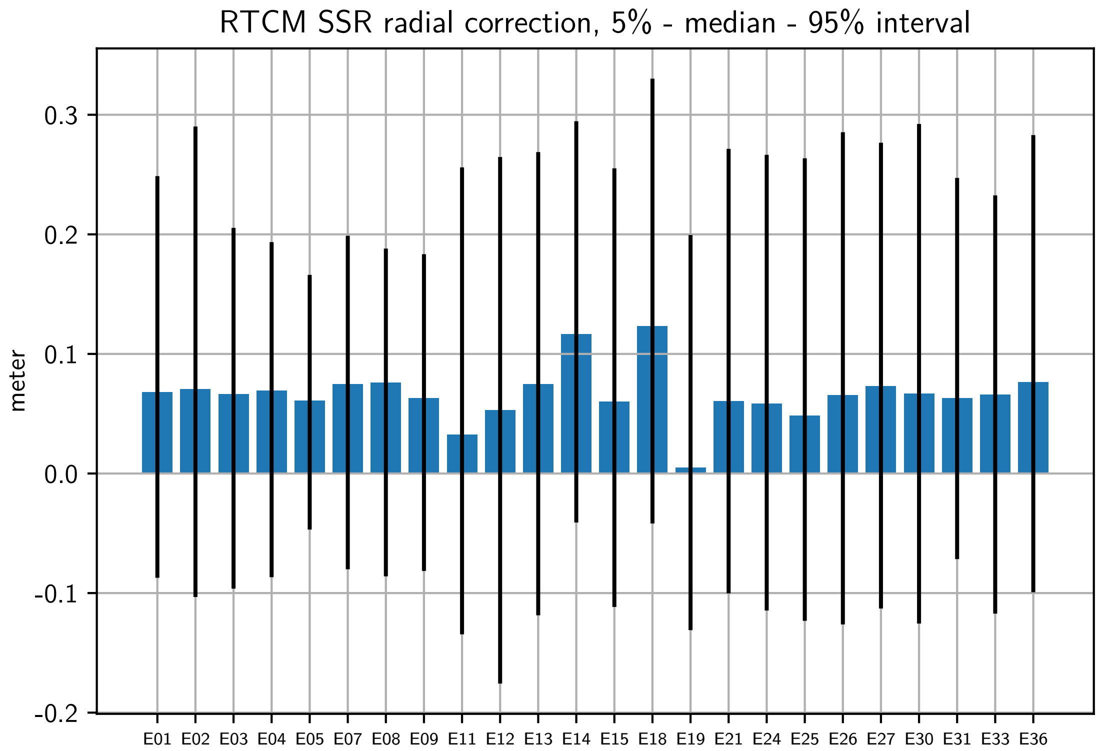
5.1 Radial error

In a nominal situation, this graph shows many overlapping lines all clustered around 0 meters error. If any SV deviates significantly, this shows up in subsequent graphs.

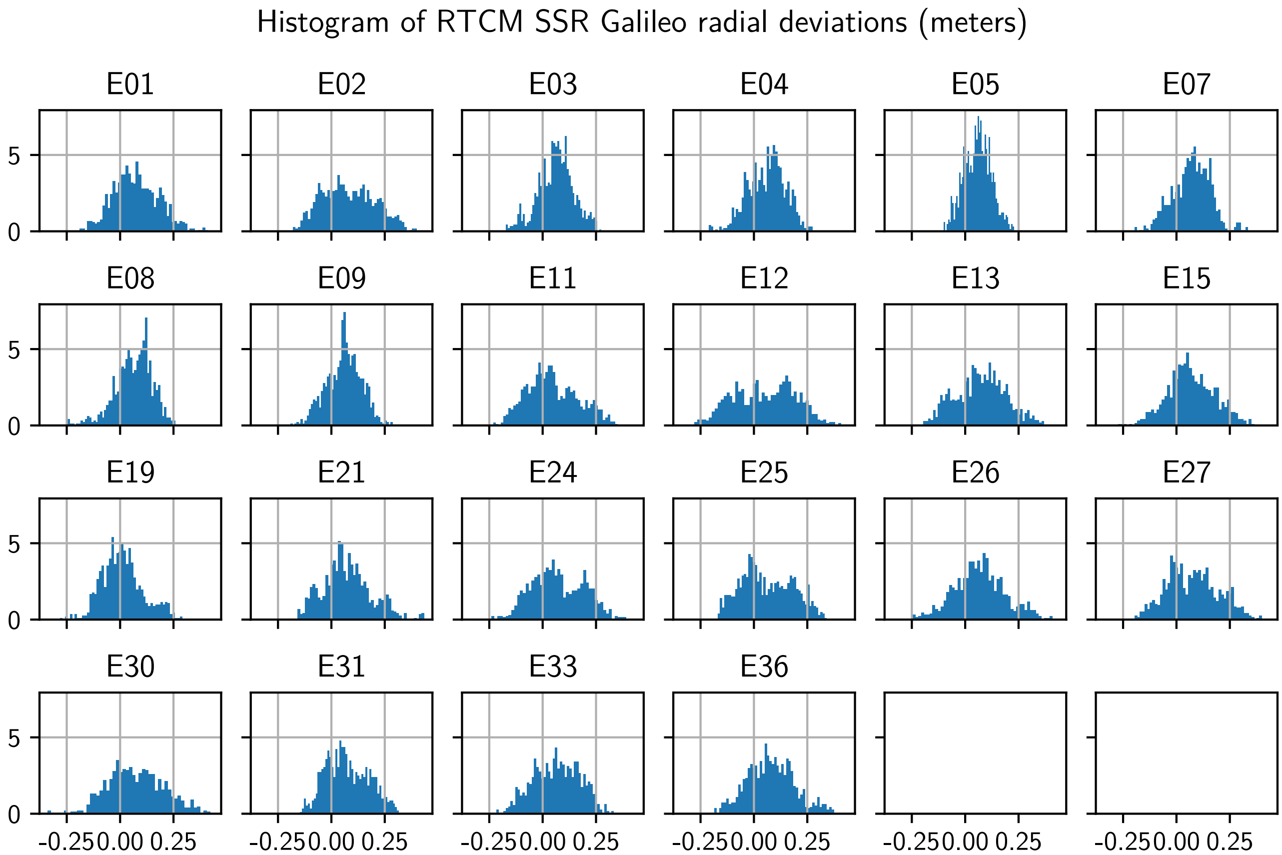
Details for individual satellites can be found at the end of this report.

Note that the RTCM radial data appears to have a 5 centimeter bias. This may reflect a transposition to a different coordinate system.





RTCM SSR radial correction, 5% - median - 95% interval
meter
0.3
0.2
0.1
0.0
-0.1
-0.2
E01 E02 E03 E04 E05 E07 E08 E09 E11 E12 E13 E14 E15 E18 E19 E21 E24 E25 E26 E27 E30 E31 E33 E36



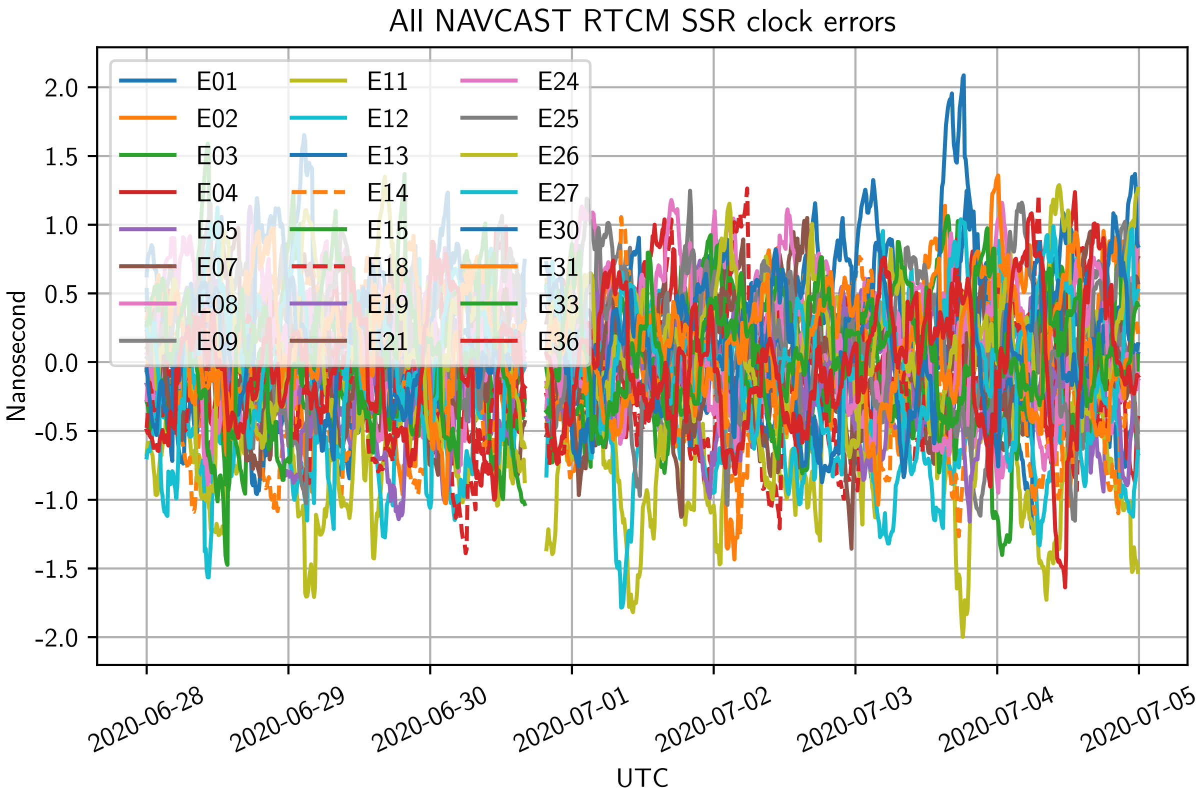
Histogram of RTCM SSR Galileo radial deviations (meters)
E01
E02
E03
E04
E05
E07
E08
E09
E11
E12
E13
E15
E19
E21
E24
E25
E26
E27
E30
E31
E33
E36
5
0
-0.25 0.00 0.25

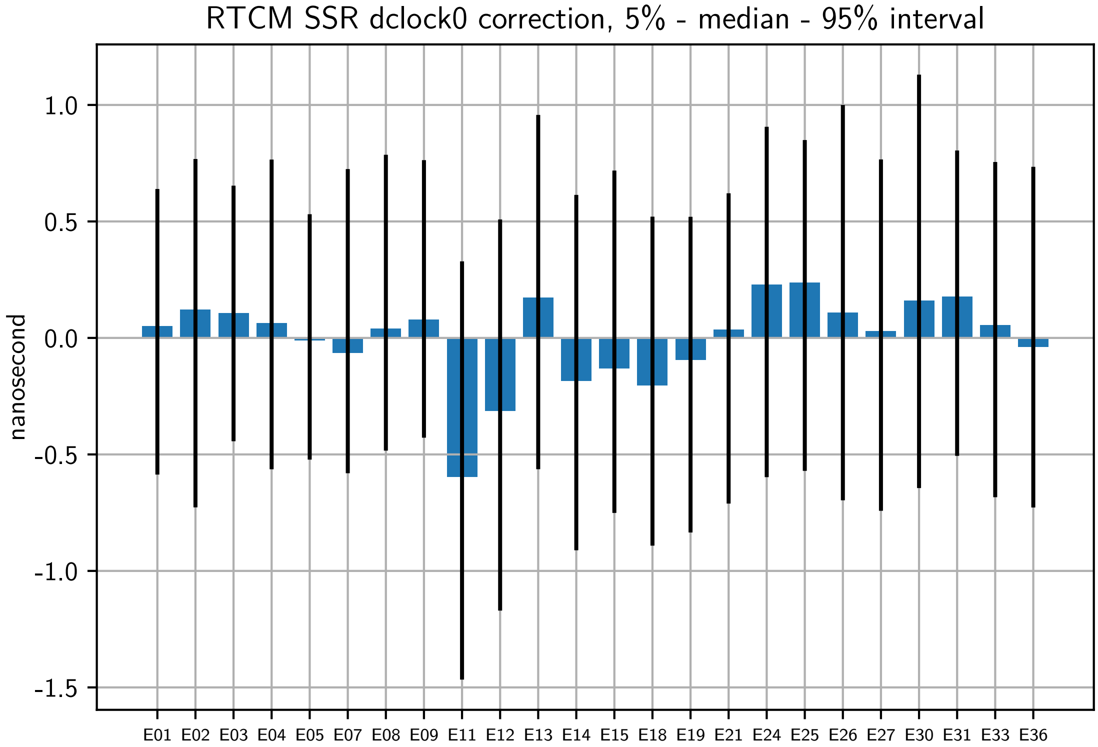
5.2 Clock error

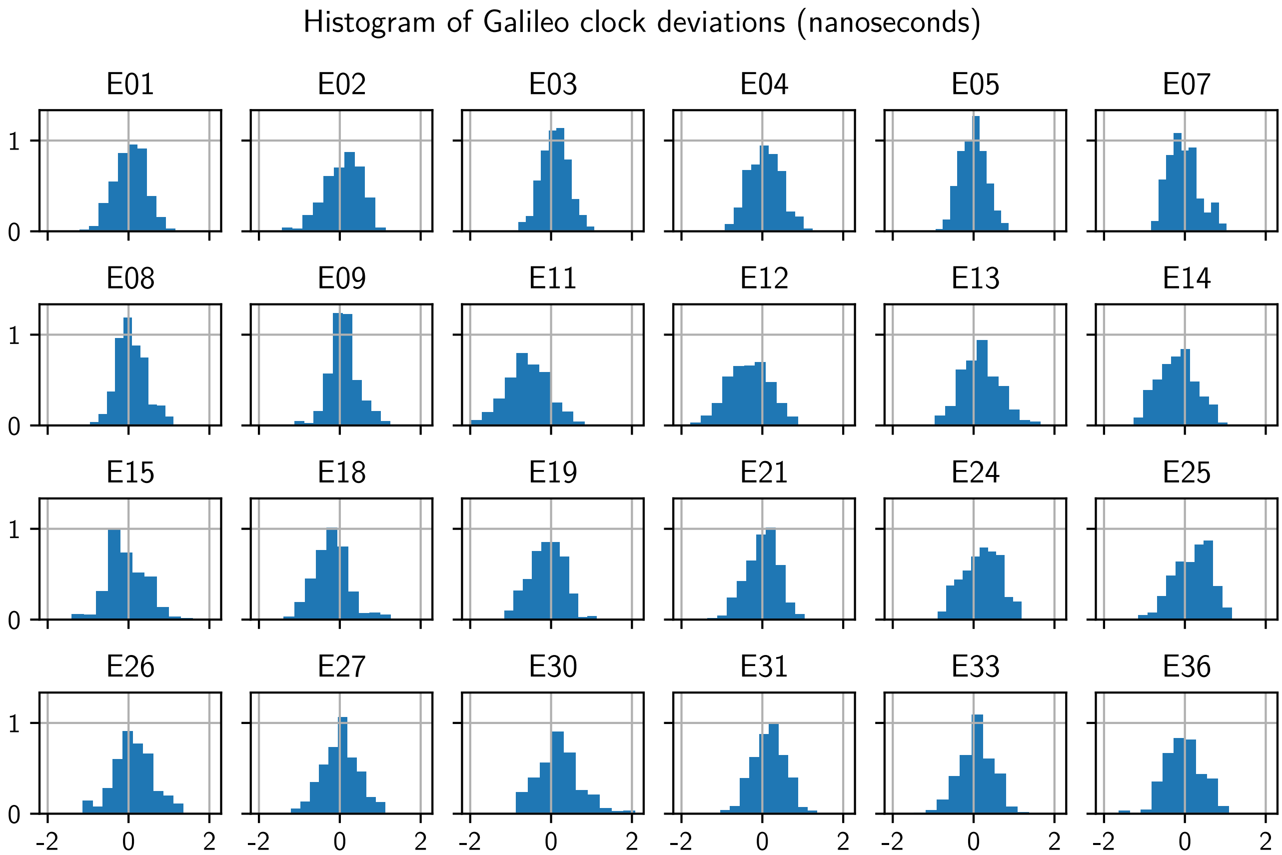
In a nominal situation, this graph shows many overlapping lines all clustered around 0 nanosecond error. If any SV deviates significantly, this shows up in subsequent graphs.

Details for individual satellites can be found at the end of this report.

Note that the RTCM clock error data as provided by DLR/NAVCAST and CNES is expressed in terms of a metric which corrects the F/NAV clock to the I/NAV clock. This creates non-physical corrections. To compensate, the data as presented in this report undoes the I/NAV-F/NAV transition. Further details on this situation can be found in two blogposts by independent researcher Daniel Estévez, "About Galileo BGDs" and "RTCM clock corrections for Galileo E24".




RTCM SSR dclock0 correction, 5% - median - 95% interval
nanosecond
1.0
0.5
0.0
-0.5
-1.0
-1.5
E01 E02 E03 E04 E05 E07 E08 E09 E11 E12 E13 E14 E15 E18 E19 E21 E24 E25 E26 E27 E30 E31 E33 E36


Histogram of Galileo clock deviations (nanoseconds)
E01
E02
E03
E04
E05
E07
E08
E09
E11
E12
E13
E14
E15
E18
E19
E21
E24
E25
E26
E27
E30
E31
E33
E36
1
0
-2
0
2

Chapter 6

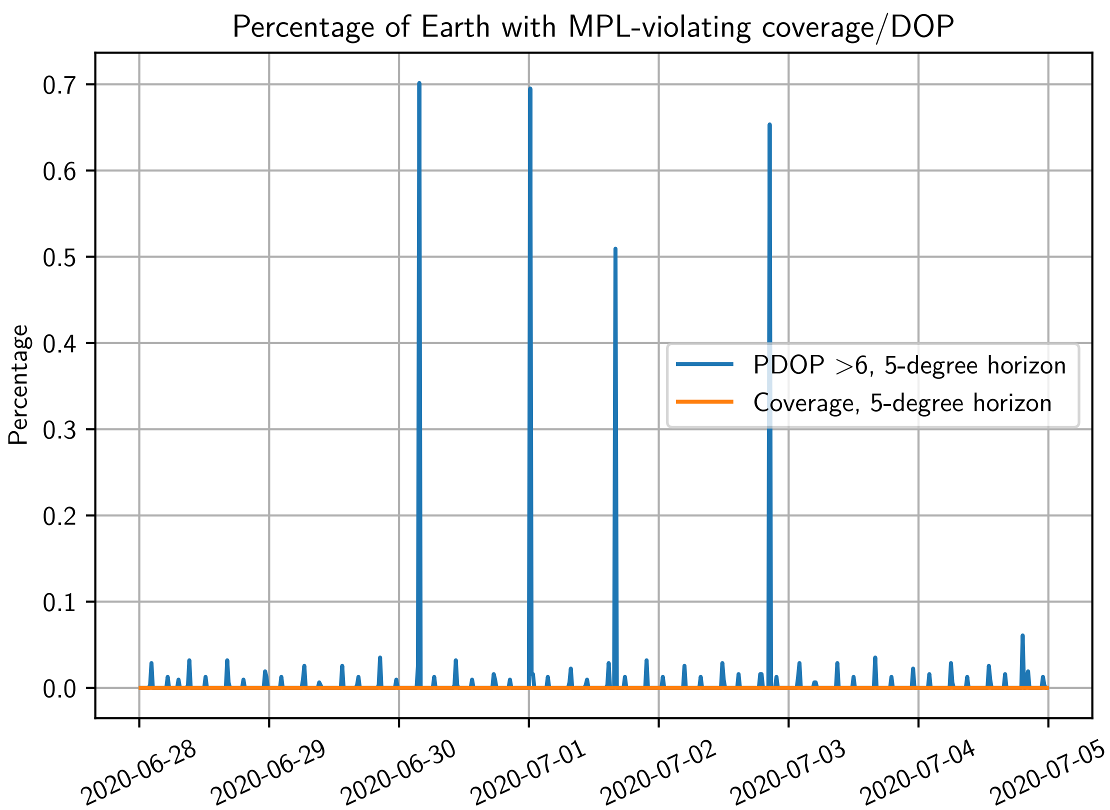
Global performance

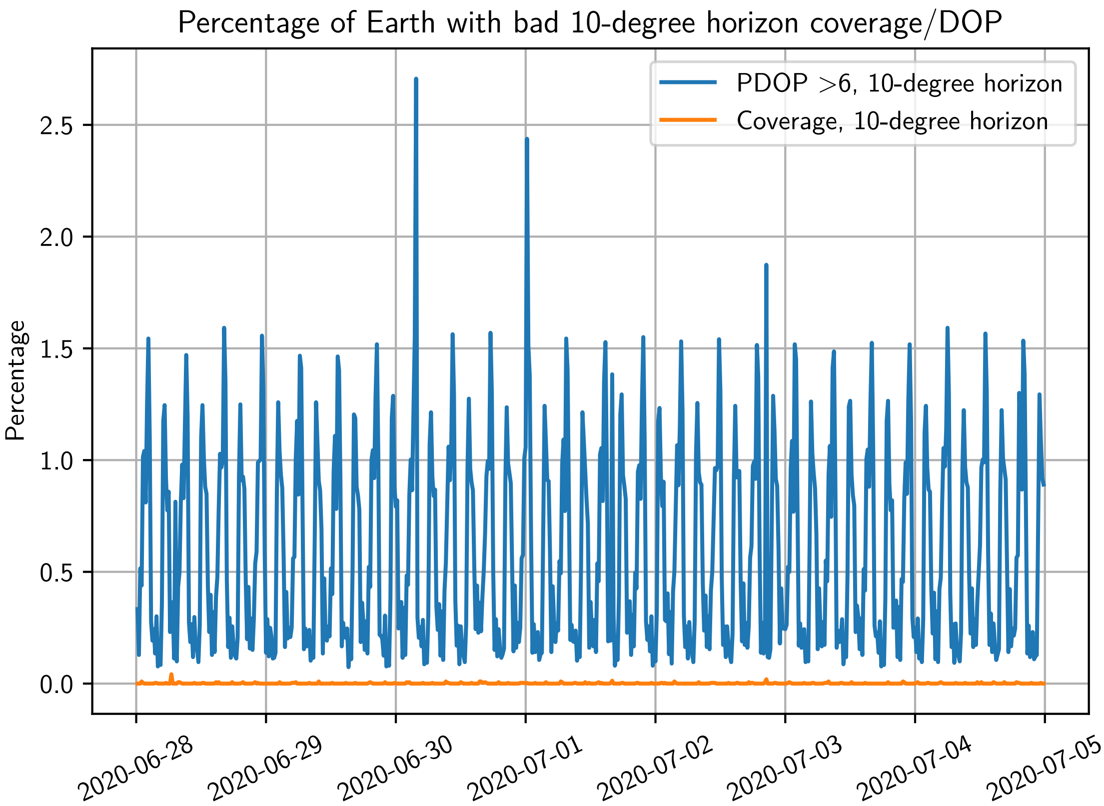
The performance for average and worst user locations features large in the Galileo Service Definition Document. Of specific note is availability (coverage, visibility of 4 or more satellites) with an elevation more than 5 degrees above the horizon.

