

IGS RINEX 3 Transition Plan v1.0

IGS Infrastructure Committee, Rinex Working Group, Multi-GNSS Experiment.

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1. Introduction

This RINEX 3 transition plan aims at consolidating the developments and the evolution within the IGS to ensure the final agreed goal of the IGS 2014 Workshop; **“one network and one archive”**

The acceptance by the IGS in 2012 of the RINEX 3 (Rx3) as the only GNSS data exchange format moving forward, and the positive progress of the MGEX (Multi-GNSS Experiment) mean that we need to start to integrate all the data sources into the common IGS data repositories. The adoption of the RINEX standard means that **new station names** and **new data file filenames** will be introduced. So far only the new RINEX 3 file formats have been utilized, as the MGEX retained the old RINEX 2 (Rx2) filenames for the new RINEX 3 data files to avoid too much initial confusion, but this is only a temporary measure.

At the 2014 IGS Workshop it has been agreed to **assume the whole RINEX 3 standard** (<ftp://igs.org/pub/data/format/RINEX302.pdf>) including the new station identifiers and data file filenames. This requires a plan to be able to have a smooth transition from data providers to published results. This plan recognizes that we will have to live with the **RINEX 2.11 and RINEX 3 duality** for a long time since many legacy stations will not be able to produce RINEX 3 files from older receivers. Analysis Centers need to modify their software to be able to use the Rx3 files with the long filenames. Also generic GNSS data users may want to use the upgraded station's data even if they cannot read the new Rx3 format and a solution is needed for them by providing a Rx3 -> Rx2 down-converter.

The initial step is to make the data in RINEX 3 with correct long filenames available to the GNSS community in the expected locations (no more special 'campaign' directory for Rx3 data). It is possible to do this without confusion since files will not overwrite each other using the new Rx3 filenames, but we need to ensure that this does not cause problems to existing Rx2 data users accustomed to the standard filenames, and that Data Centers can manage the new files correctly.

The Figure 1 below gives an overview of the Rx3 effects, and the responsible parties for the transition.

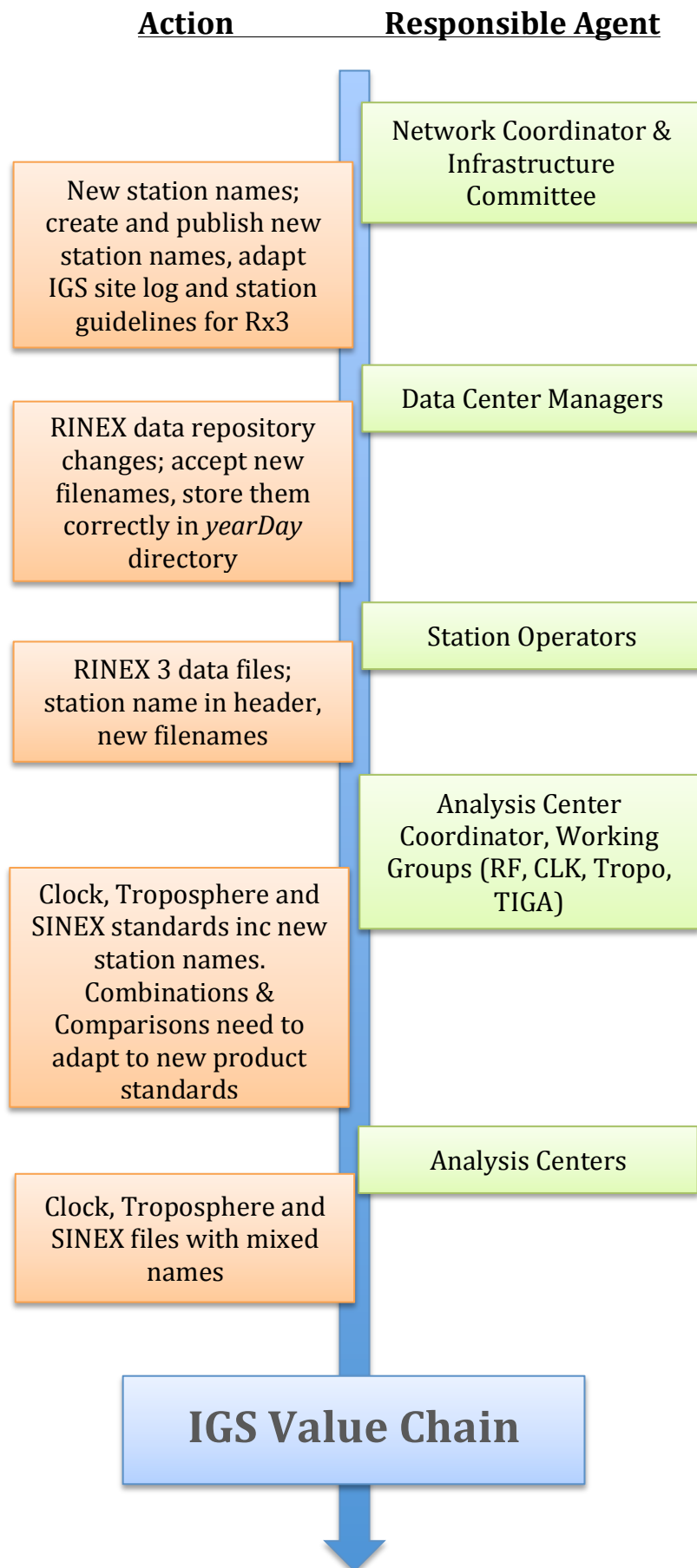


Figure 1: IGS Value Chain

RINEX 3 has been adopted as an IGS standard in 2012, and the IGS needs to move forward with its adoption in a decisive way. RINEX 2.11 (<http://igscb.jpl.nasa.gov/igscb/data/format/rinex211.txt>) will be the last legacy Rx2 format as agreed in the 'IGS/RTCM RINEX Working Group', any past reference to a possible RINEX 2.12 or a RINEX 2.30 are no longer valid. It is recognized that Rx2 files will remain around for many legacy stations and applications that use the limited constellations and signals defined therein. On the other hand future developments need to accommodate the evolving GNSS constellations and signals will only be made in the RINEX 3 standard.

It is well understood that station operators and network managers, who can only operate using the old RINEX 2.11 format will do so and continue to be an integral part of the IGS. Station operators who operate up to date multi-GNSS receivers are encouraged to update their software and procedures and provide fully compliant multi-GNSS Rx3 files. This document provides a non-redundant and straight forward way to do so within the mainstream IGS, thus ensuring that **future development in GNSS continues to be led by the IGS.**

The sections below explain the necessary steps as listed in Figure 1, and they follow the IGS Value Chain. Many of the steps can be performed in parallel, as format changes will have their own review and acceptance cycles, which do not necessarily depend on other steps being completed.

2. Preparatory Tasks (NC, IC)

The RINEX 3 standard introduces **new station names**, thus the first step of the transition is for the Network Coordinator (NC) and Infrastructure Committee (IC) to make available the new station names for all the IGS network stations. The new filenames together with their traditional four character IDs will be published on the IGS website in a flat text file.

It is essential to note that the full station and filename accommodations affect the entire GNSS processing chain and beyond. It is crucial that, to avoid any possible confusion, the **new station names must be constructed centrally by the IGS CB**. The new station names are still backwards compatible by removing the last 5 characters, which are the monument number, receiver number and country code, e.g; **mas1**