In addition, we plot the perhaps more meaningful similar measure with a view of more than 10 degrees above the horizon.

Note that these graphs show minute variations, where sometimes only tiny fractions of the Earth's surface are impacted.

6.1 PDOP and coverage



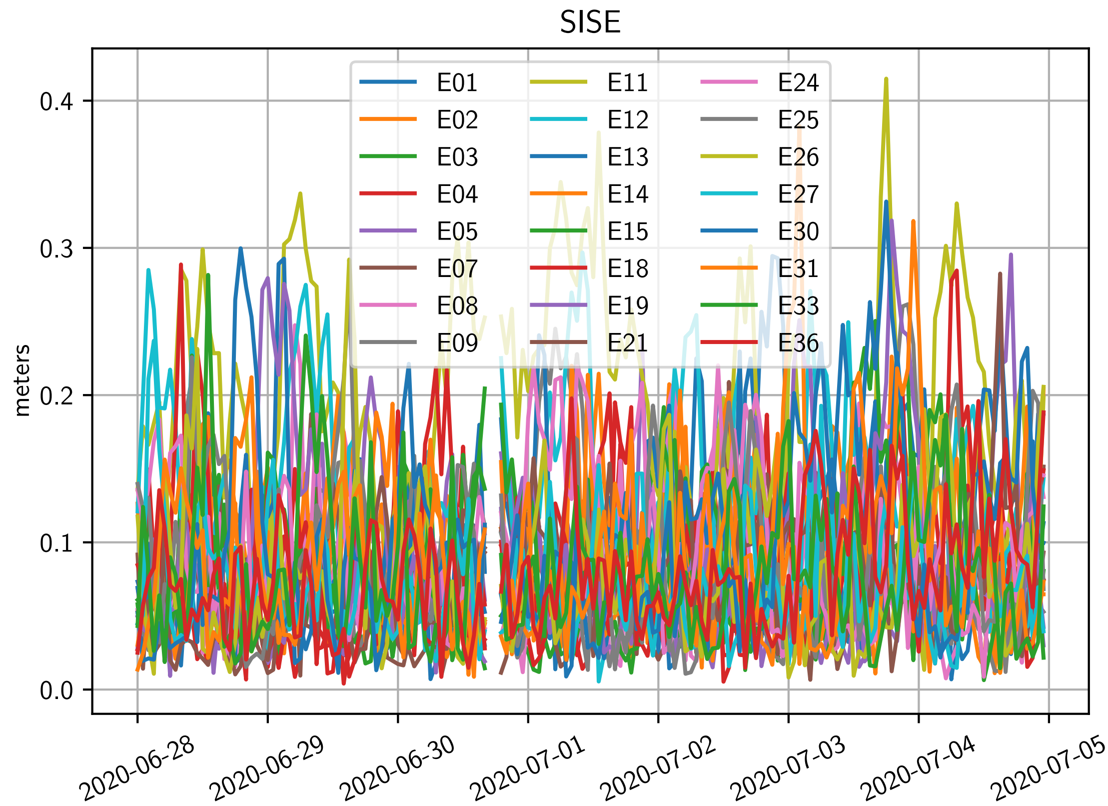


6.2 Signal In Space Error (SISE)

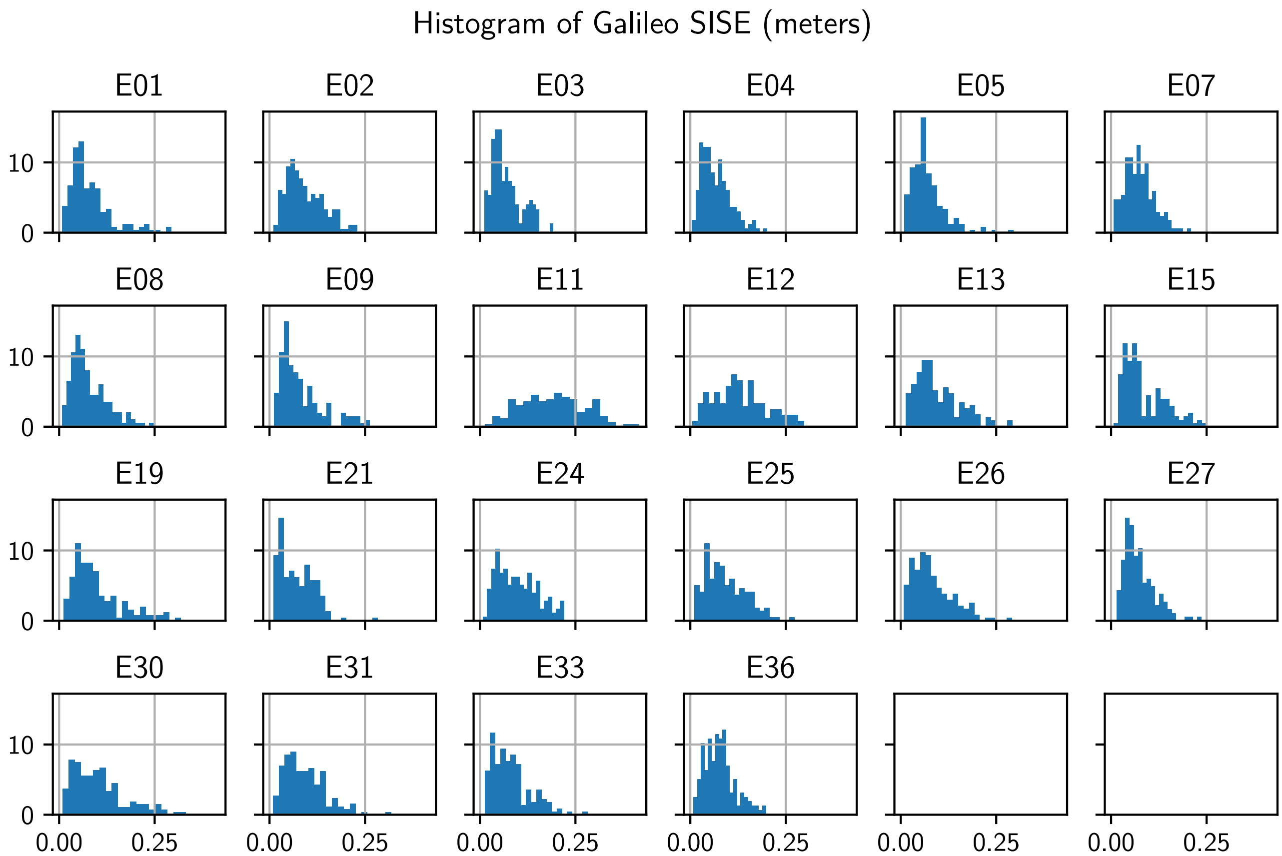
The data in this section is based on the approximation formula from section C.4.3.2 from the Galileo Service Definition Document.

The source of the corrections is the realtime NAVCAST data from Spaceopal/DLR. This data has, as usual, been adjusted for the F/NAV-I/NAV clock situation. In addition, an observed bias of around 5 centimeters has been deducted from the radial error.

The first graph shows all SISE values for all SVs, and should show a lot of data quite close to 0 meters (usually 10 centimeters).



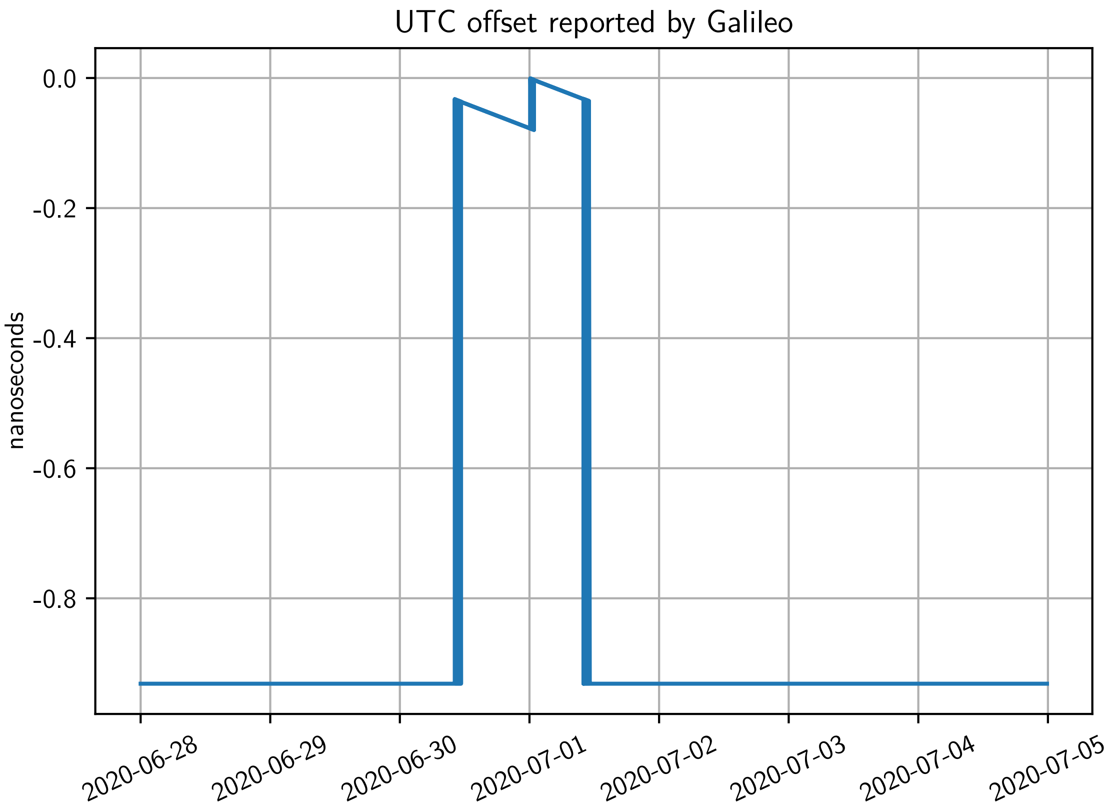
This second graph shows a histogram of Signal In Space Errors for all Galileo SVs:

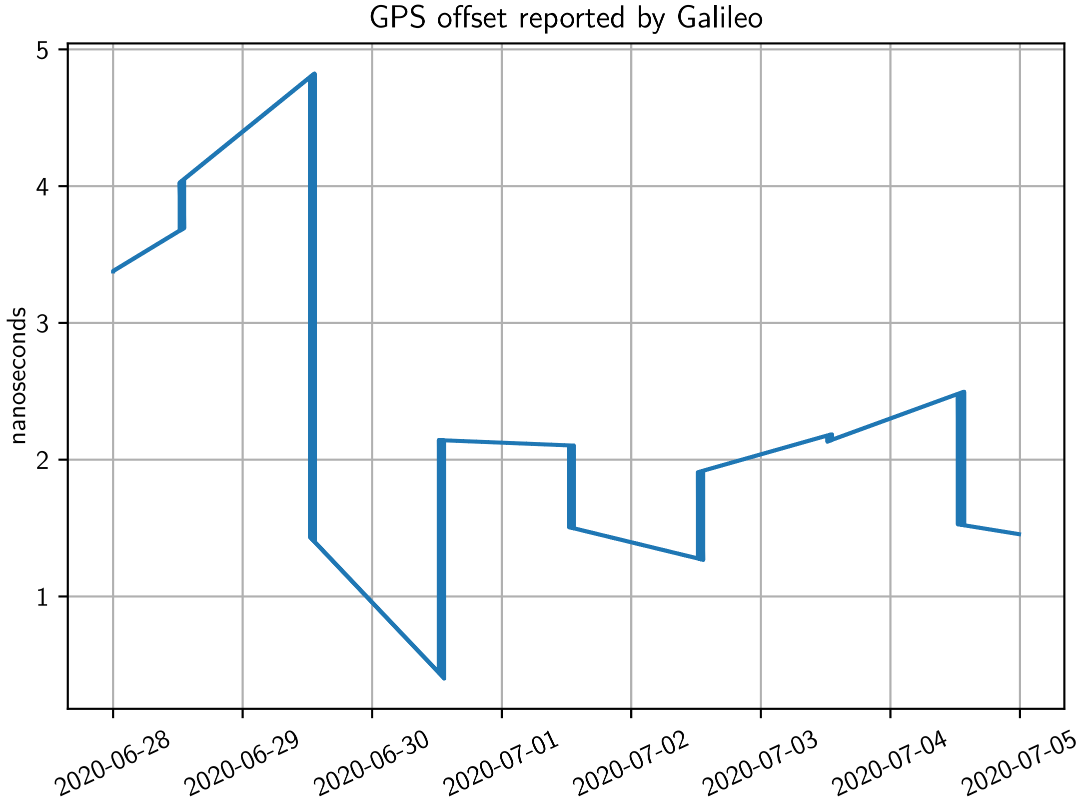


Chapter 7

UTC offset, GPS offset (GGTO)

Galileo satellites broadcast their offset between "Galileo Time" (GST), UTC and GPS Time. These graphs show what offsets are transmitted.




GPS offset reported by Galileo
nanoseconds
1
2
3
4
5
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

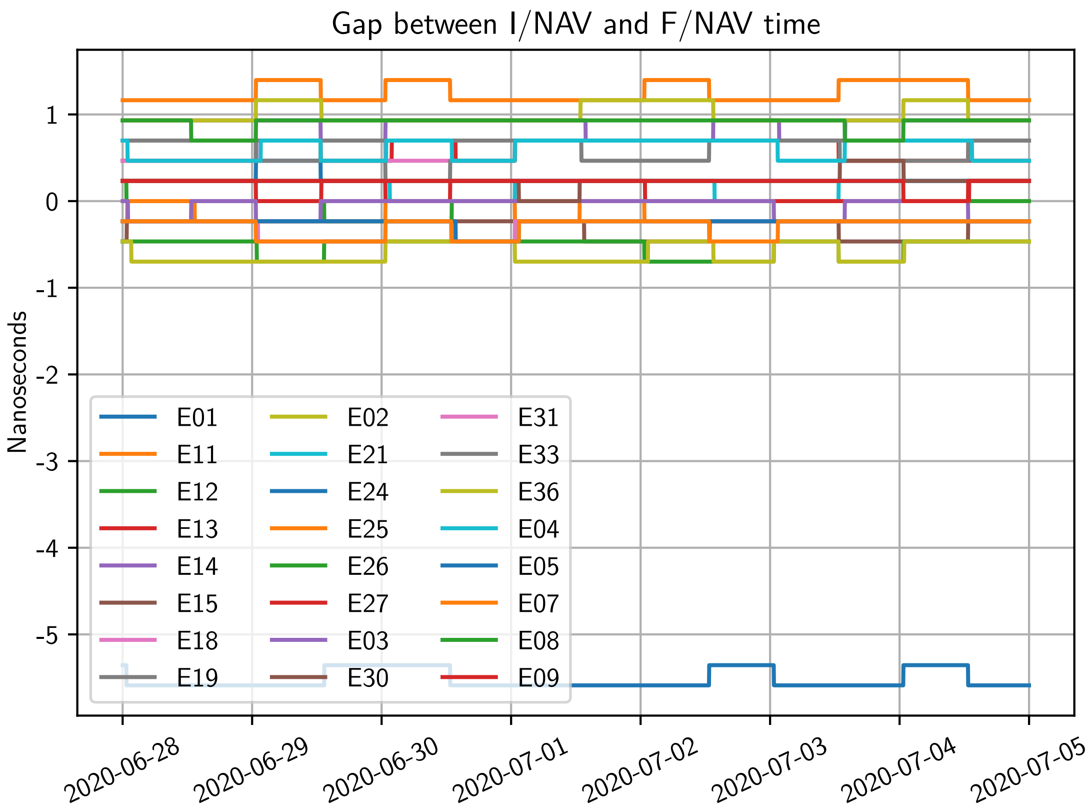
Chapter 8

Parameters

8.1 BGD E1E5a, E1E5b

This plots the difference between the E1E5a and E1E5b parameters, which should correspond to the gap between the af_0 values broadcast over E1/E5b (I/NAV) and E5a (F/NAV).

This graph incidentally also describes the correction this report applies to the RTCM SSR data to undo the I/NAV-F/NAV modification.



Chapter 9

Per SV

The SP3 data as provided by GFZ Potsdam and ESOC refers to the Center of Mass (CoM) coordinates. The broadcast ephemerides however describe the trajectory of the Antenna Phase Centre (APC).

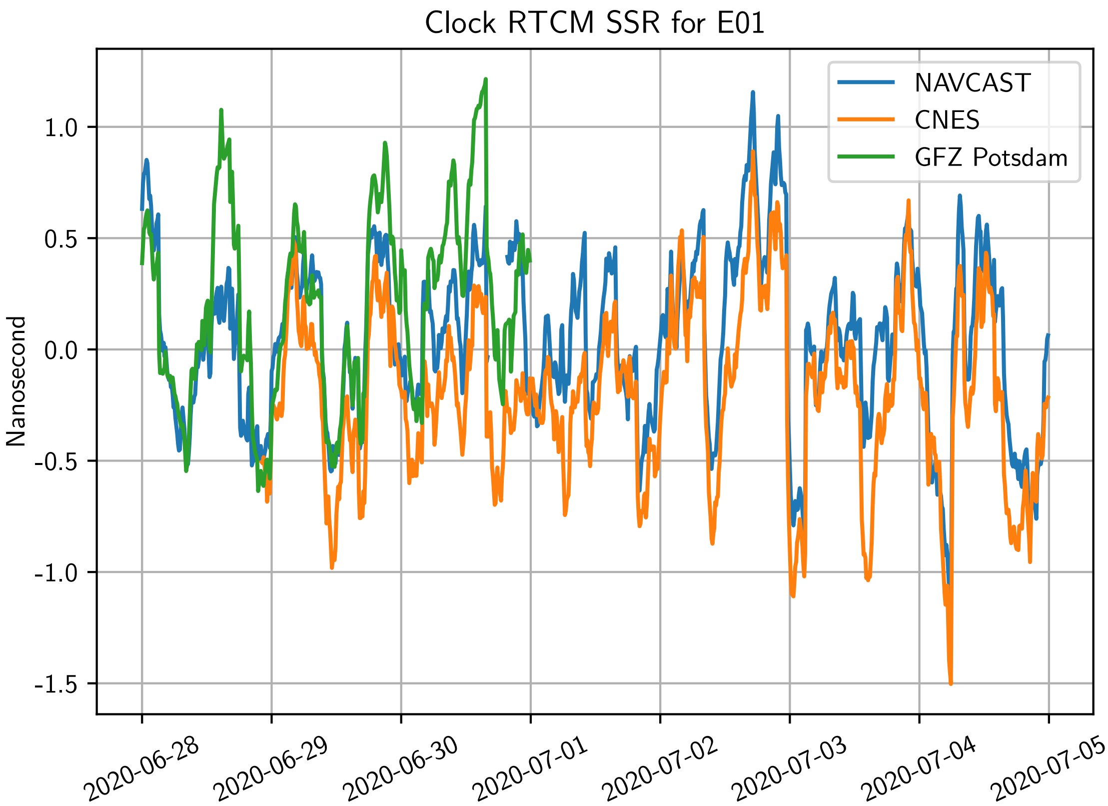
There is a measurable distance between CoM and APC, typically of around 80 centimeters.

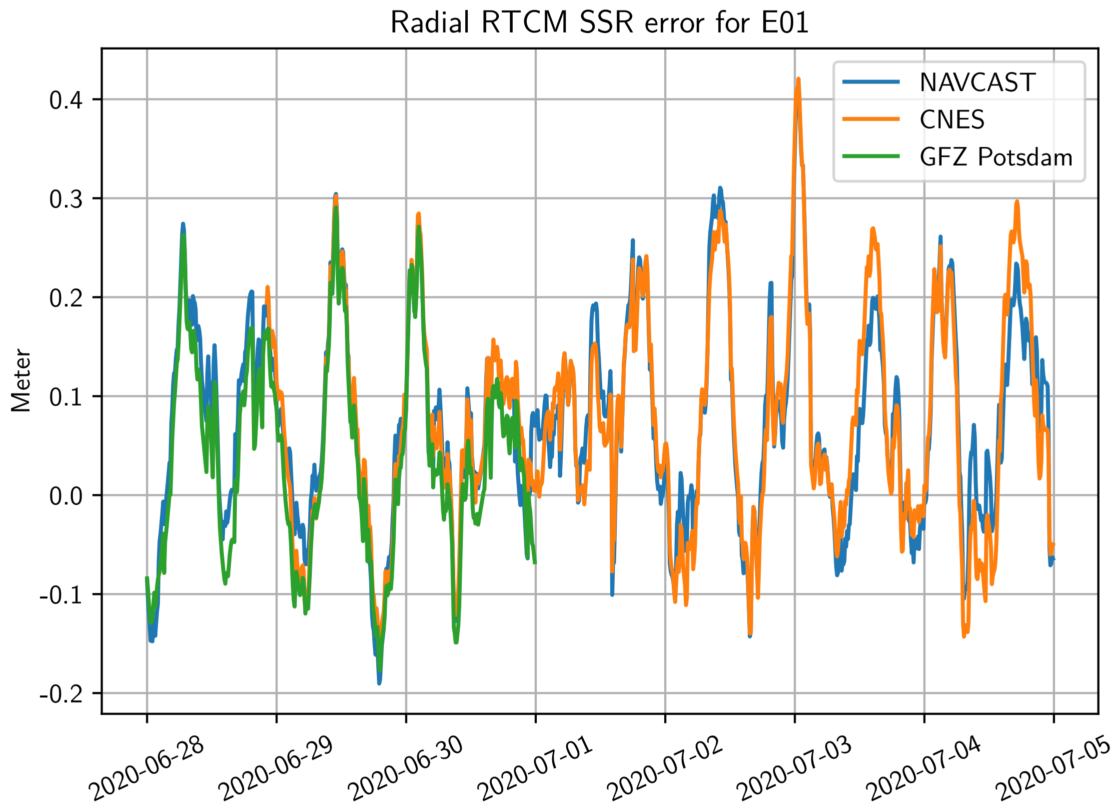
By using metrics provided by ESA for the Galileo satellites, it is possible to transpose the APC to the CoM via the Antenna Reference Point.