MAS100ESP

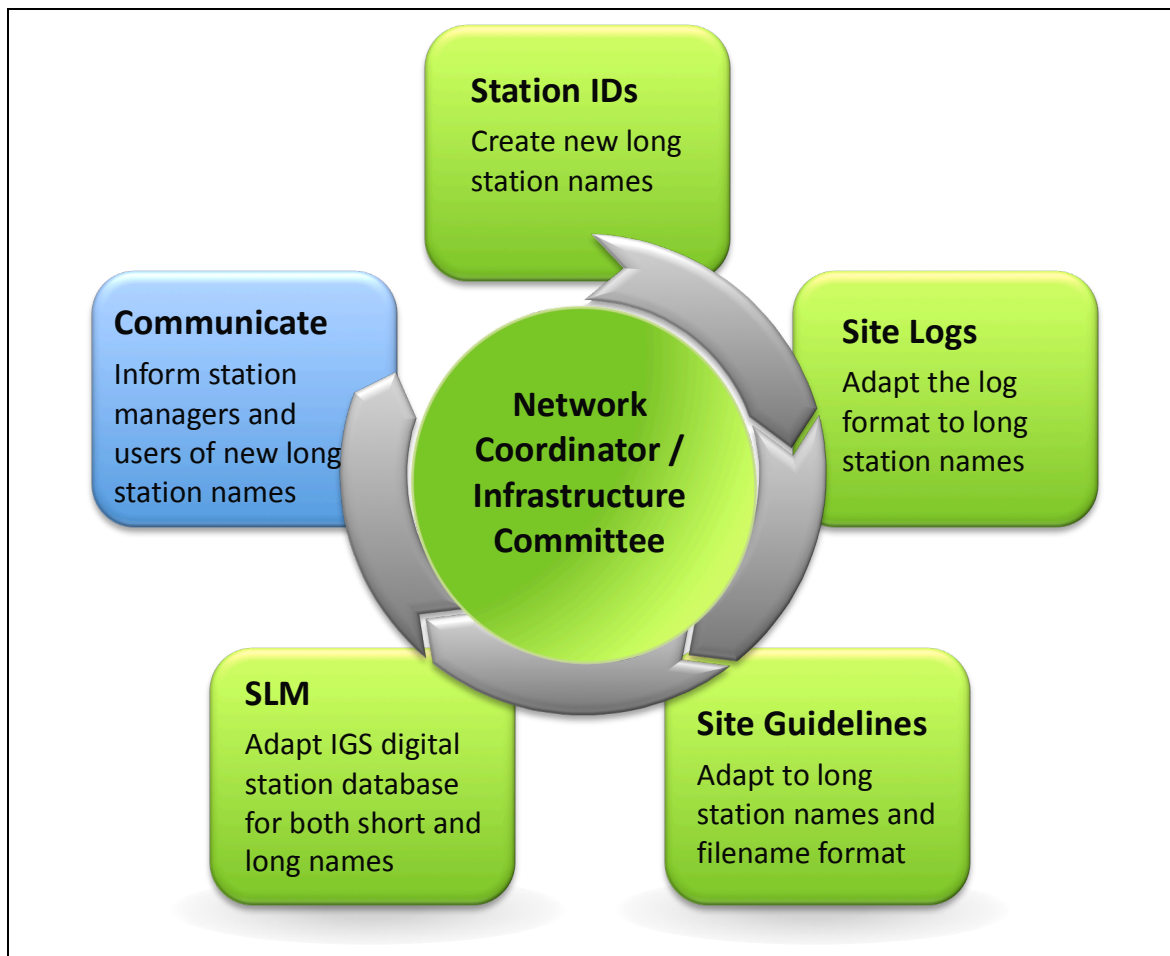


Figure 2: Rx 3 Transition Preparatory Tasks

In parallel, both the **site log form** and the **IGS station information database (SLM)** need to be revised to accommodate the new station names and anything else needed. Additionally the **IGS station guidelines** will need to be revised to include the new long station names, and to ensure that IGS network stations can provide Rx2 and/or Rx3 files.

Finally station operators and station network managers need to be informed of the parallel designation of their stations by pointing them to a central location (i.e. the IGS station network page), where they can find the new official Rx3 and long station file names.

[Open issue: should the downconverter Rx3 -> Rx2 be tested and provided by the NC/IC/CB (I think so) rather than as it is now by the ACC]

3. Data Center Tasks (DCs)

Data Centers (DCs) need to prepare to **accept GNSS data files** with the new filenames, to uncompress them, check they are Rx3 files, check the file size is reasonable and store them in the correct *yearDay* directory of the public data server and perform basic data QC.

Additionally DCs that gather real-time observation and navigation data streams need to write Rx3 files from the streams with the correct long names. Finally the DCs need to be prepared to store some products with new long filenames, such as the tropo products, which are separated 'by station'.