This transposition has so far proved to be too difficult for the authors of this report, but we have found the correction in the z-axis is 80 centimeters for most but not all SVs.

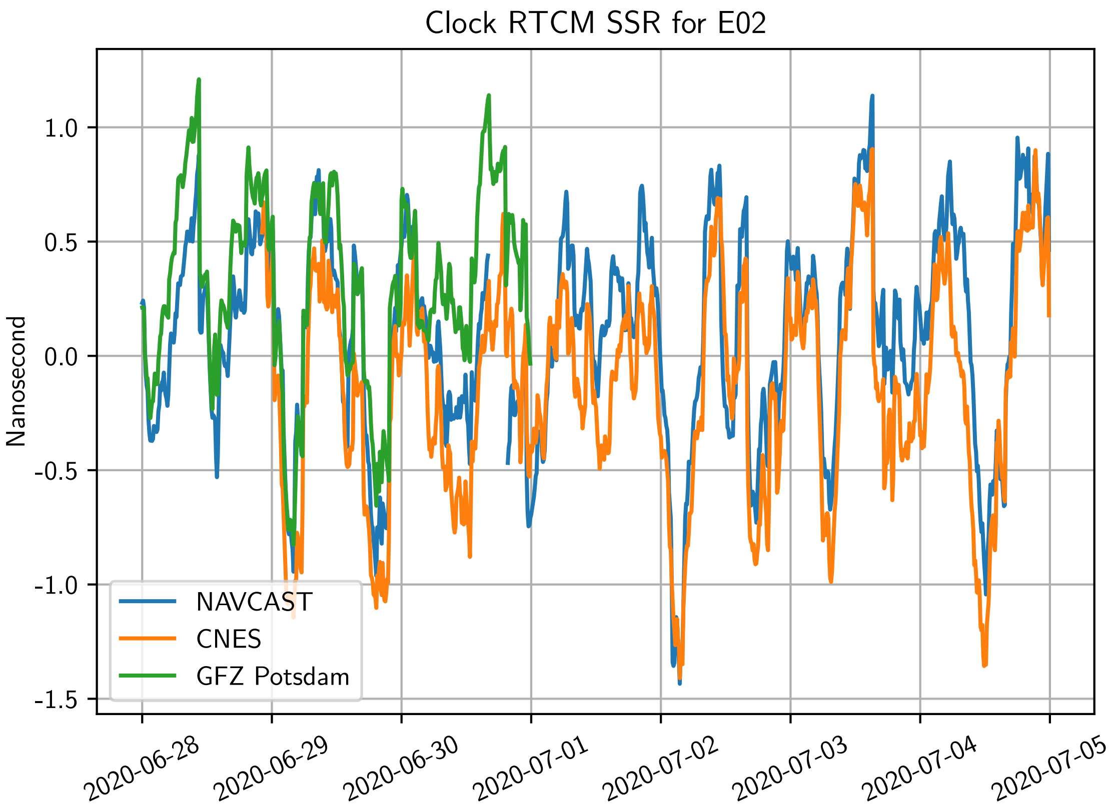
In future editions of this report, a more sophisticated correction will be applied. But for now, if SP3 data (GFZ or ESOC) is offset somewhat from the APC RTCM SSR data, this is why.

E01

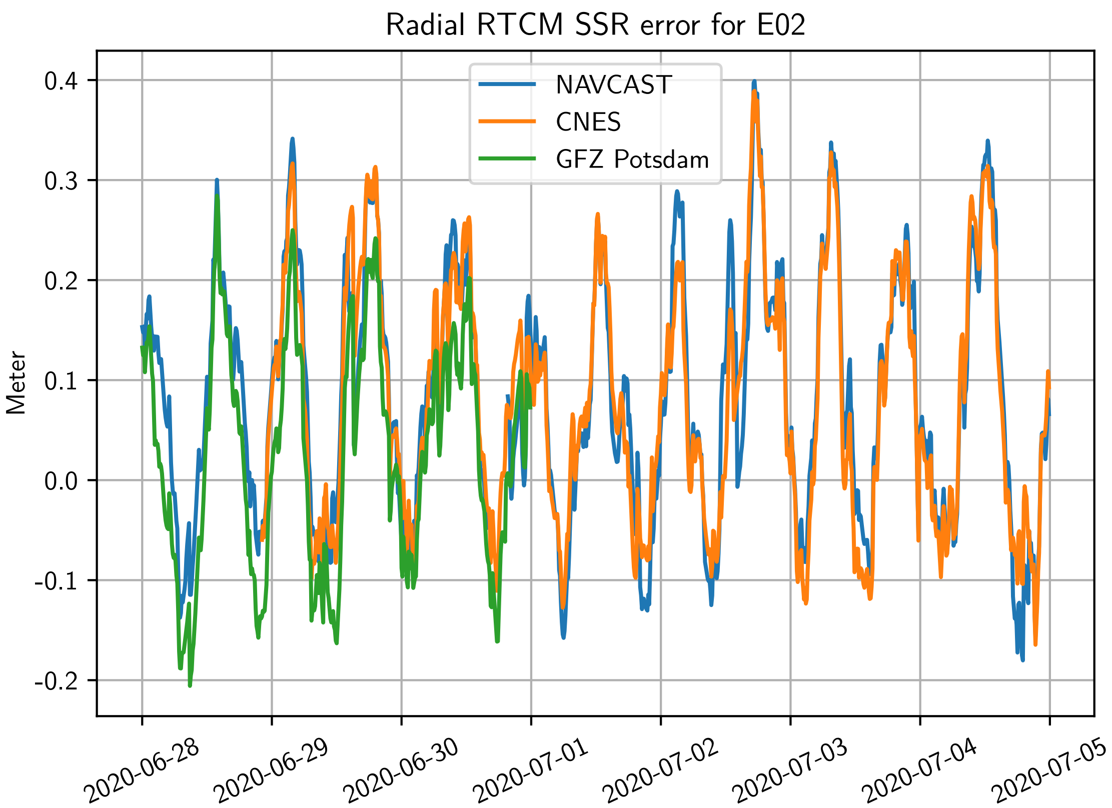



Radial RTCM SSR error for E01
NAVCAST
CNES
GFZ Potsdam
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E02

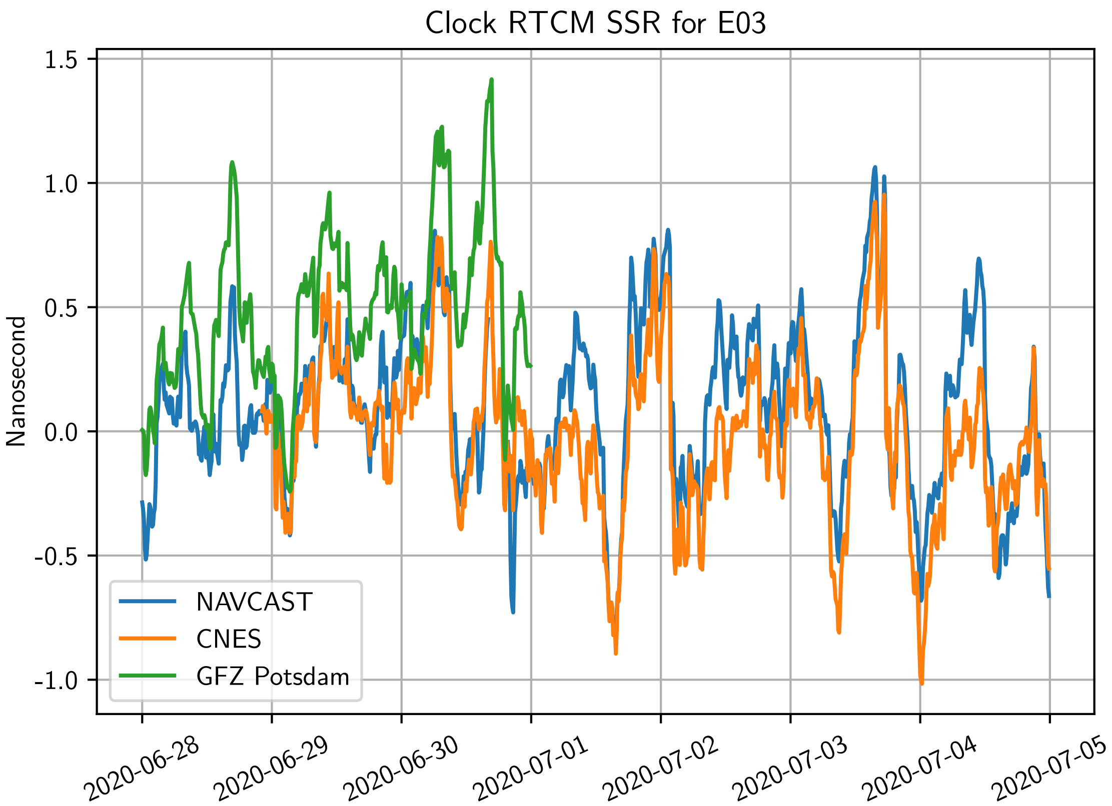


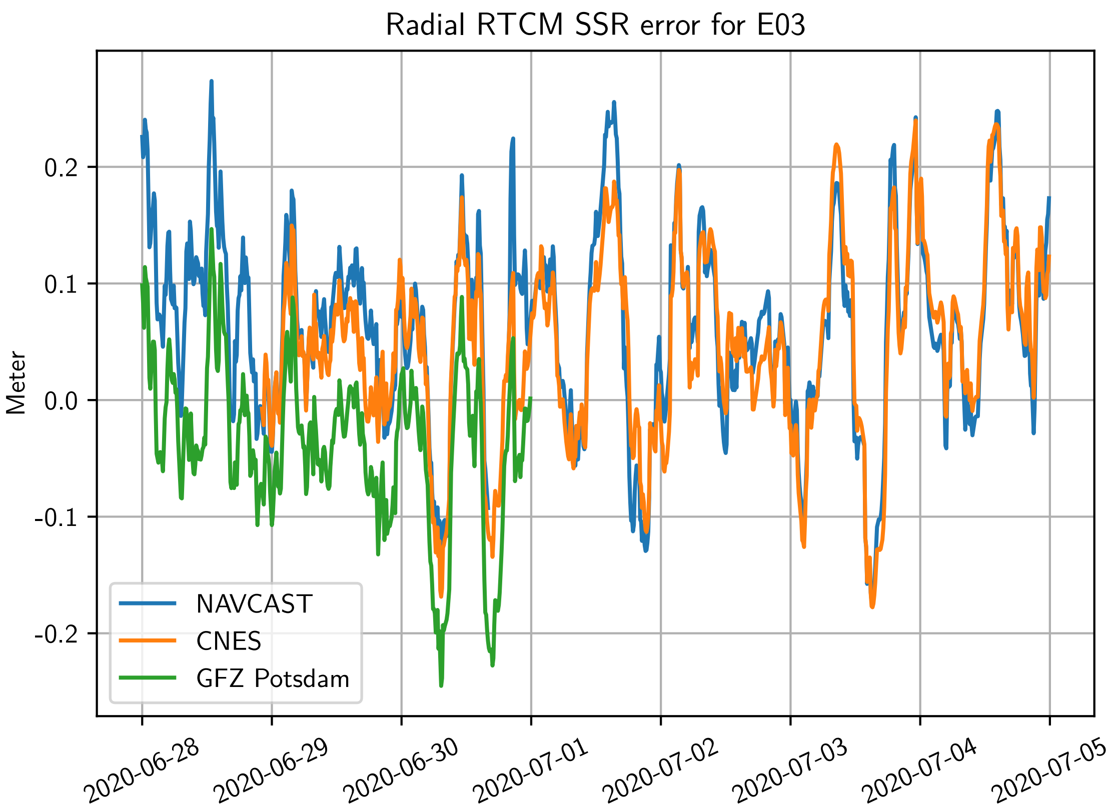
Clock RTCM SSR for E02
Nanosecond
1.0
0.5
0.0
-0.5
-1.0
-1.5
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05



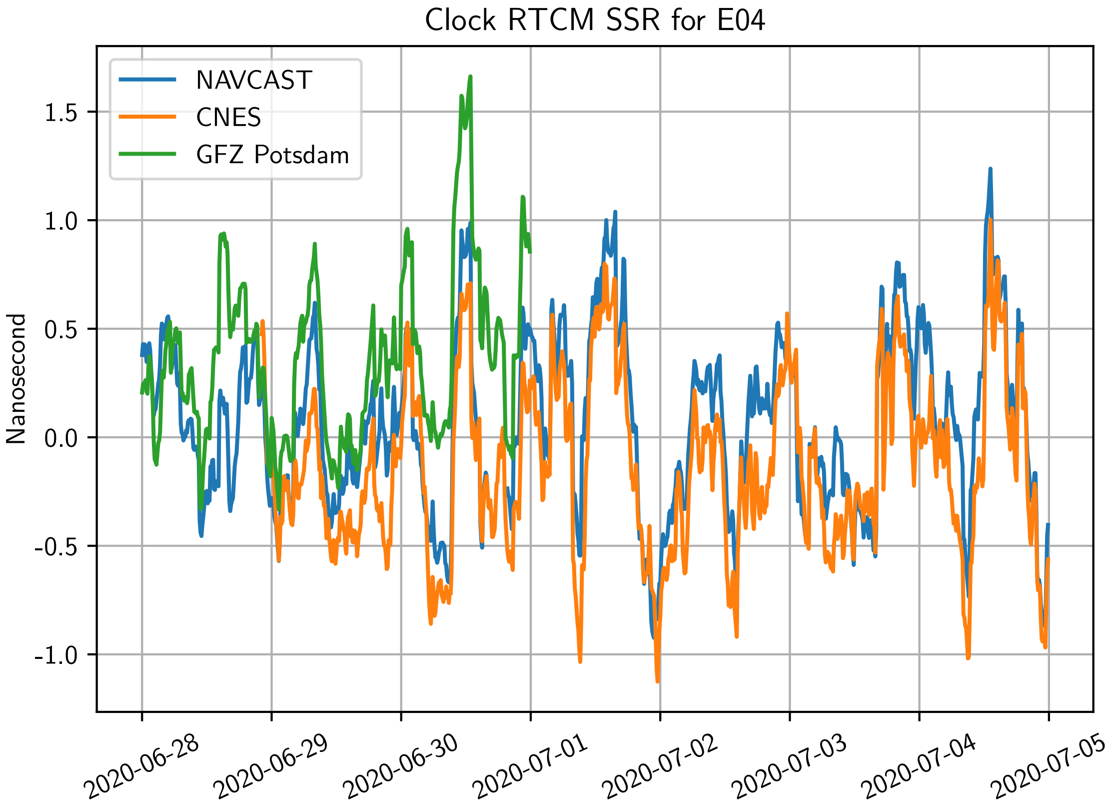
Radial RTCM SSR error for E02
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E03

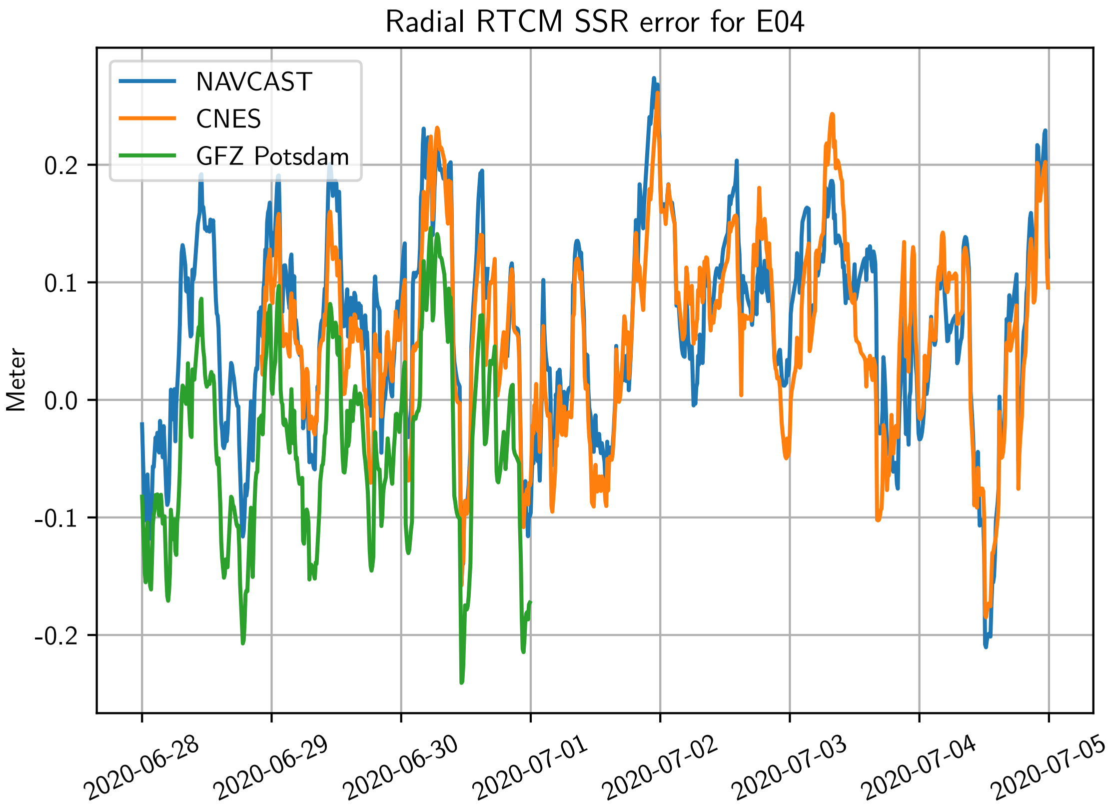

Clock RTCM SSR for E03
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05


Radial RTCM SSR error for E03
Meter
0.2
0.1
0.0
-0.1
-0.2
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E04

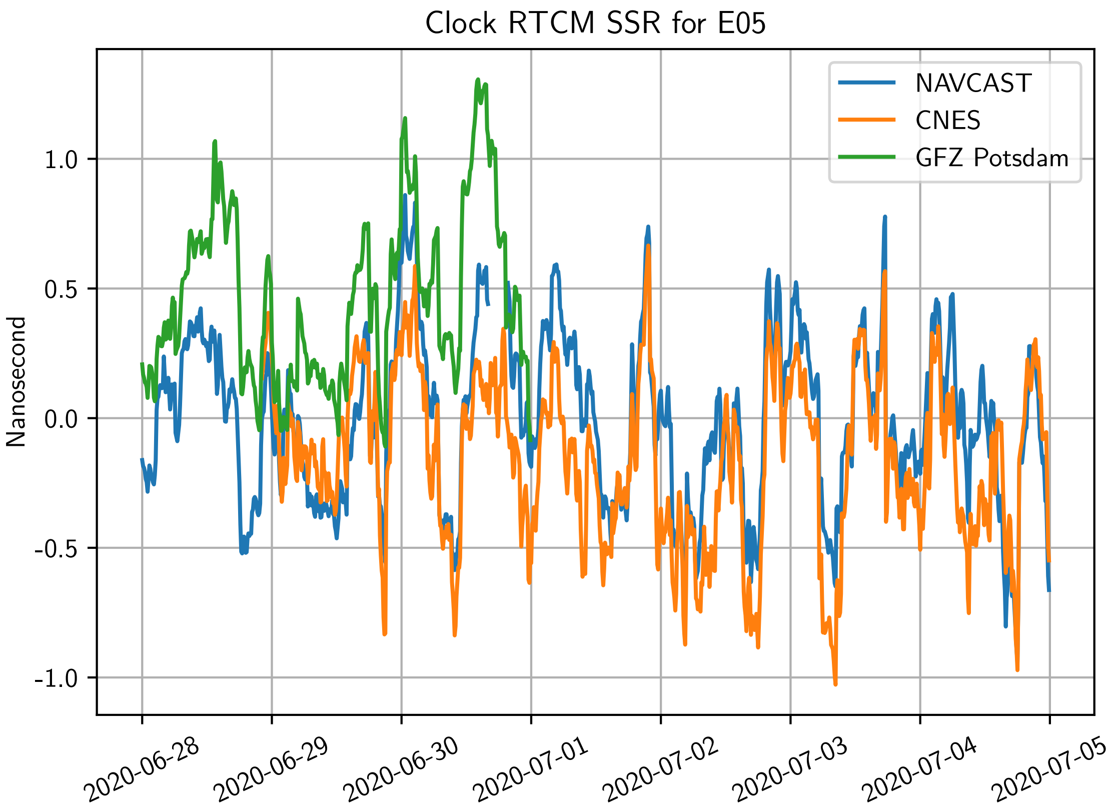


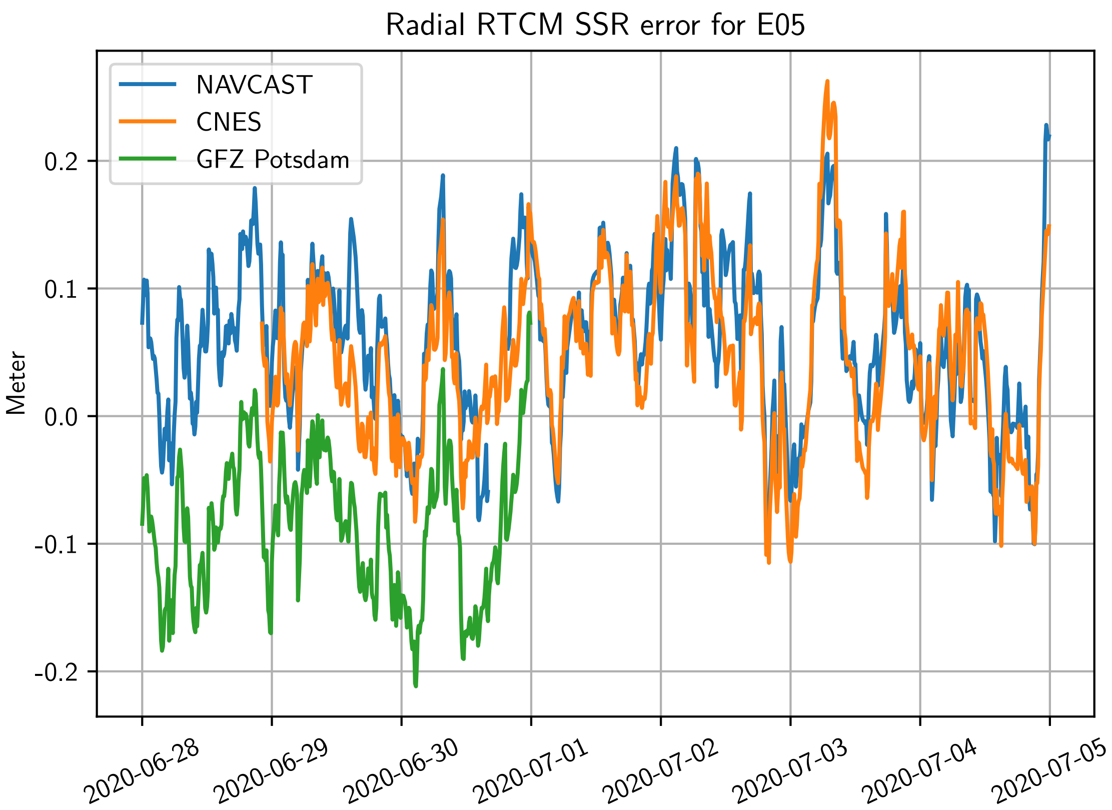
Clock RTCM SSR for E04
NAVCAST
CNES
GFZ Potsdam
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05