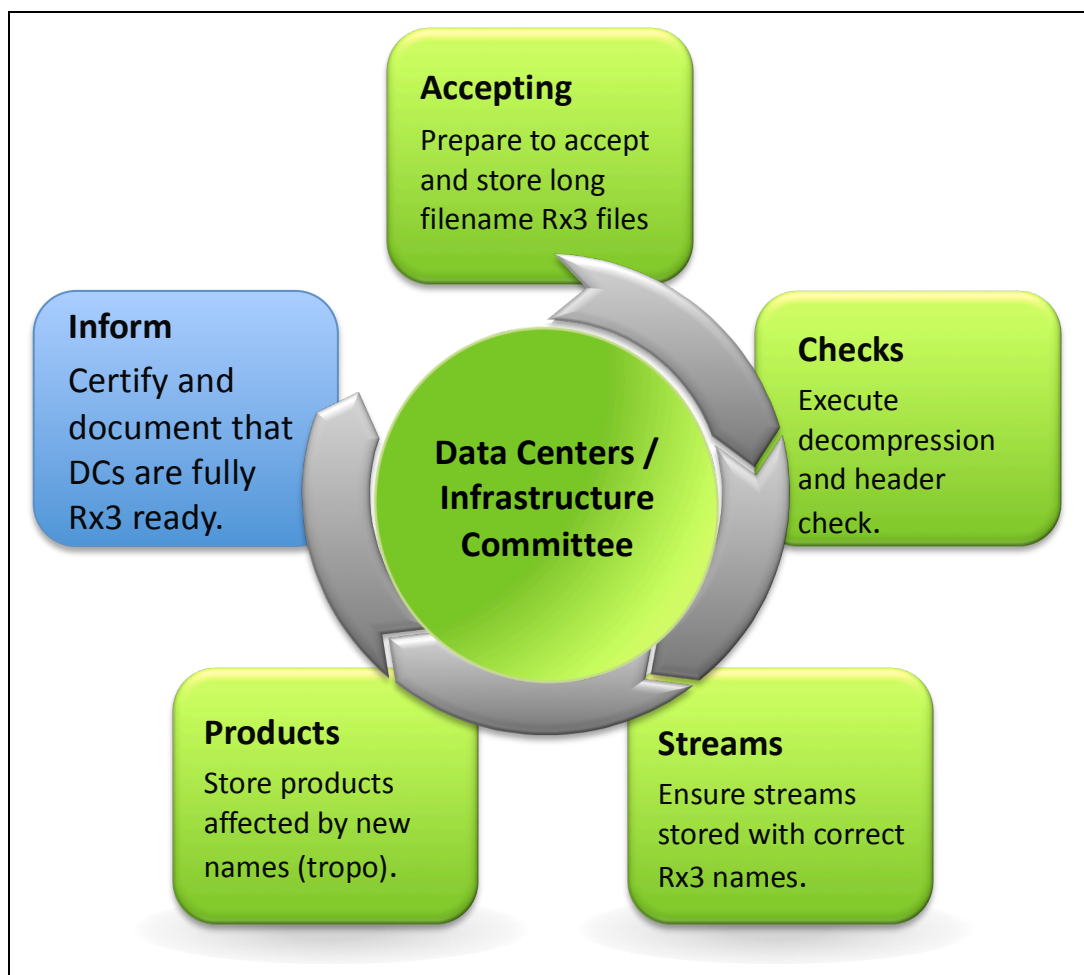


Figure 3: Rx3 Data Center Transition Tasks

Rx3 files using long names are delivered using *gzip* compression, finally moving away from the old UNIX compress.

The Rx3 long filenames are fully described in the latest Rx3 format definition: <ftp://igs.org/pub/data/format/RINEX302.pdf>, some examples are shown below.

For **daily** Rx3 files we currently have in the *campaign/mgex/daily* directory:

mas12350.14d.Z

which becomes, with the Rx3 long names;

MAS100ESP_R_20142350000_01D_30S_MO.crx.gz

For **hourly** Rx3 files we currently have in *campaign/mgex/hourly* directory;

cebr240b.14d.Z

which becomes, with the Rx3 long names;

CEBR00ESP_R_20142400100_01H_30S_MO.crx.gz

For **high-rate** Rx3 files we currently have in *campaign/mgex/highrate* directory;

faa1245c30.14d.Z

which becomes, with the Rx3 long names;

FAA100PYF_R_20142450230_15M_01S_MO.crx.gz

The contents of all equivalent files above are exactly the same, it is only the filename that changes. The DCs need to ensure that the new filenames get stored properly in the regular data repository directories (no longer in *campaign* directories!). The new names indicate the start of the data, the length of the file, the frequency of the data inside the file, the type of data (i.e.- MO – Mixed Observations), and the compression methods; *crx* for Hatanaka compressed, and *gz*.

[Open issue: we need to decide together with the DCs if IGS Rx3 filenames will reflect the real contents of the data files or be symbolic as they are now; Daily, Hourly, HR. Symbolic names are easier to implement and sort for storage but realistic names are much more useful]

As for streamed data most Data Centers that accumulate streams into high-rate RINEX files do so using station header skeleton files and the old filenames. These skeleton files and associated applications will have to be adapted, since writing Rinex 3 files will now require the new long filenames.

[Open issue: we need an indication from BKG about the possibility of BNC writing/reading the correct Rx3 filenames]

4. Station Managers/Station Operators Tasks

Stations Managers/Station Operators (SOs) are generally directly in charge of their own station's data flows and they should be given the necessary indications and instructions to generate RINEX 3 files correctly and which are properly named. The file flow of **existing Rx3 stations will be in parallel using the two different names for 6 months (TBC)**. The RINEX 3 file arriving with the old name would continue to be stored in the *campaign/mgex* directory and the file with the long filenames would be merged into the regular *gps/data/[daily/hourly/highrate]* directory, once validated.

Therefore, Station Operators with existing Rx3 data files will be directed to continue to submit their files using the old naming scheme, as they do now, to be stored in the '*mgex*' campaign directory for a few months, plus to add a second submission using the new long names for storage in the regular Rinex data repository. After a short trial period the Rx3 files with the new names will be discontinued.

[Open issue as there is no renaming software available now; should the IGS CB provide a basic script to station operators to rename their Rx3 files correctly until vendor tools write the complete correct names?]

For streaming data the situation remains as it is, but RINEX 3 high-rate files, which may be generated from streams, need to use the new naming scheme including the file source parameter in the names. RINEX 2 high-rate files will stay as they are.

5 Analysis Coordinators and Combiner Tasks

It is the responsibility of the ACC and the different Working Group Coordinators (Tropo, Reference Frame, IERS WG on SINEX format, Clock, etc) to **change the product formats as needed to accommodate the new station names**. We need to ensure that the products as presented below are properly addressed.