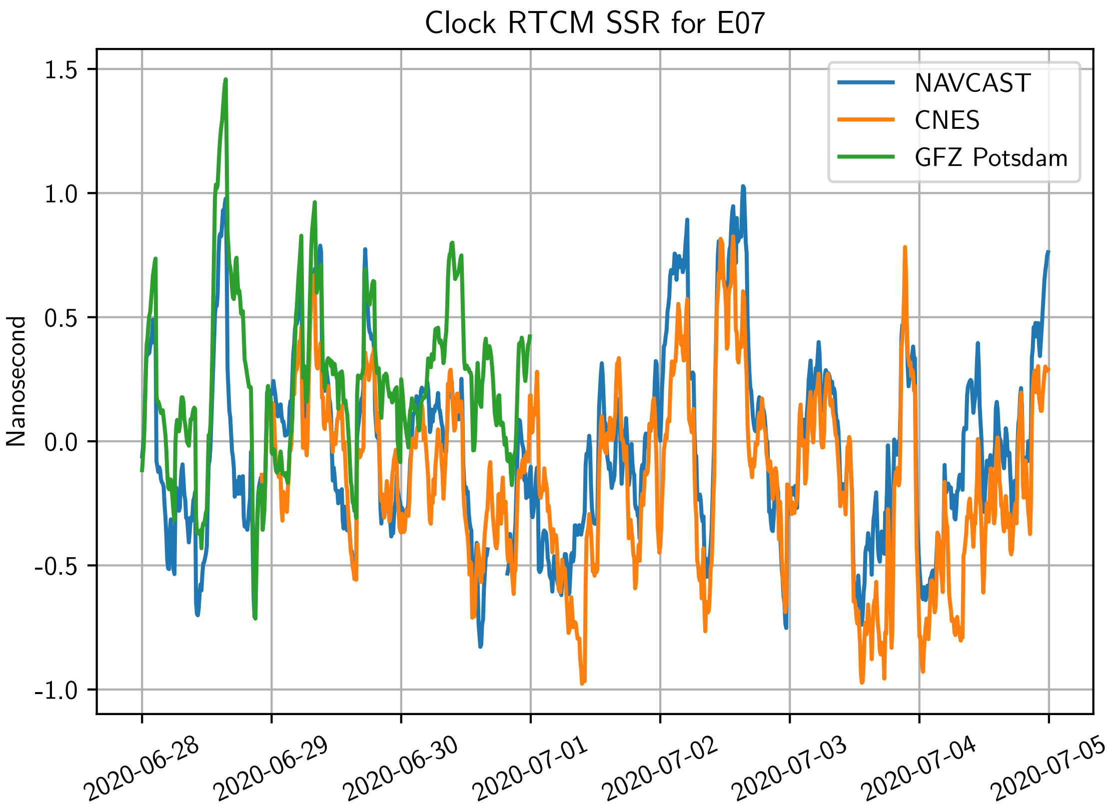
Radial RTCM SSR error for E04
NAVCAST
CNES
GFZ Potsdam
Meter
0.2
0.1
0.0
-0.1
-0.2
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E05

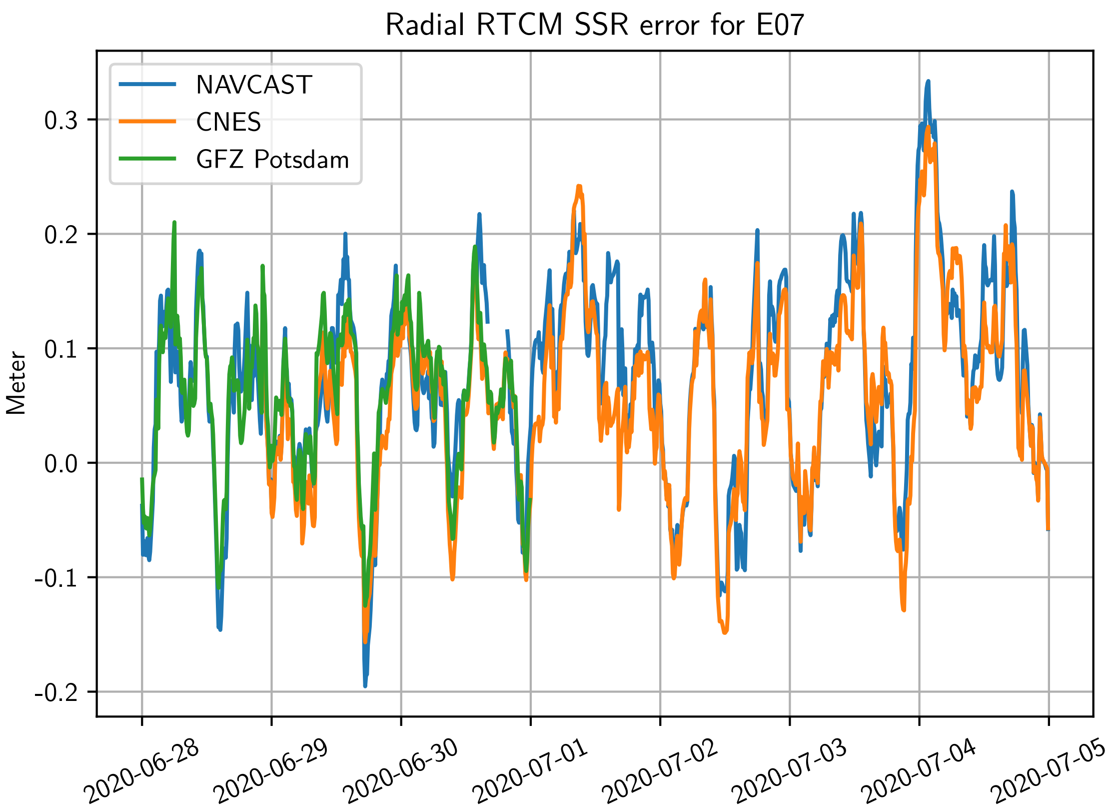

Clock RTCM SSR for E05
NAVCAST
CNES
GFZ Potsdam
Nanosecond
1.0
0.5
0.0
-0.5
-1.0
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05


Radial RTCM SSR error for E05
NAVCAST
CNES
GFZ Potsdam
Meter
0.2
0.1
0.0
-0.1
-0.2
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E07

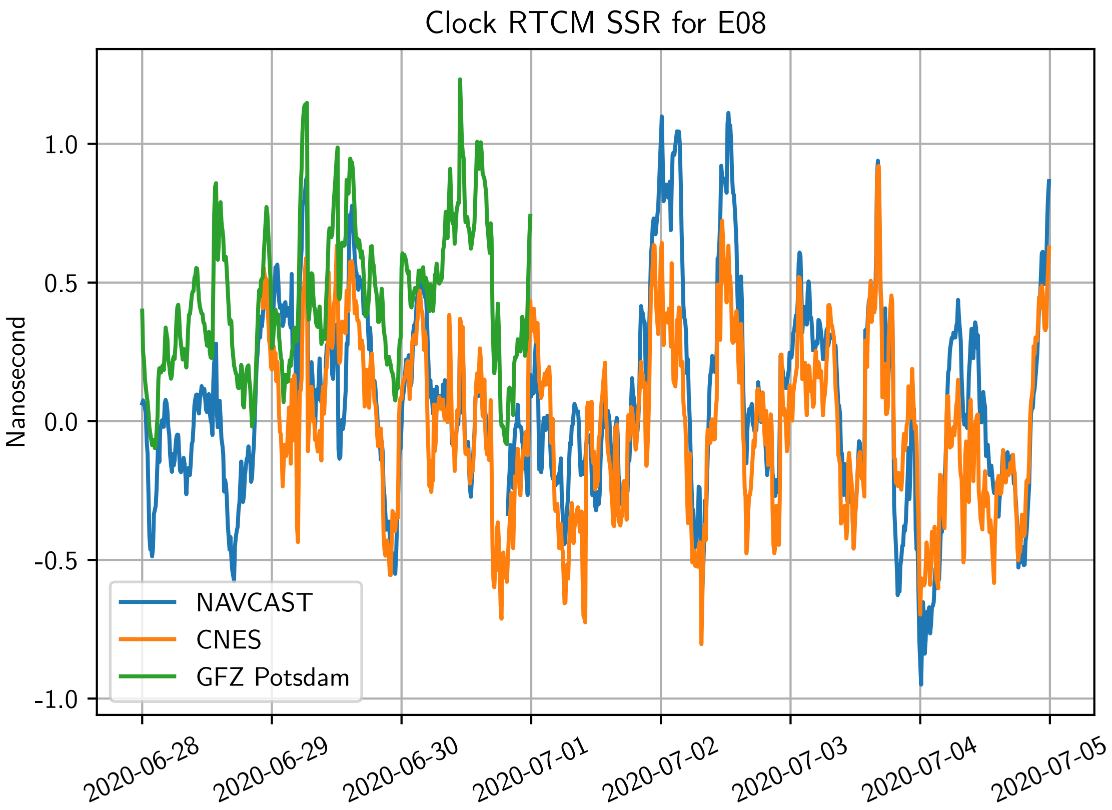


Clock RTCM SSR for E07
NAVCAST
CNES
GFZ Potsdam
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

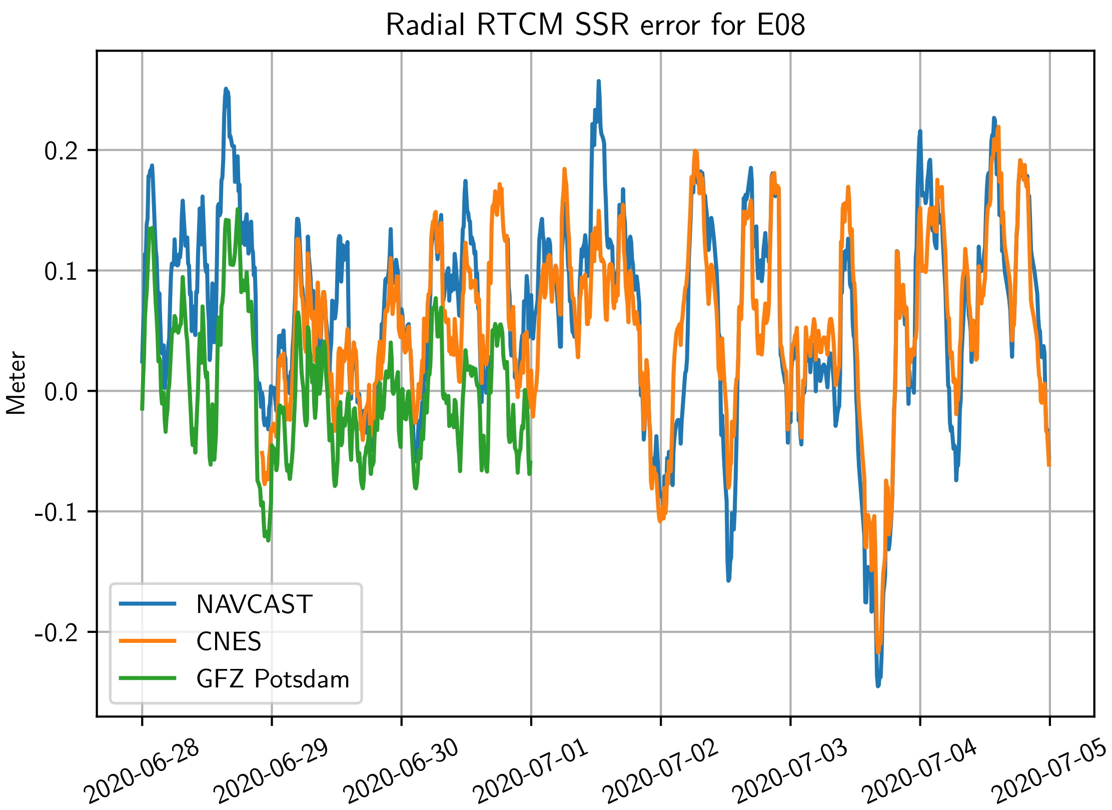


Radial RTCM SSR error for E07
NAVCAST
CNES
GFZ Potsdam
Meter
0.3
0.2
0.1
0.0
-0.1
-0.2
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E08

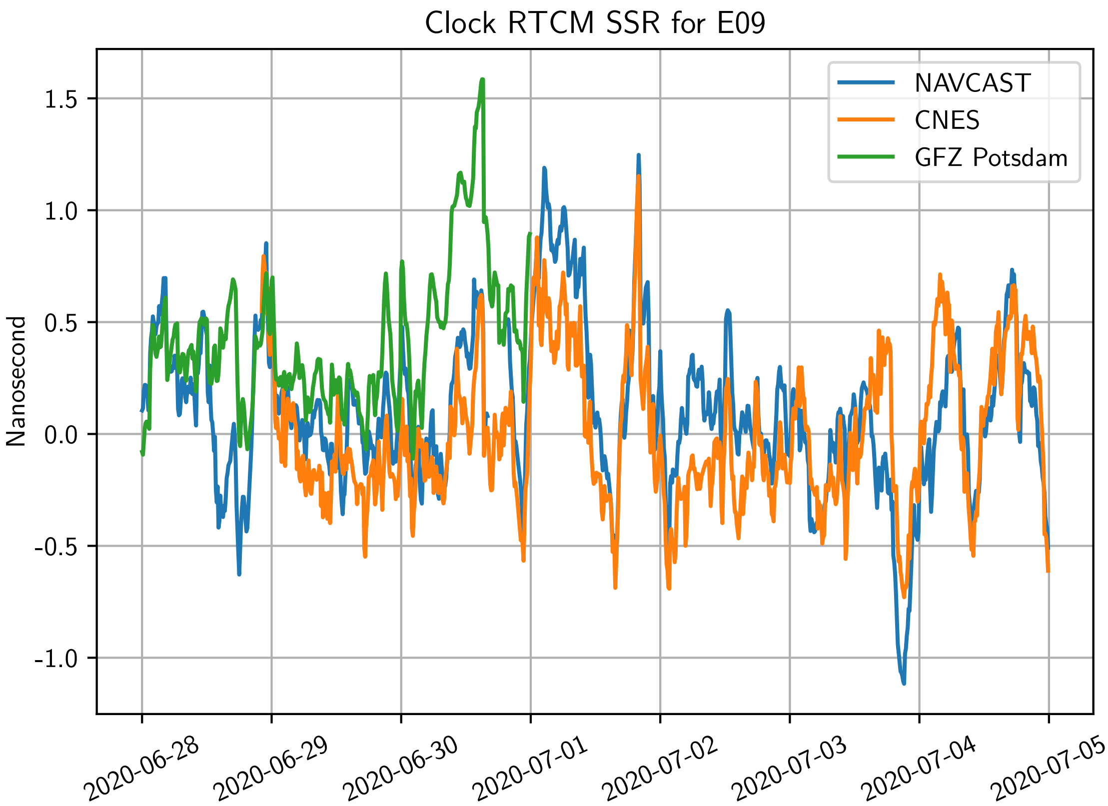


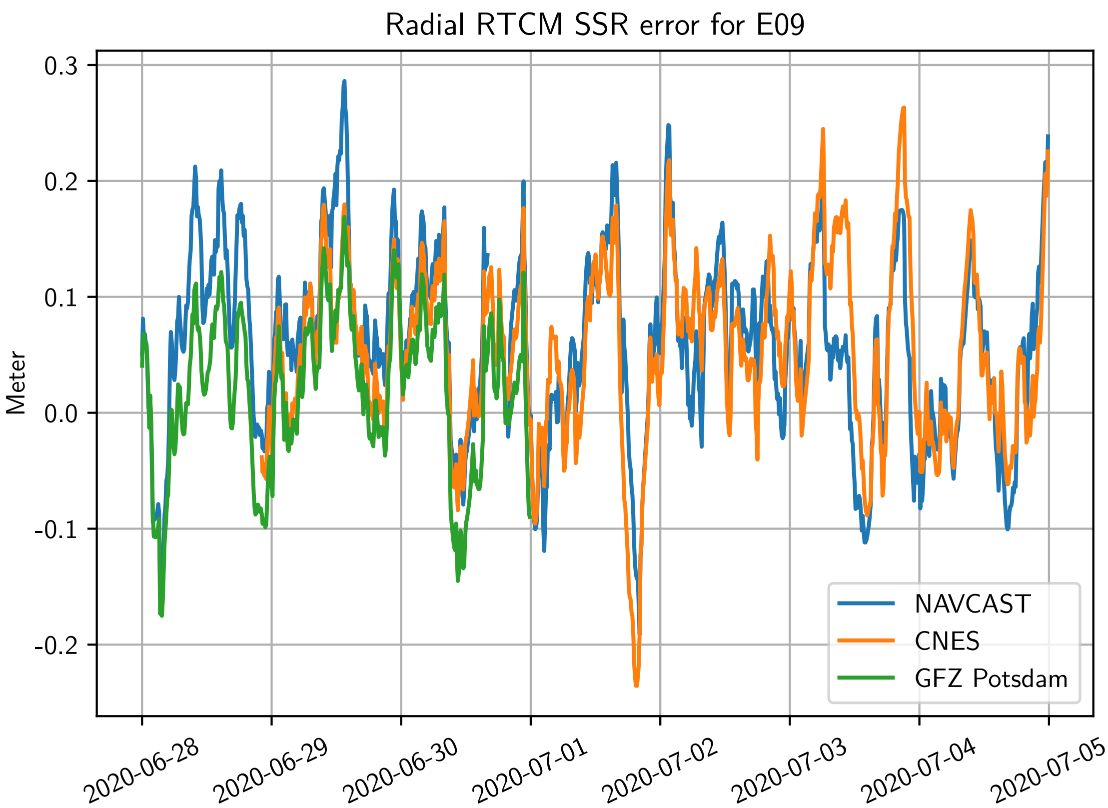
Clock RTCM SSR for E08
Nanosecond
1.0
0.5
0.0
-0.5
-1.0
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05



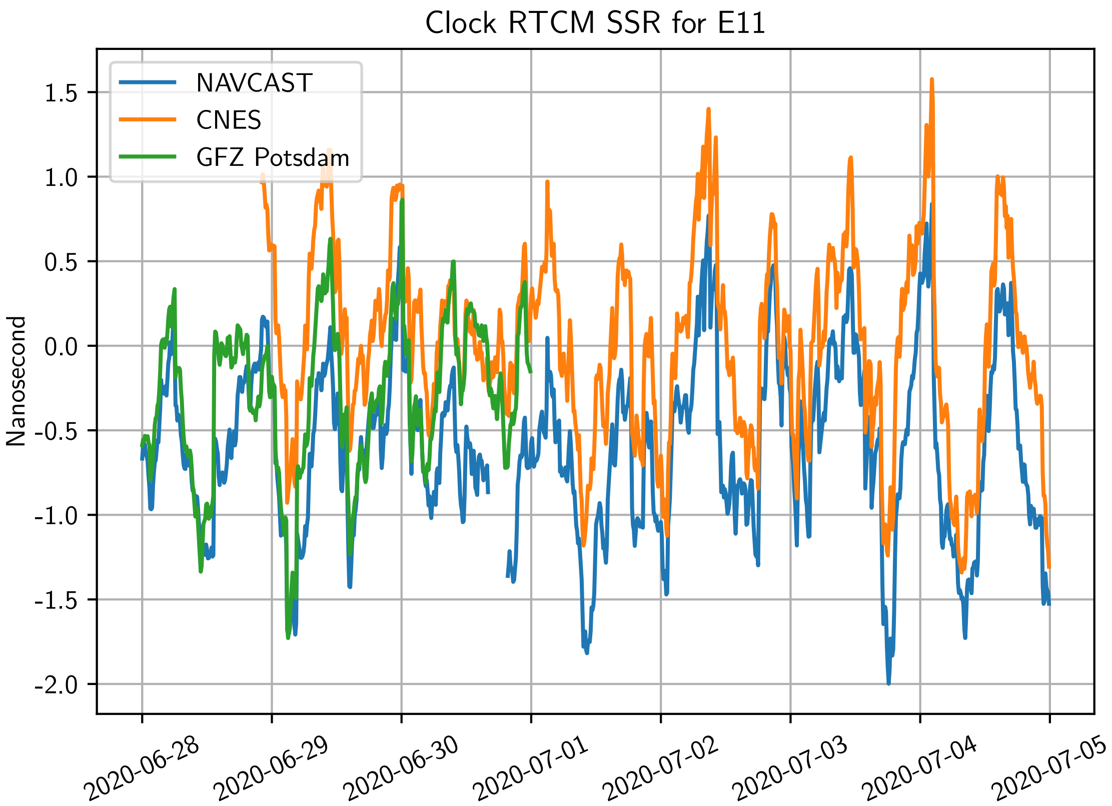
Radial RTCM SSR error for E08
Meter
0.2
0.1
0.0
-0.1
-0.2
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

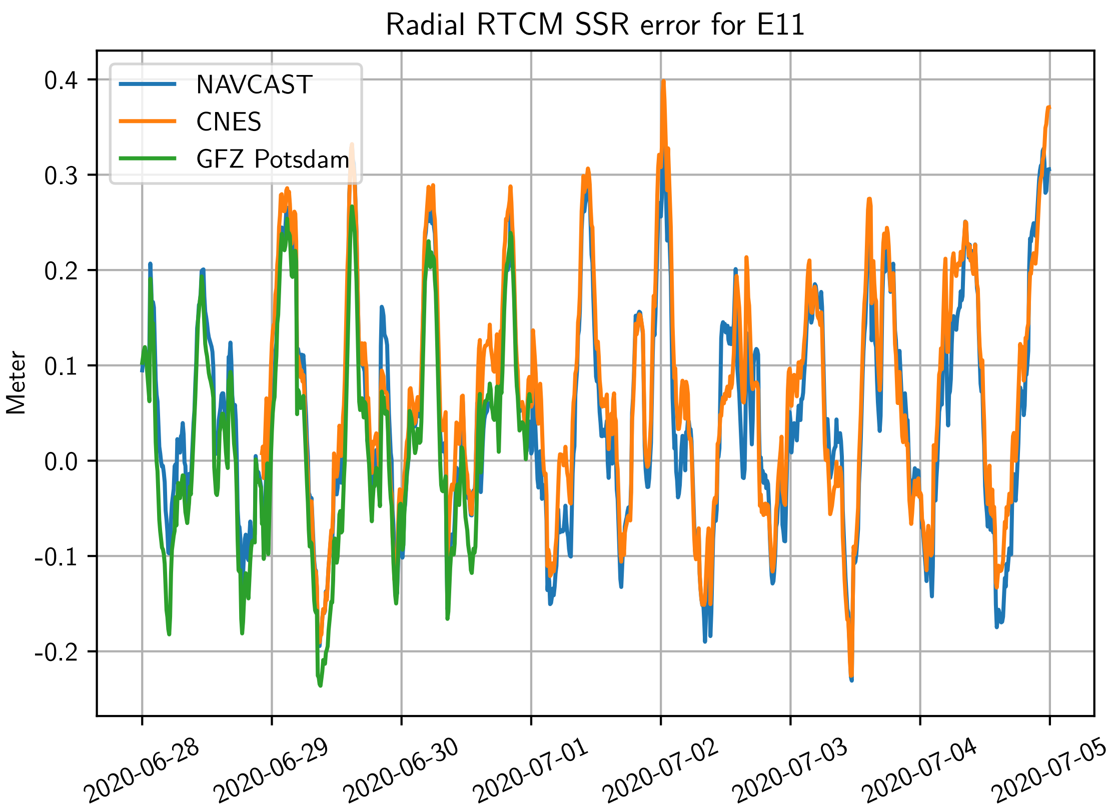
E09


Clock RTCM SSR for E09
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

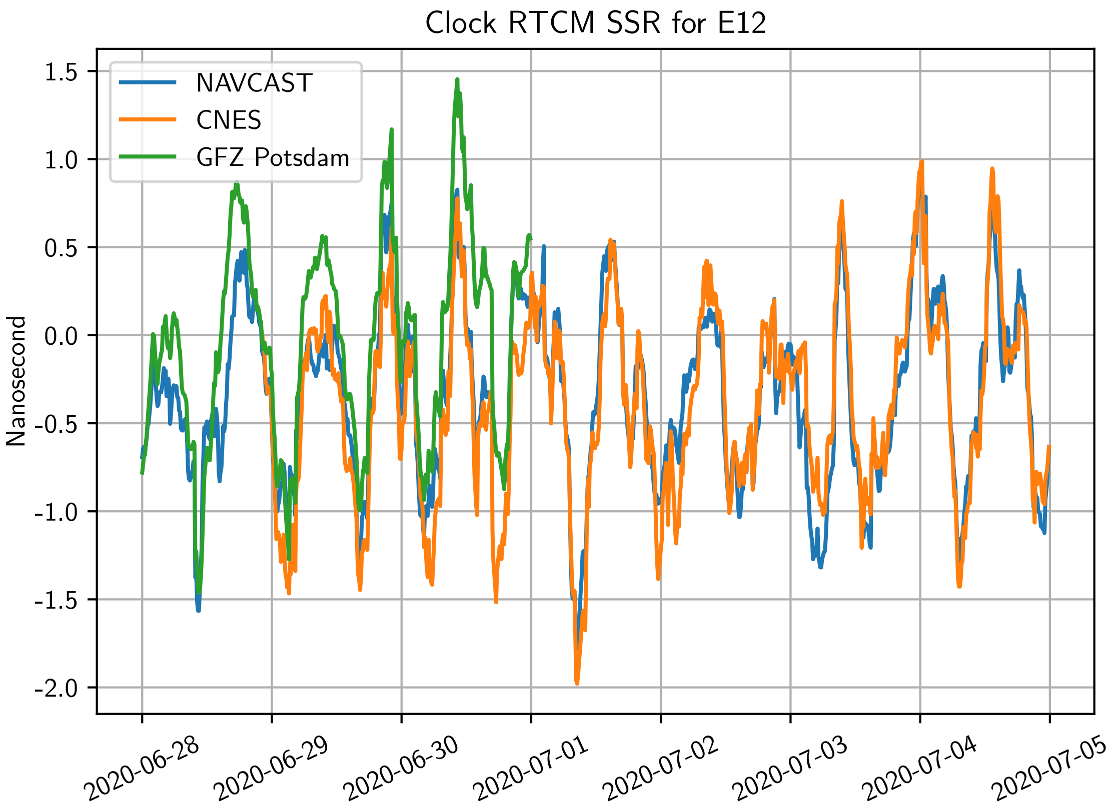

Radial RTCM SSR error for E09
Meter
0.3
0.2
0.1
0.0
-0.1
-0.2
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E11

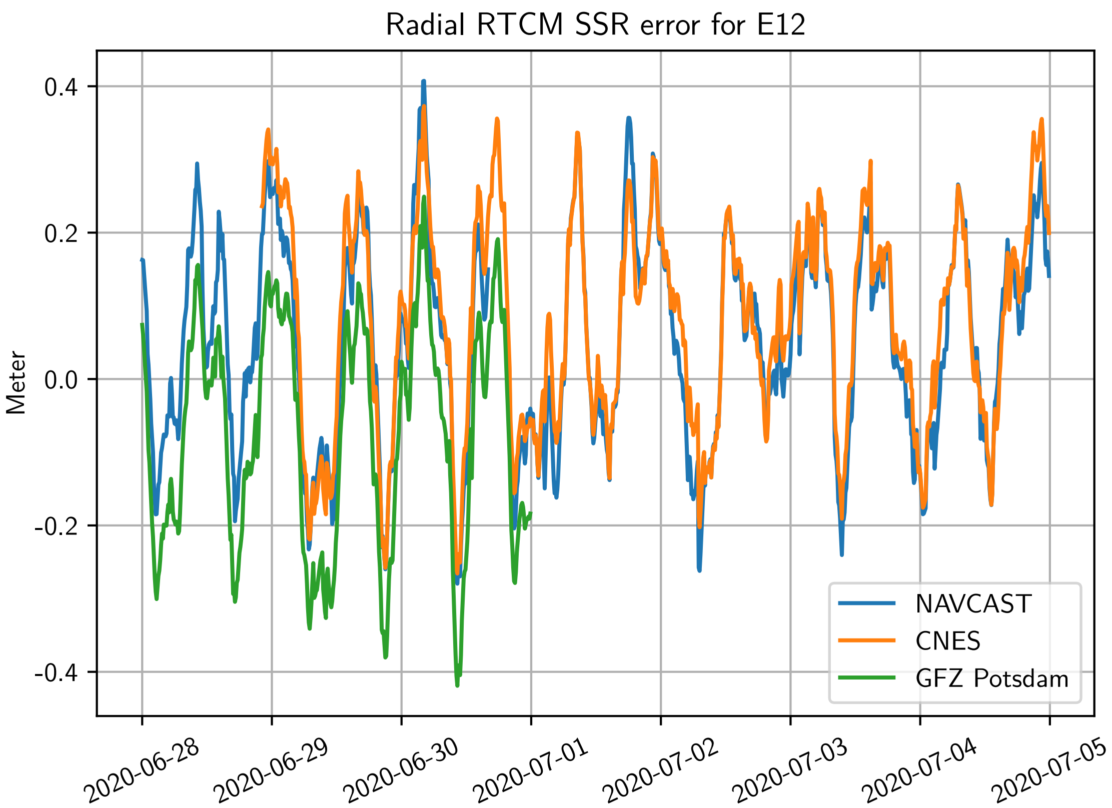

Clock RTCM SSR for E11
NAVCAST
CNES
GFZ Potsdam
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05


Radial RTCM SSR error for E11
NAVCAST
CNES
GFZ Potsdam
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E12

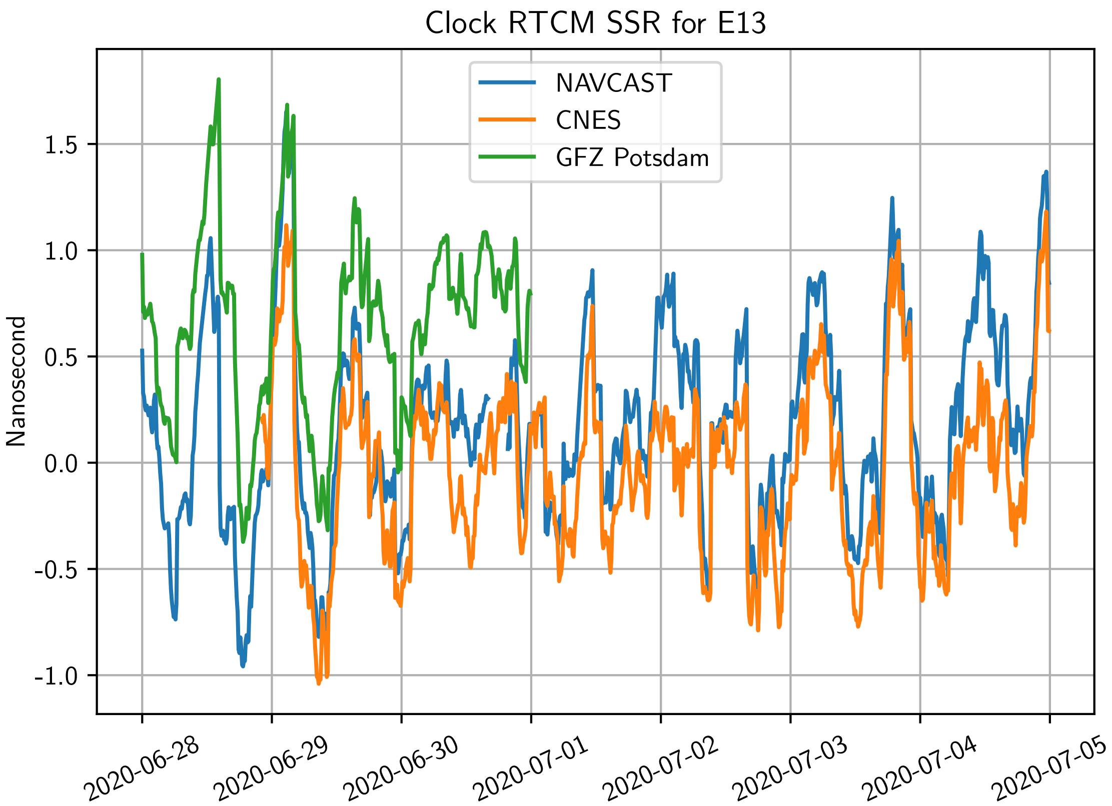


Clock RTCM SSR for E12
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

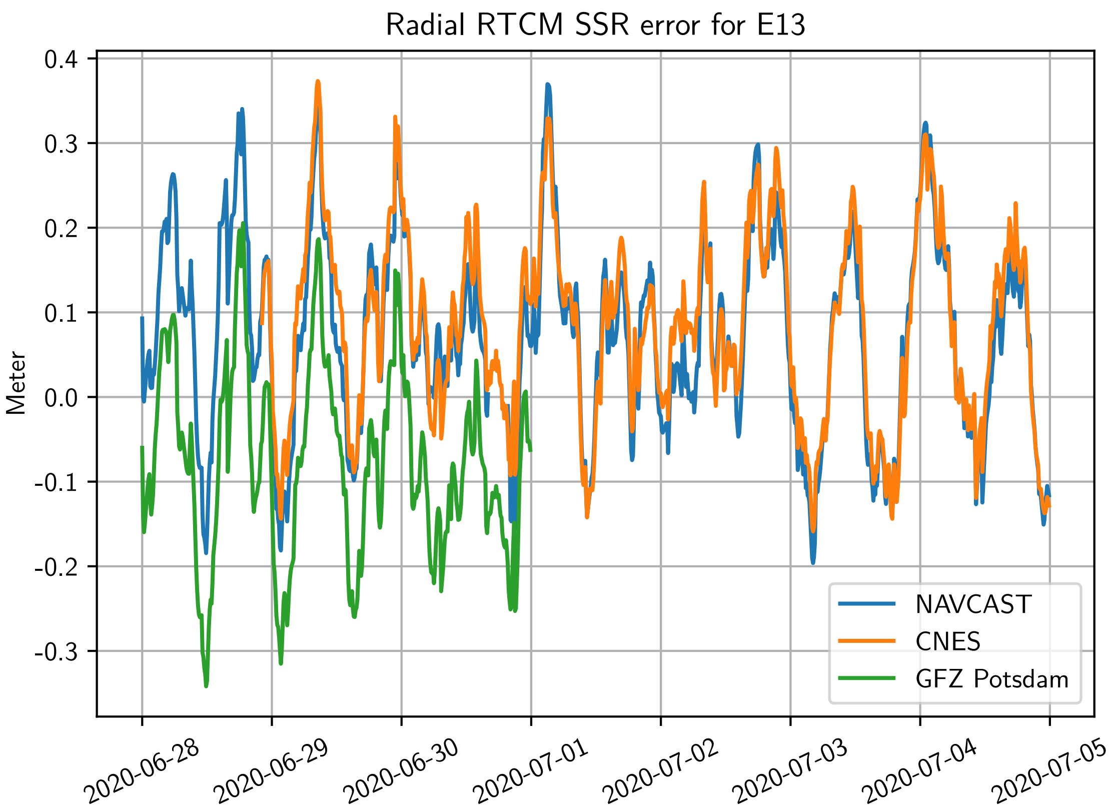


Radial RTCM SSR error for E12
Meter
0.4
0.2
0.0
-0.2
-0.4
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E13

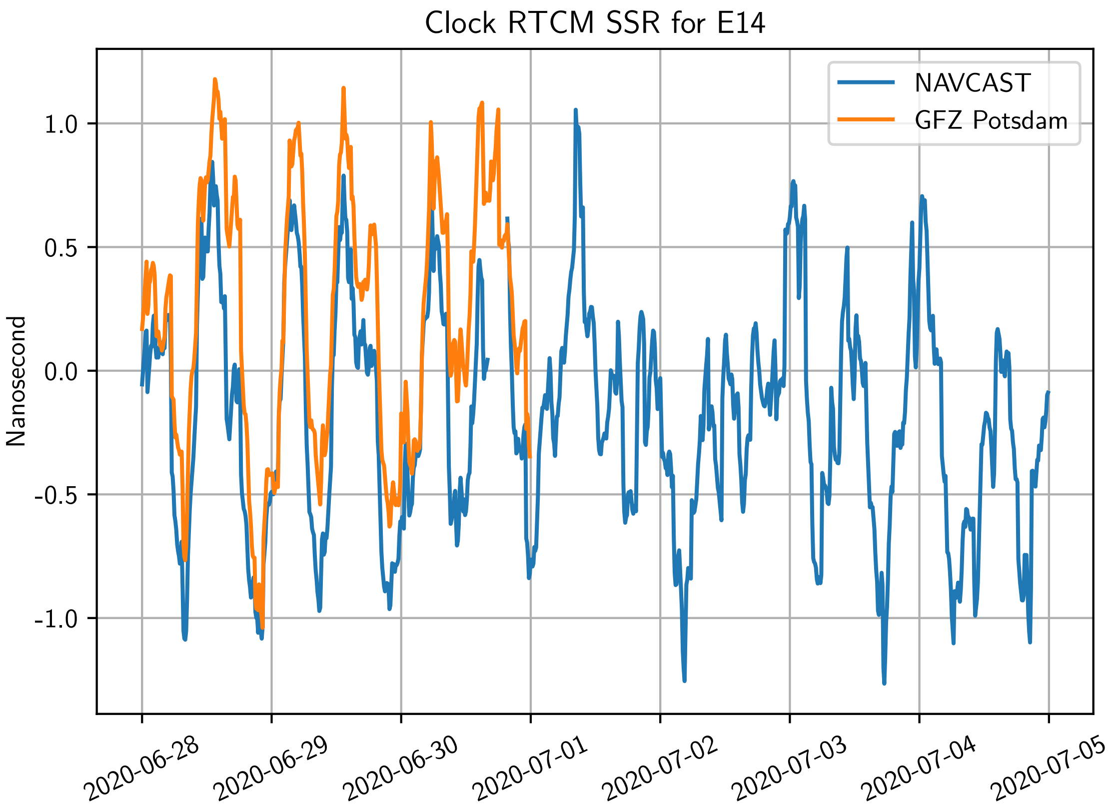


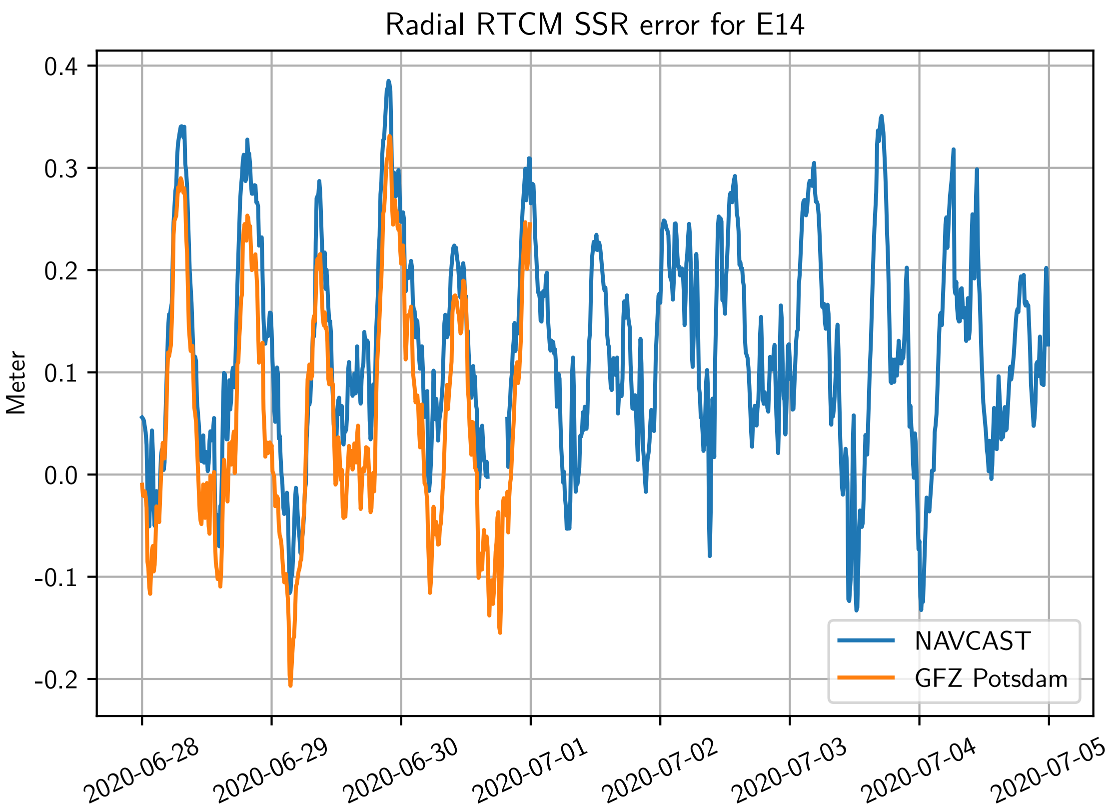
Clock RTCM SSR for E13
NAVCAST
CNES
GFZ Potsdam
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05



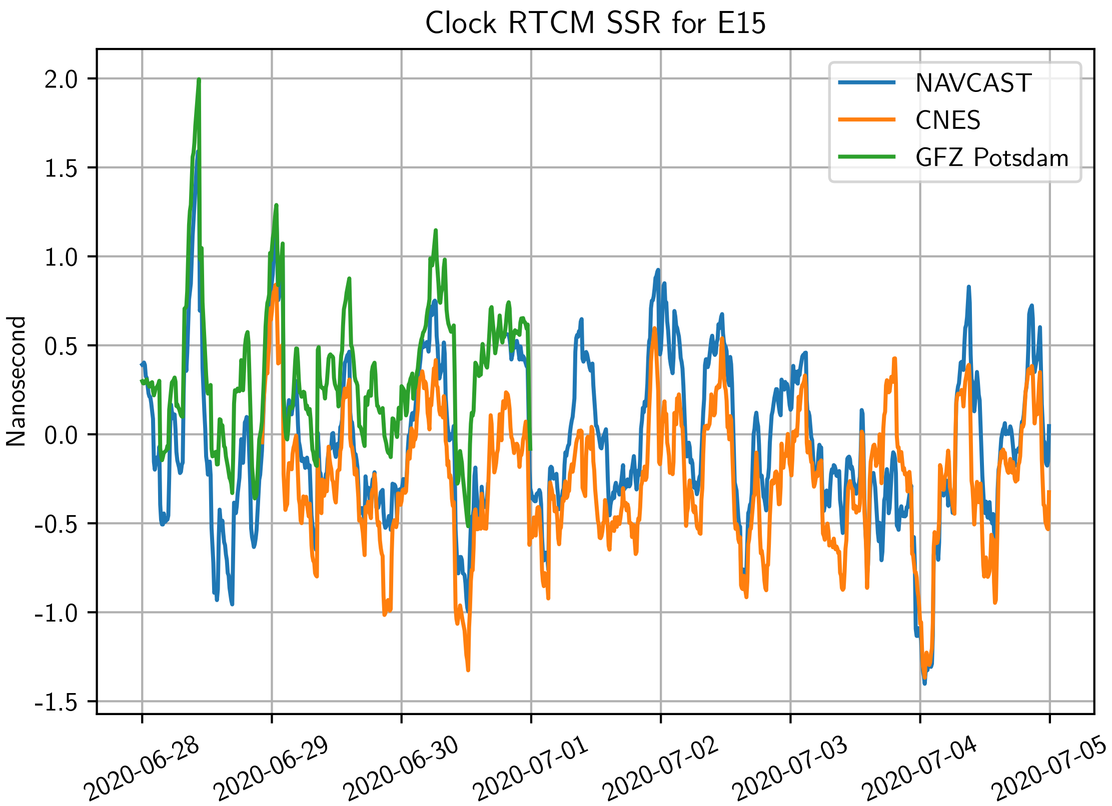
Radial RTCM SSR error for E13
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E14

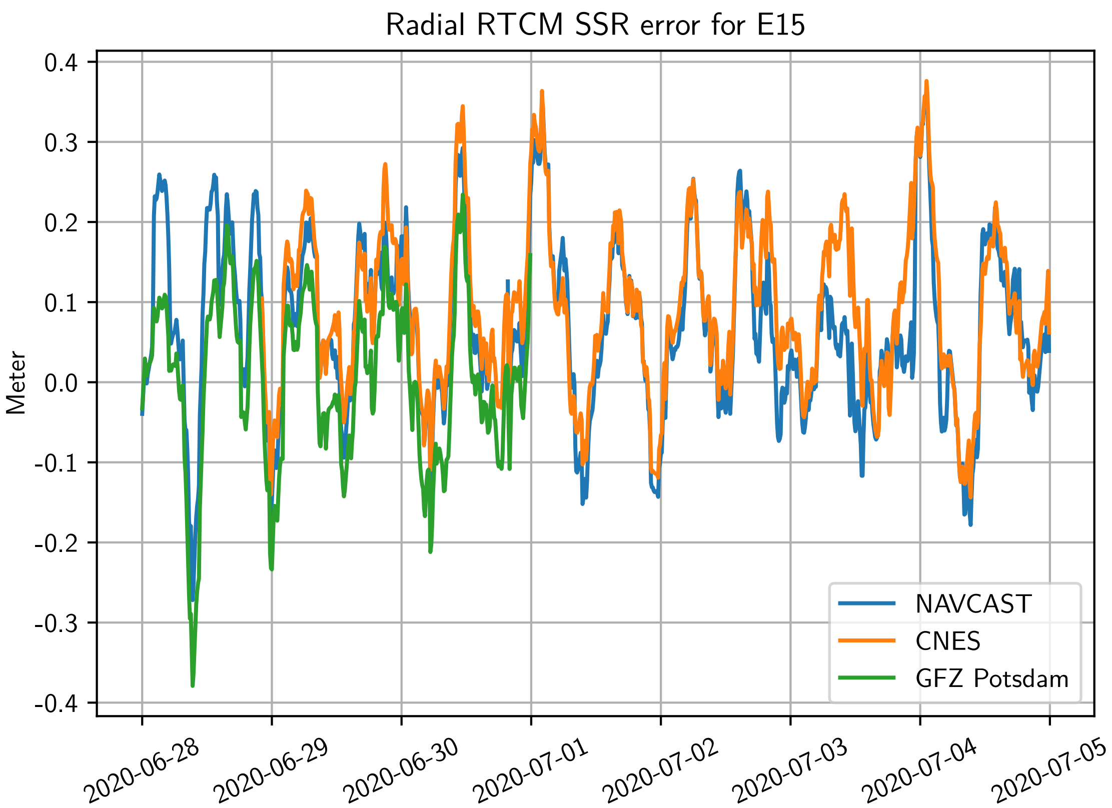

Clock RTCM SSR for E14
NAVCAST
GFZ Potsdam
Nanosecond
1.0
0.5
0.0
-0.5
-1.0
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05


Radial RTCM SSR error for E14
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
NAVCAST
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E15

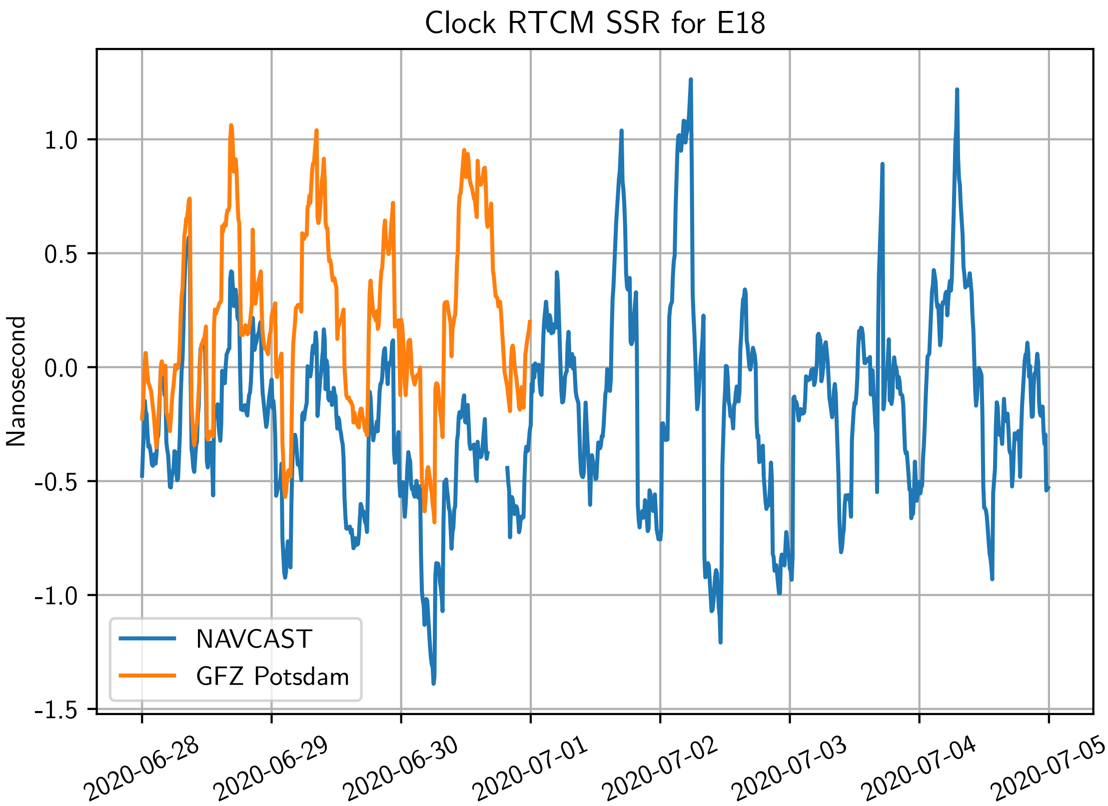


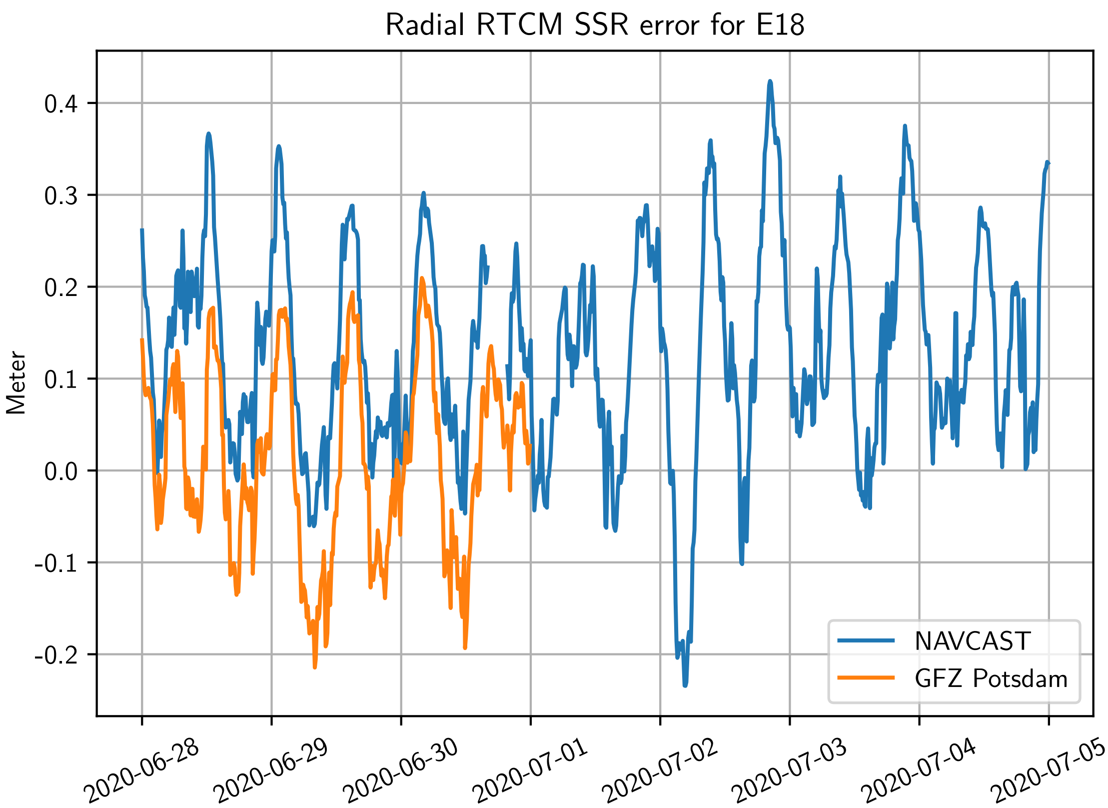
Clock RTCM SSR for E15
Nanosecond
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05



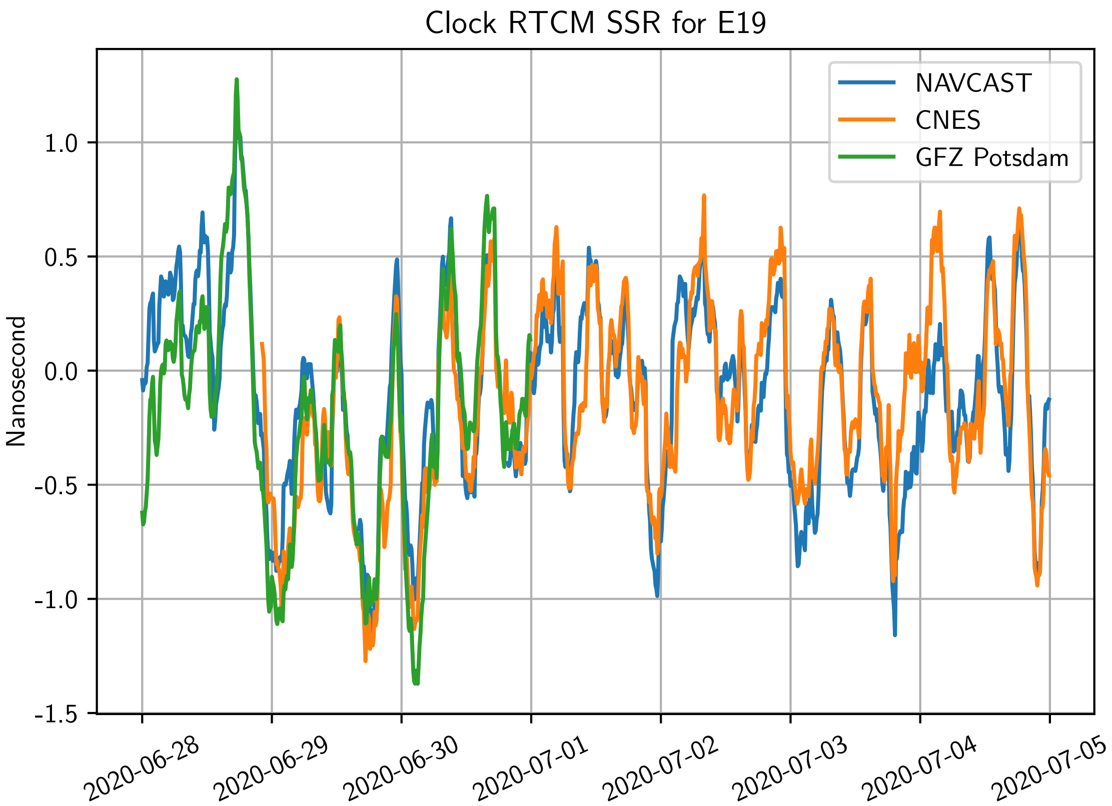
Radial RTCM SSR error for E15
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

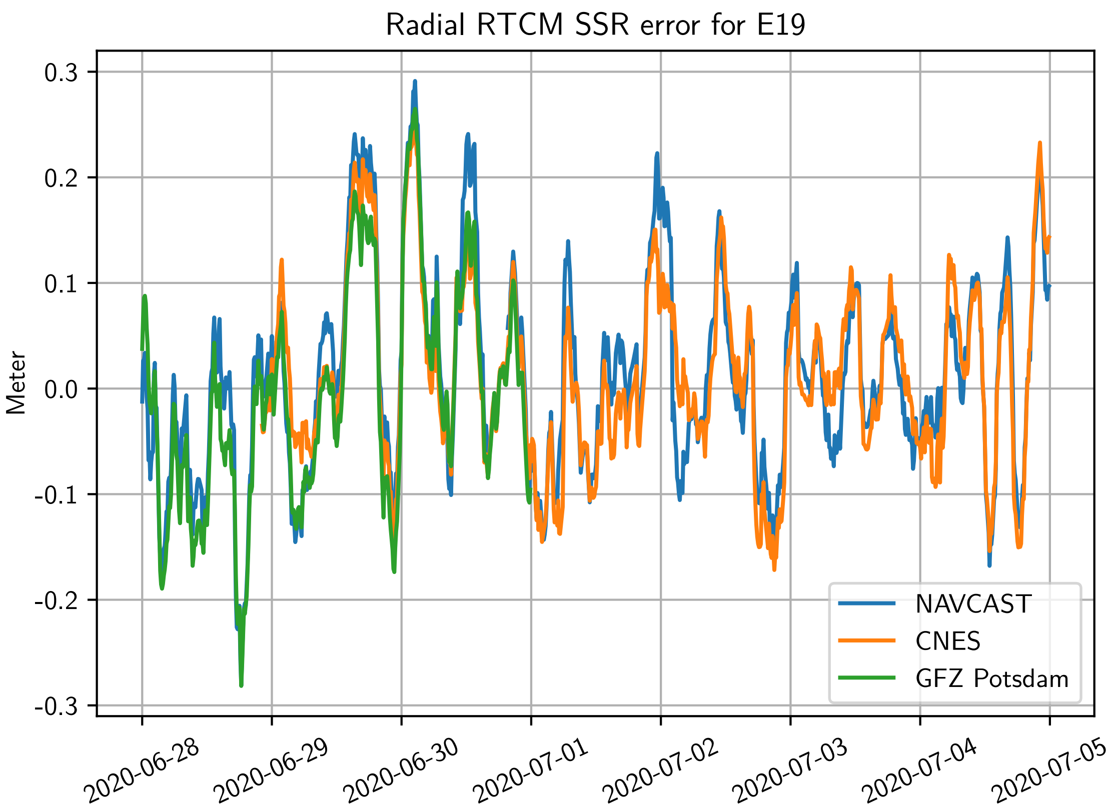
E18


Clock RTCM SSR for E18
Nanosecond
1.0
0.5
0.0
-0.5
-1.0
-1.5
NAVCAST
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

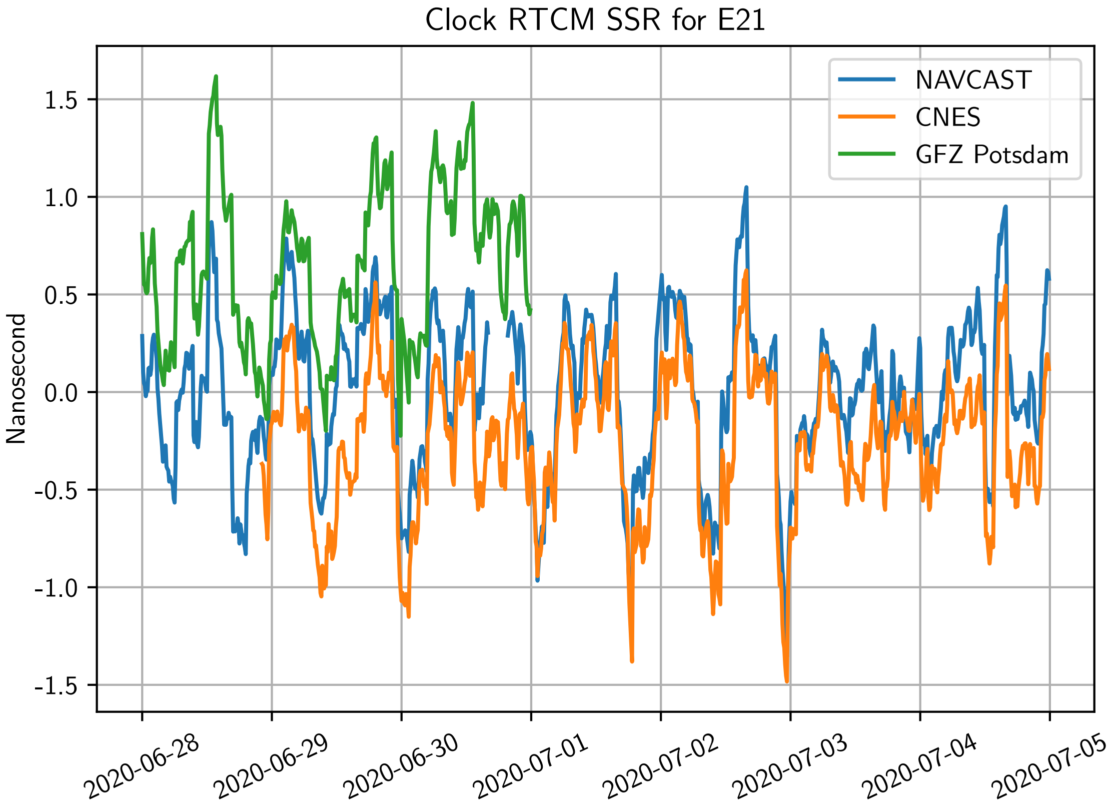

Radial RTCM SSR error for E18
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
NAVCAST
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

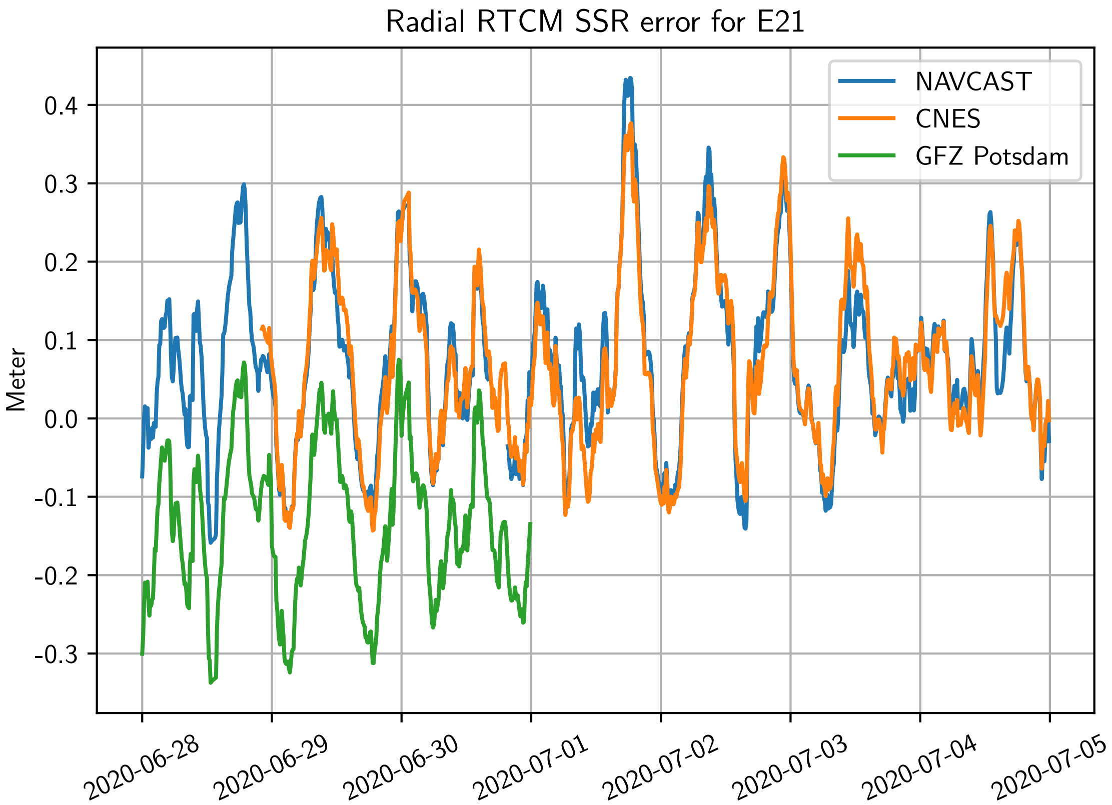
E19


Clock RTCM SSR for E19
Nanosecond
1.0
0.5
0.0
-0.5
-1.0
-1.5
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05
NAVCAST
CNES
GFZ Potsdam

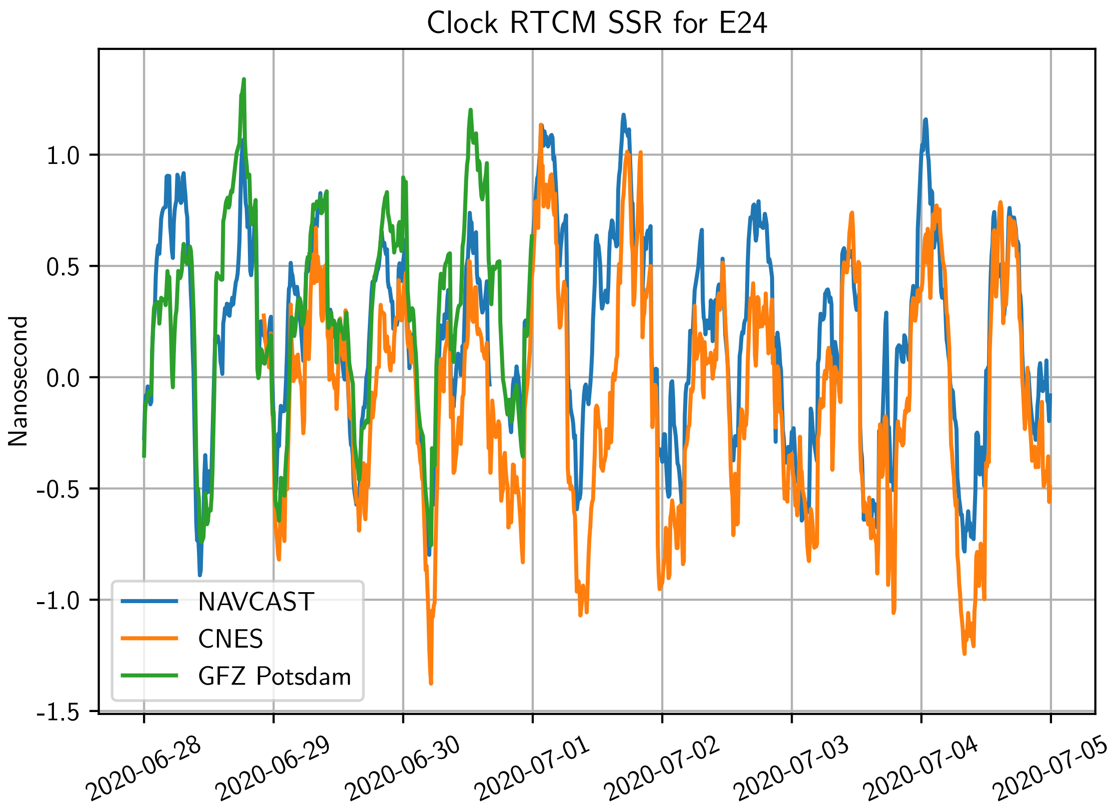

Radial RTCM SSR error for E19
Meter
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05
NAVCAST
CNES
GFZ Potsdam

E21

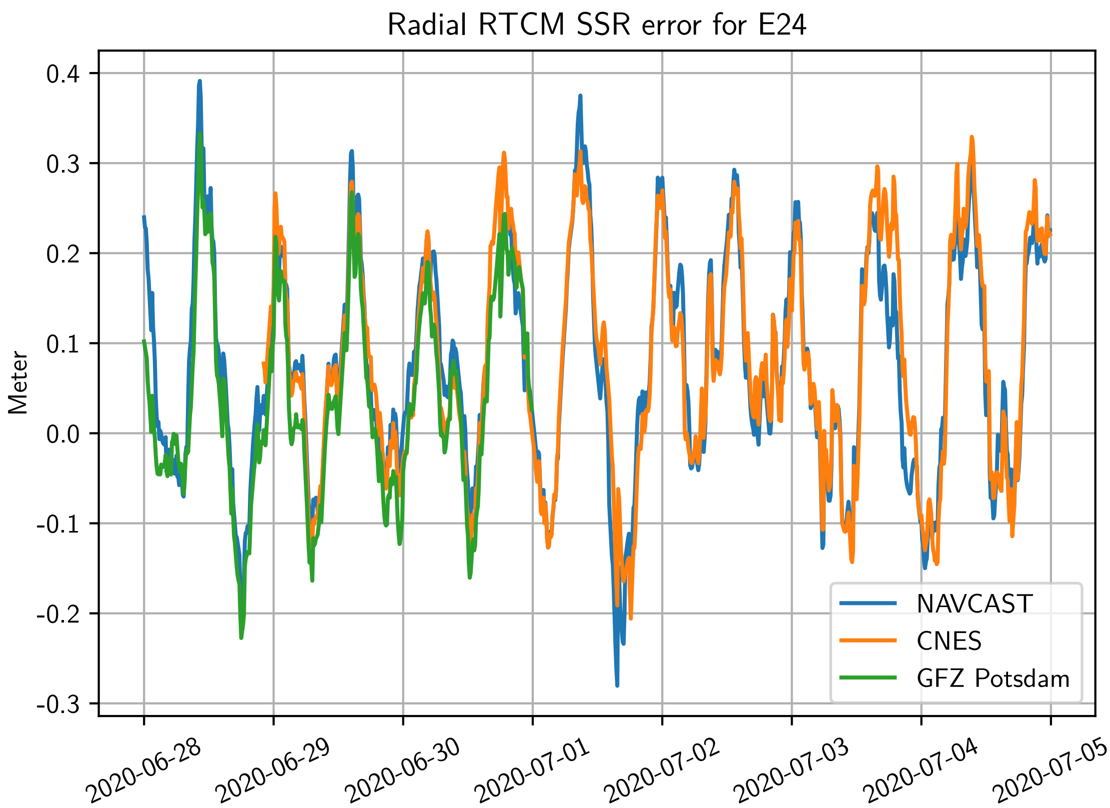

Clock RTCM SSR for E21
NAVCAST
CNES
GFZ Potsdam
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05


Radial RTCM SSR error for E21
NAVCAST
CNES
GFZ Potsdam
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E24

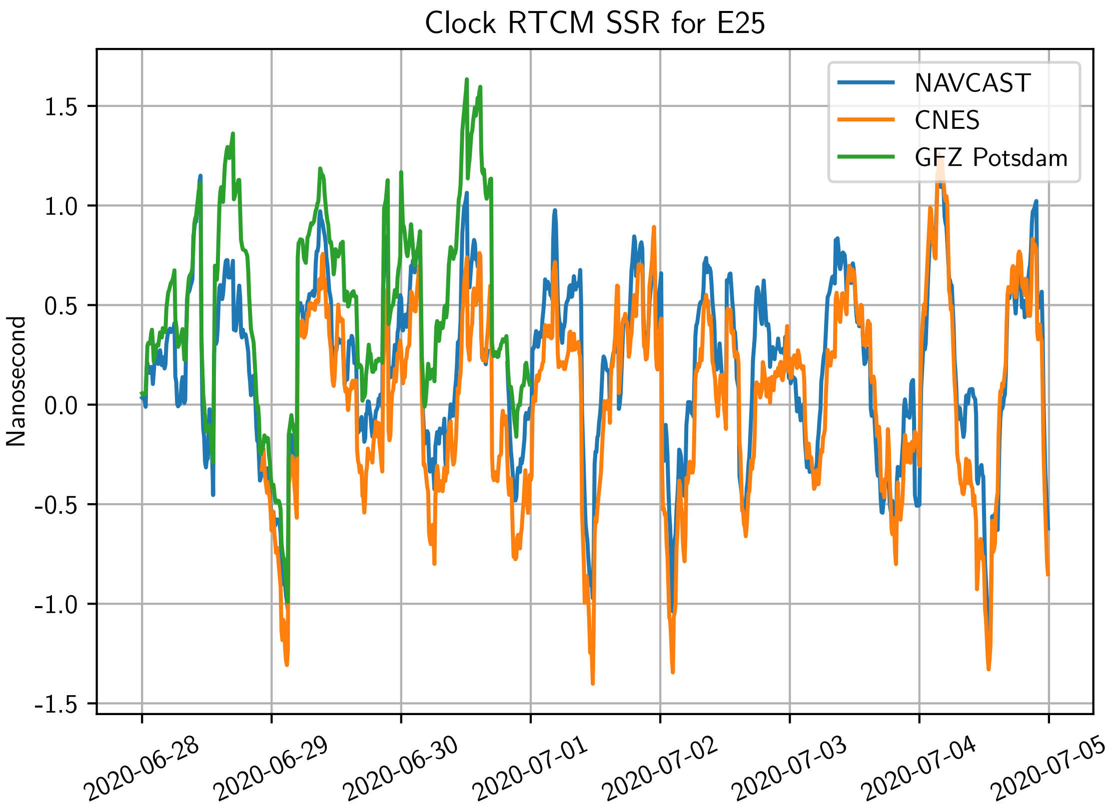


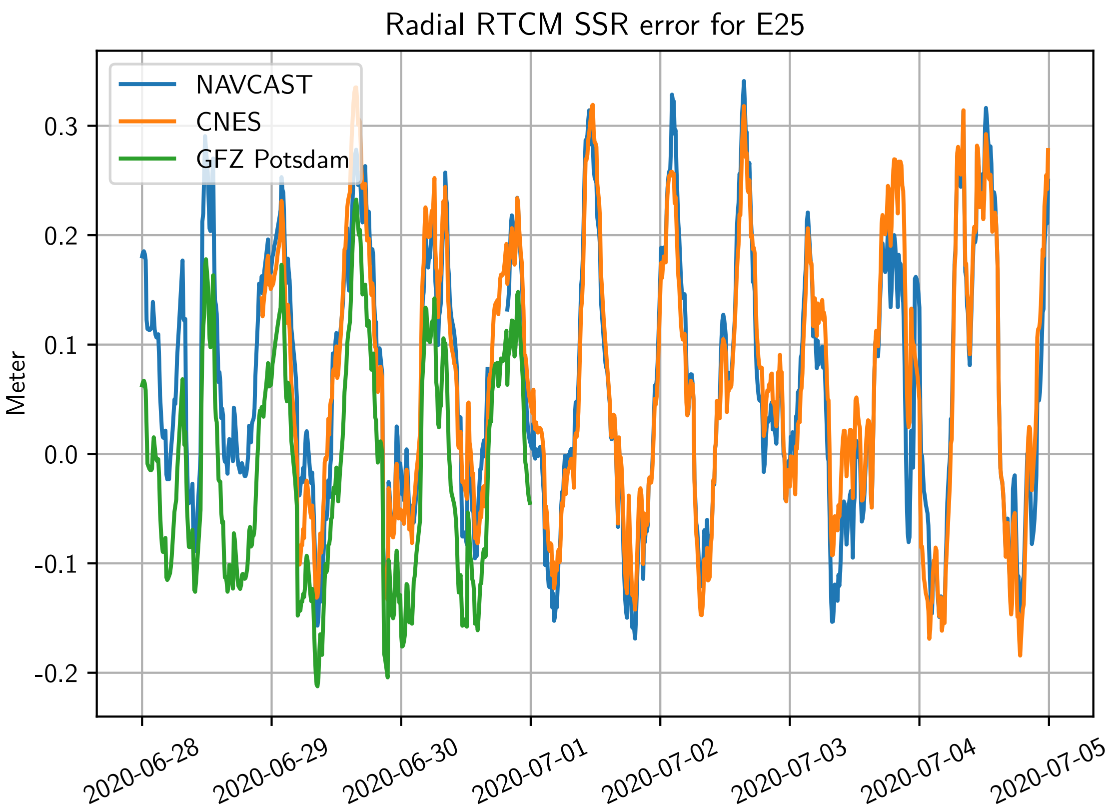
Clock RTCM SSR for E24
Nanosecond
1.0
0.5
0.0
-0.5
-1.0
-1.5
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05
NAVCAST
CNES
GFZ Potsdam



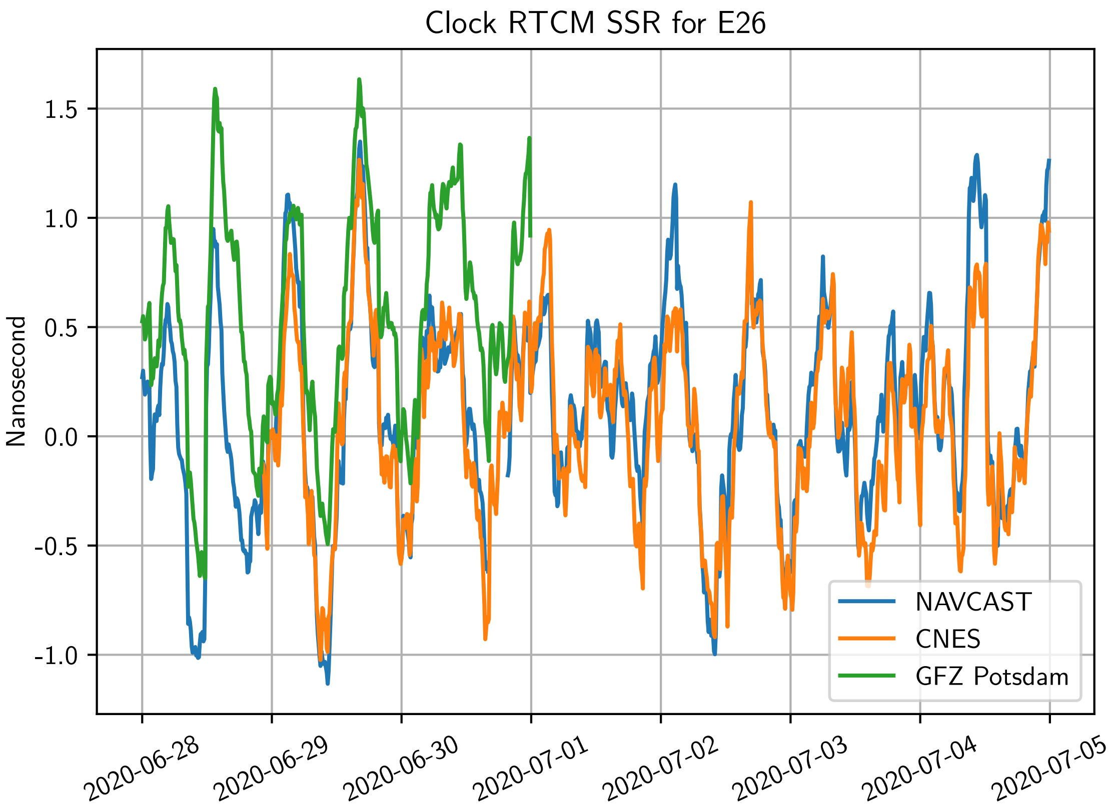
Radial RTCM SSR error for E24
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05
NAVCAST
CNES
GFZ Potsdam

E25

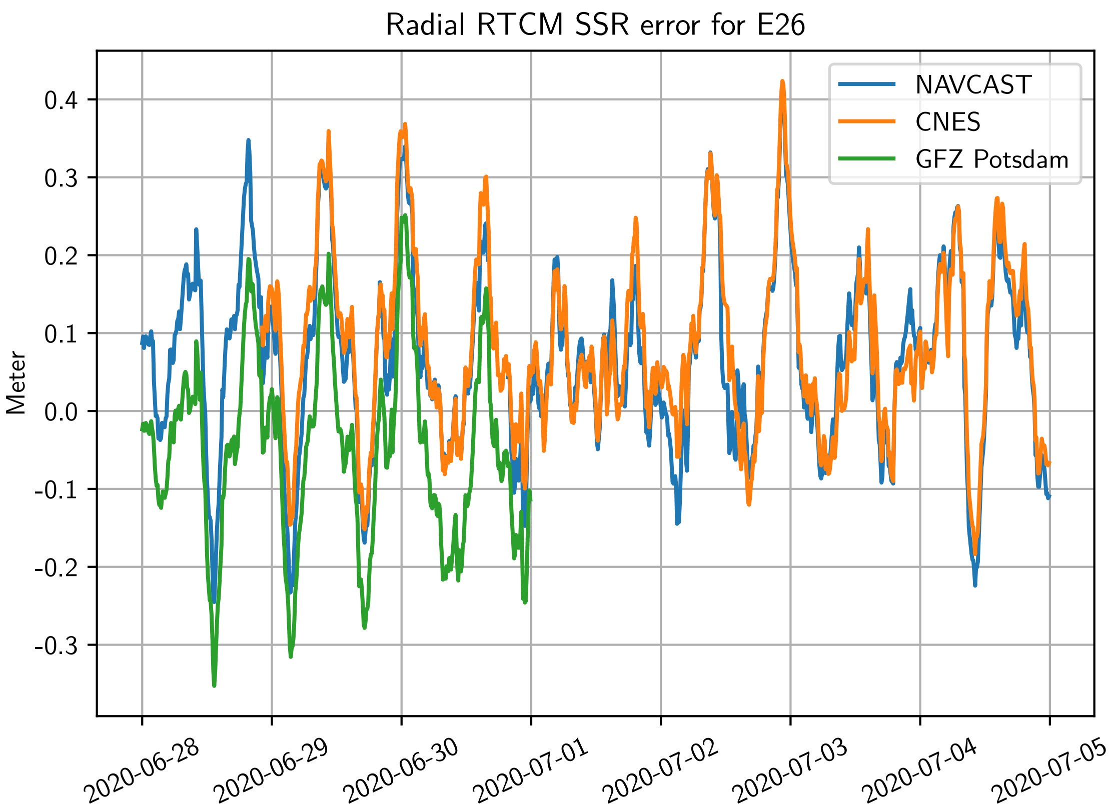

Clock RTCM SSR for E25
NAVCAST
CNES
GFZ Potsdam
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05


Radial RTCM SSR error for E25
NAVCAST
CNES
GFZ Potsdam
Meter
0.3
0.2
0.1
0.0
-0.1
-0.2
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

E26

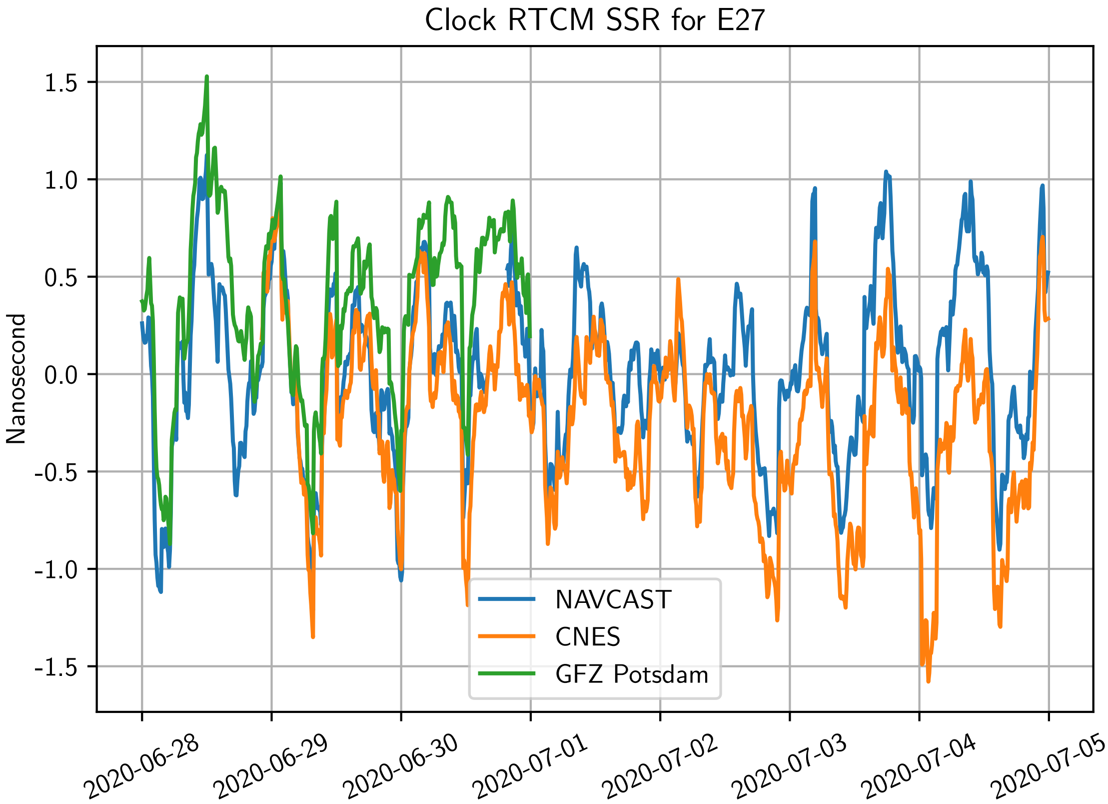


Clock RTCM SSR for E26
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05
NAVCAST
CNES
GFZ Potsdam



Radial RTCM SSR error for E26
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05
NAVCAST
CNES
GFZ Potsdam

E27


Clock RTCM SSR for E27
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
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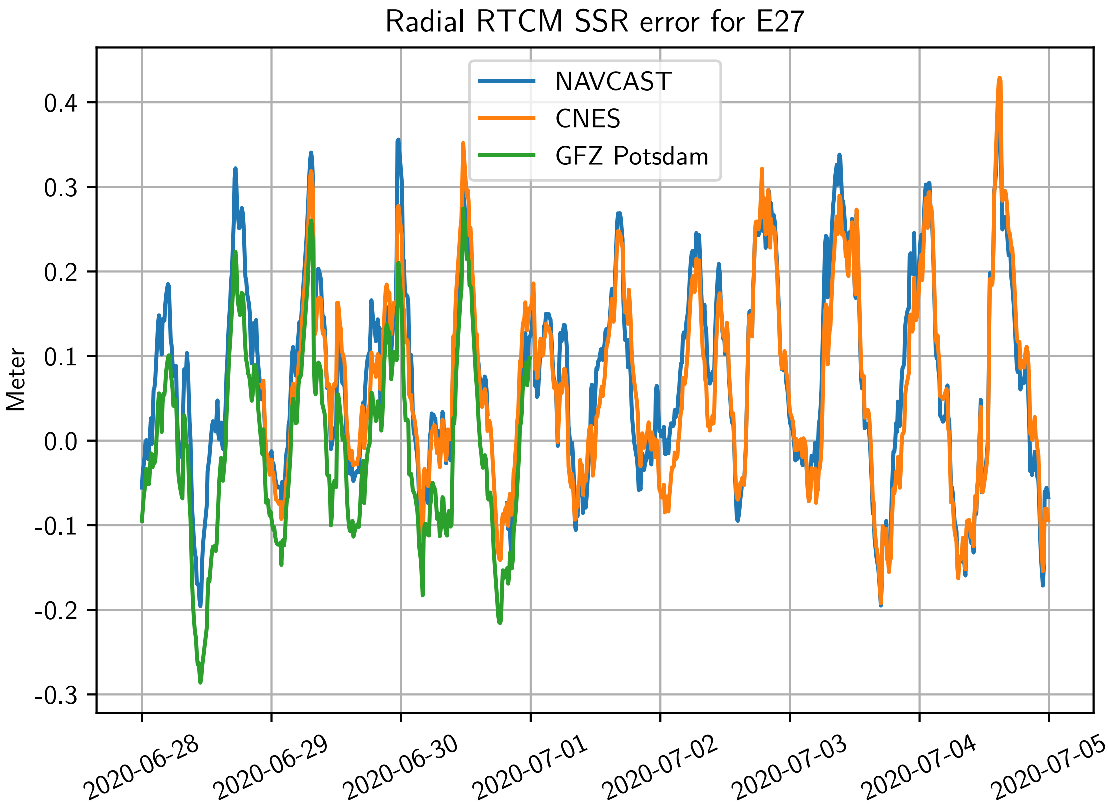
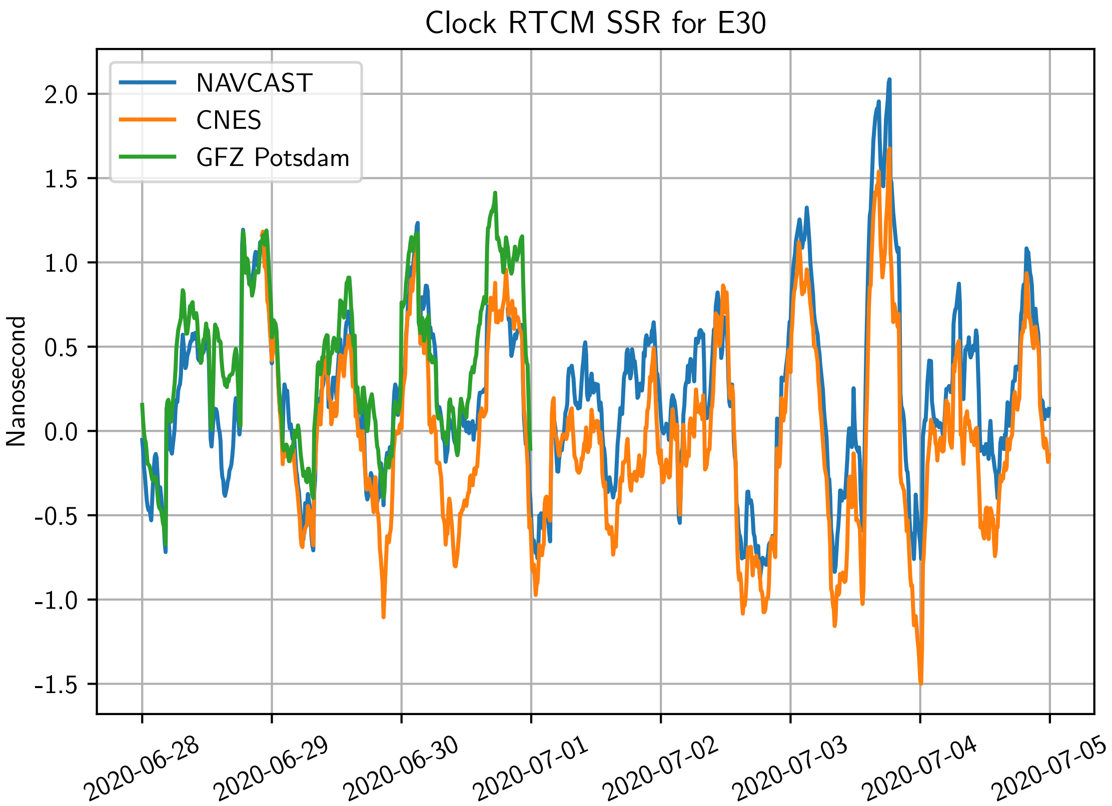
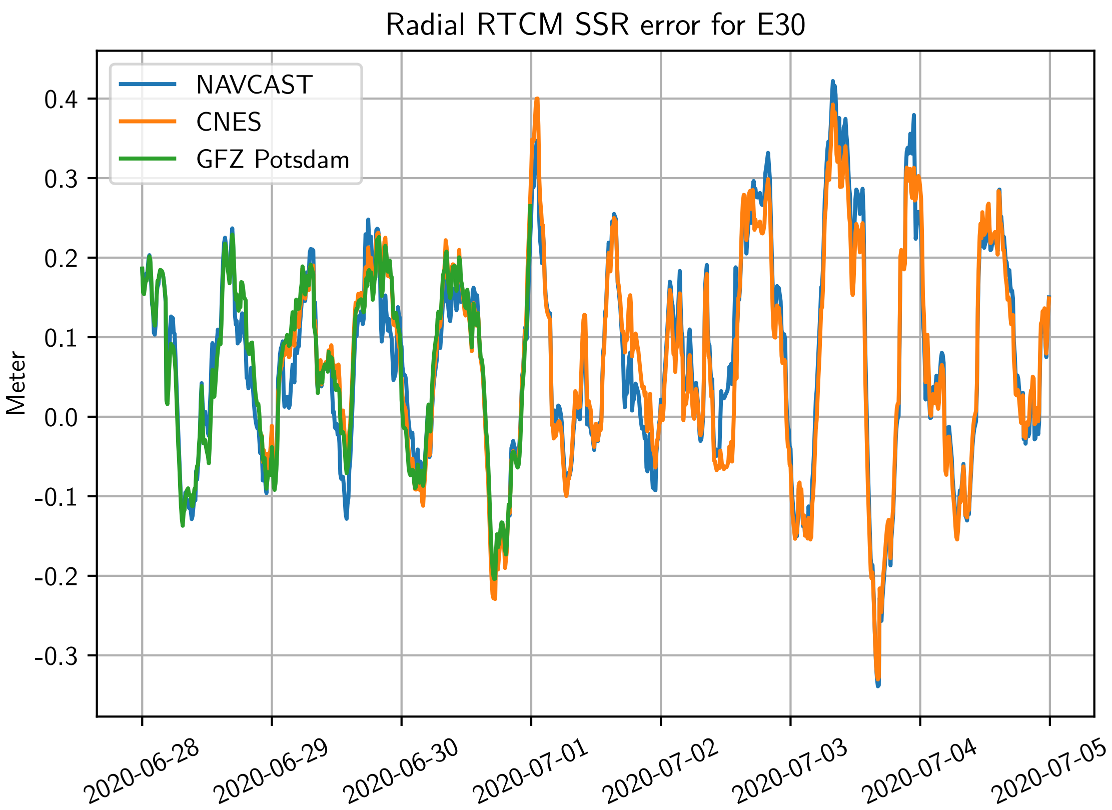
2020-07-04
2020-07-05

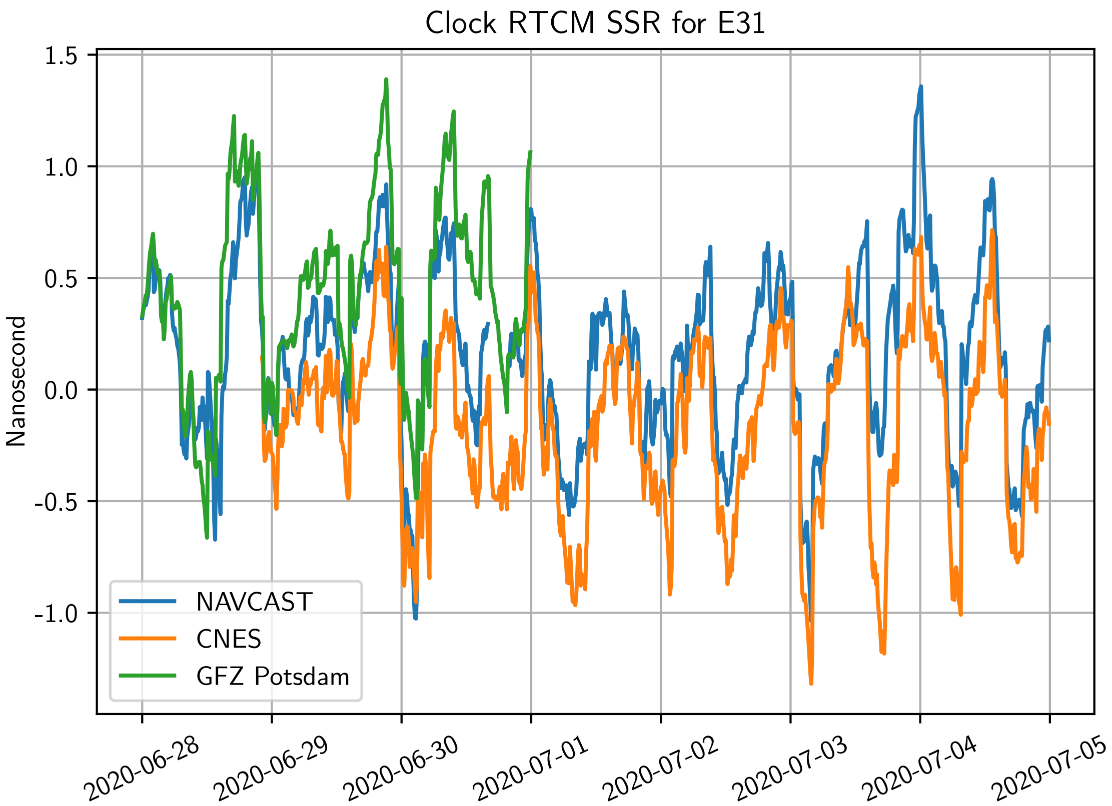

Radial RTCM SSR error for E27
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

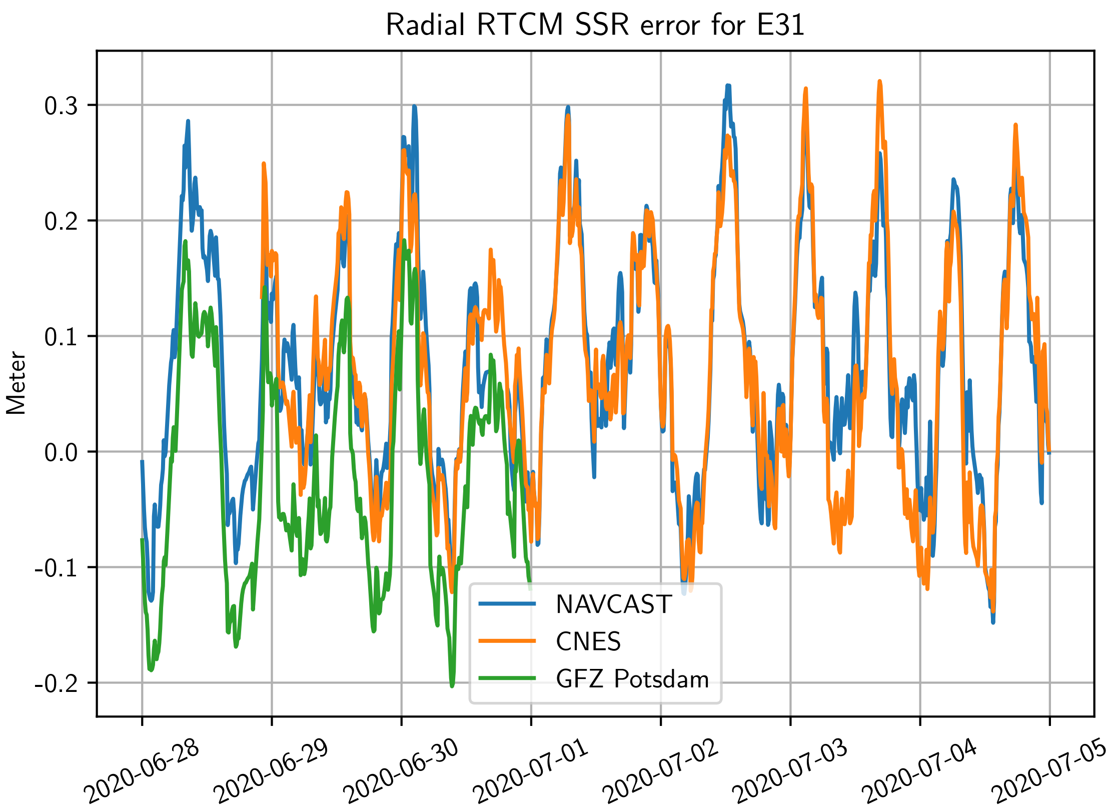
E30


Clock RTCM SSR for E30
NAVCAST
CNES
GFZ Potsdam
Nanosecond
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

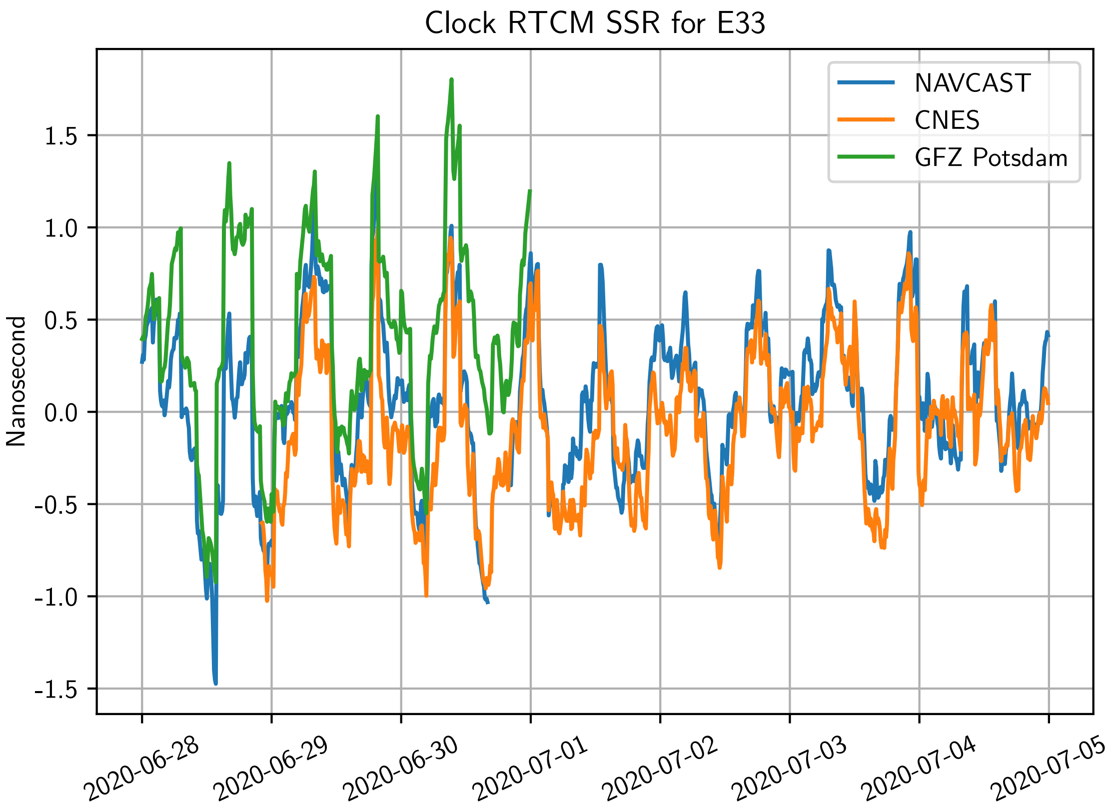

Radial RTCM SSR error for E30
NAVCAST
CNES
GFZ Potsdam
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

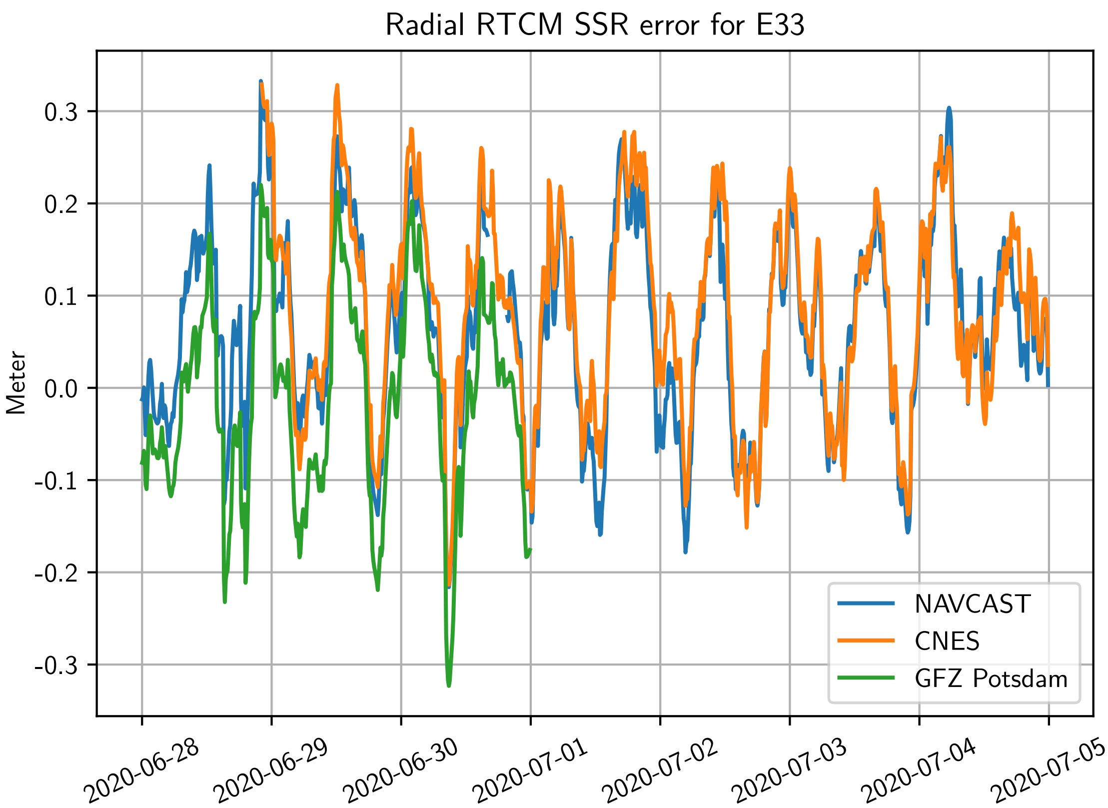
E31


Clock RTCM SSR for E31
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

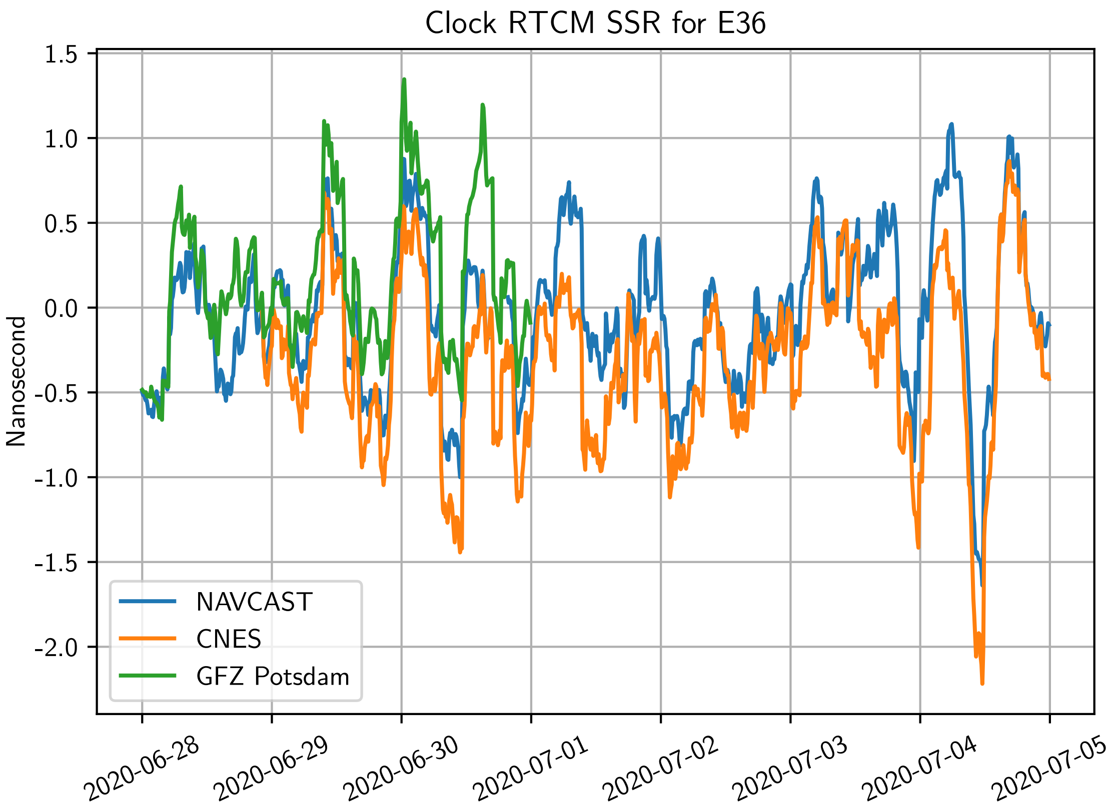

Radial RTCM SSR error for E31
Meter
0.3
0.2
0.1
0.0
-0.1
-0.2
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05

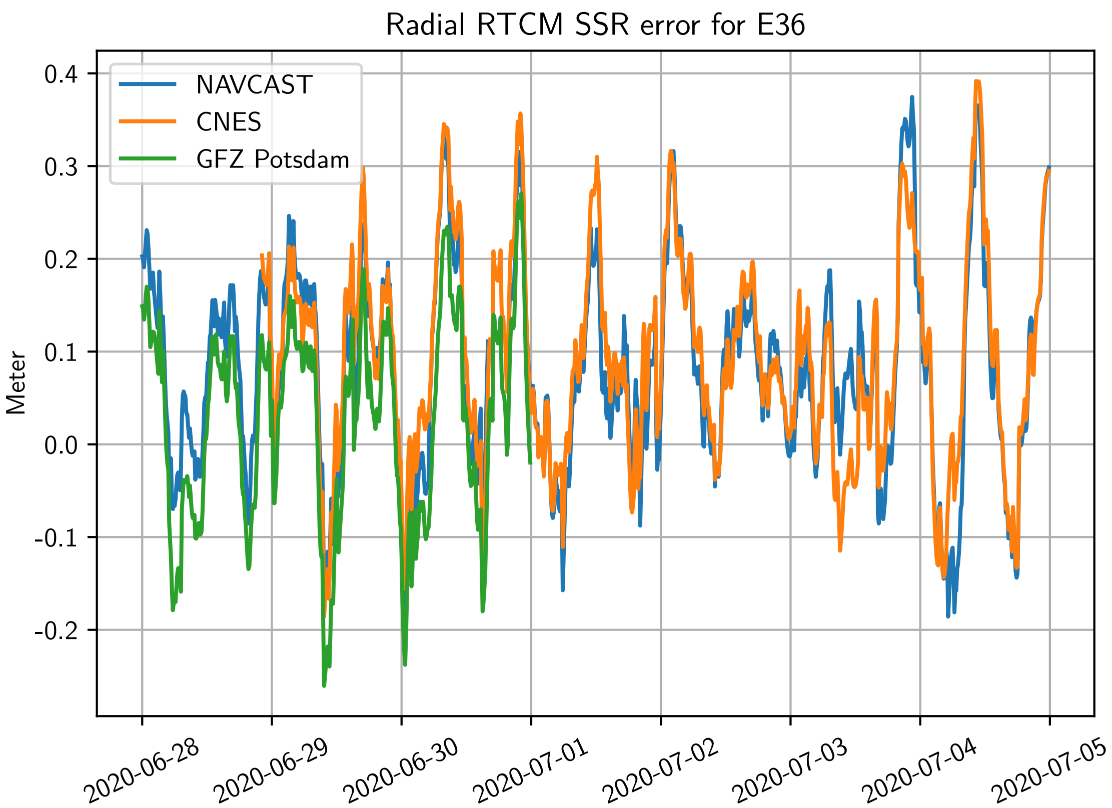
E33


Clock RTCM SSR for E33
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05
NAVCAST
CNES
GFZ Potsdam


Radial RTCM SSR error for E33
Meter
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05
NAVCAST
CNES
GFZ Potsdam

E36


Clock RTCM SSR for E36
Nanosecond
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05


Radial RTCM SSR error for E36
Meter
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
NAVCAST
CNES
GFZ Potsdam
2020-06-28
2020-06-29
2020-06-30
2020-07-01
2020-07-02
2020-07-03
2020-07-04
2020-07-05