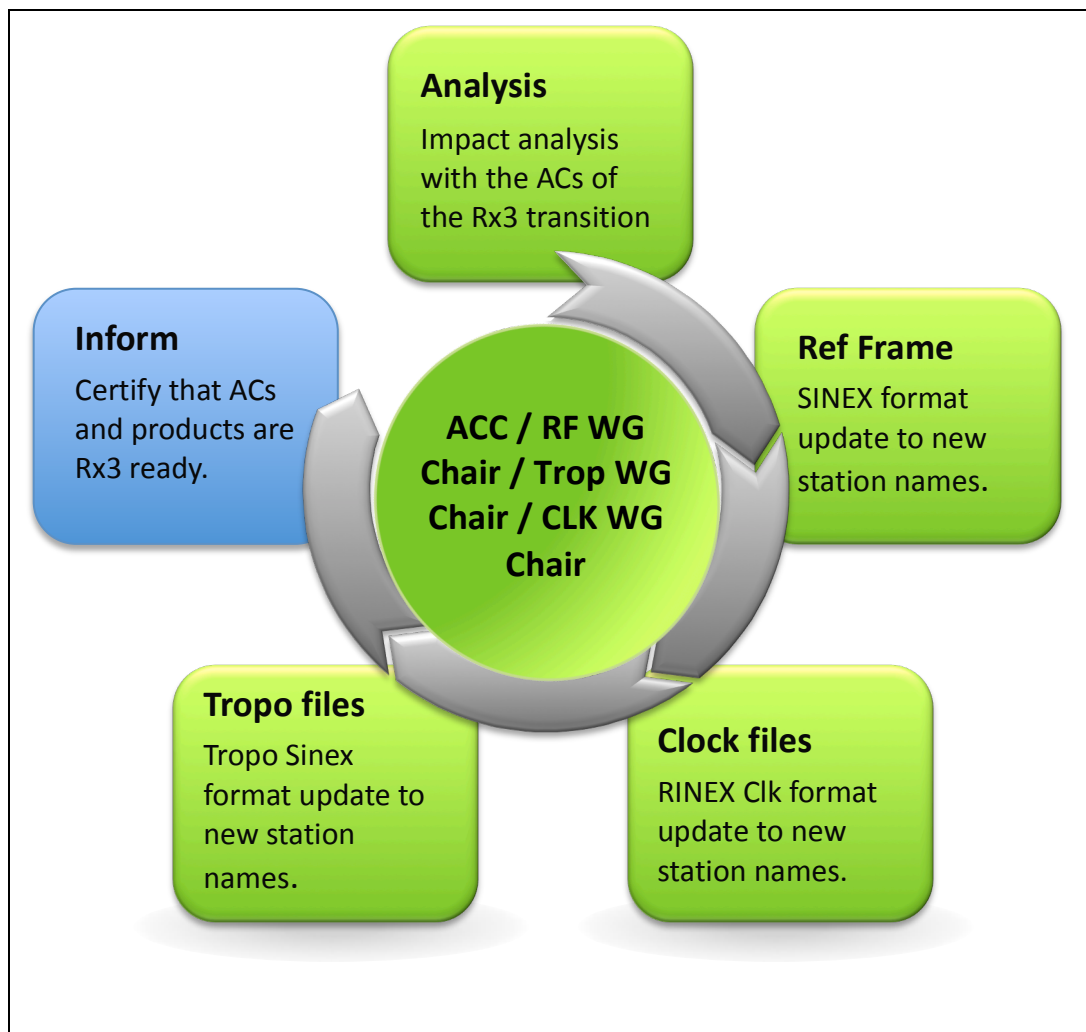


Figure 4: Analysis Coordinators and Working Group Tasks

Below is a preliminary list of the products that need to be addressed and a possible way forward.

5.1 RINEX Clock files

Only format issues need to be corrected (not product filenames), for example;

From this;									
MAL2	33201M003				4865385527	4110717376	-331137462	SOLN	STA NAME / NUM
MAS1	31303M002				5439192171	-1522055306	2953454994	SOLN	STA NAME / NUM
MIZU	21702M002				-3857170474	3108693106	4004040330	SOLN	STA NAME / NUM
NNOR	50181M001				-2414152121	4907778579	-3270644465	SOLN	STA NAME / NUM
...									
AR	MAL2	2014	08	27	00	00	0.000000	2	-1.415334749625e-04 2.098948497020e-11
AR	MAS1	2014	08	27	00	00	0.000000	2	-1.141963785165e-04 3.230665580340e-11
AR	MIZU	2014	08	27	00	00	0.000000	2	-8.119328887498e-07 6.860250726770e-11
AR	NNOR	2014	08	27	00	00	0.000000	2	-2.585933960805e-04 3.747723307230e-11
...									
To this;									
MAL200KEN	33201M003				4865385527	4110717376	-331137462	SOLN	STA NAME / NUM
MAS100ESP	31303M002				5439192171	-1522055306	2953454994	SOLN	STA NAME / NUM
MIZU00JAP	21702M002				-3857170474	3108693106	4004040330	SOLN	STA NAME / NUM
NNOR00AUS	50181M001				-2414152121	4907778579	-3270644465	SOLN	STA NAME / NUM
...									
AR	MAL200KEN	2014	08	27	00	00	0.000000	2	-1.415334749625e-04 2.098948497020e-11
AR	MAS100ESP	2014	08	27	00	00	0.000000	2	-1.141963785165e-04 3.230665580340e-11
AR	MIZU00JAP	2014	08	27	00	00	0.000000	2	-8.119328887498e-07 6.860250726770e-11
AR	NNOR00AUS	2014	08	27	00	00	0.000000	2	-2.585933960805e-04 3.747723307230e-11
...									

5.2 SINEX stations position files

Internal format changes needed to accommodate the new station names, in the SITE/ID, SITE/ANTENNA, SITE/ECCENTRICITY, SOLUTION/EPOCHS, SOLUTION/ESTIMATE, SOLUTION/APRIORI blocks, assuming the 80 column limit can be removed we would increase the SITE designation to an "a9", thus we could for example have ;

From this;												
+SITE/ID												
*CODE	PT	DOMES	T	STATION_DESCRIPTION	APPROX_LON	APPROX_LAT	APP_H					
CEBR	A	13408M001	P	CEBREROS, Spain	355 37 55.7	40 27 12.3	776.4					
...												
+SOLUTION/ESTIMATE												
*INDEX	TYPE	CODE	PT	SOLN	REF_EPOCH	UNIT	S	ESTIMATED_VALUE	STD_DEV			
244	STAX	CEBR	A	1	14:228:43184	m	2	0.484666487763101E+07	.266990E-02			
245	STAY	CEBR	A	1	14:228:43184	m	2	-.370195106795309E+06	.103238E-02			
246	STAZ	CEBR	A	1	14:228:43184	m	2	0.411692957563304E+07	.222837E-02			
...												
To this;												
+SITE/ID												
*CODE	PT	DOMES	T	STATION_DESCRIPTION	APPROX_LON	APPROX_LAT	APP_H					
CEBR00ESP	A	13408M001	P	CEBREROS, Spain	355 37 55.7	40 27 12.3	776.4					
...												
+SOLUTION/ESTIMATE												
*INDEX	TYPE	CODE	PT	SOLN	REF_EPOCH	UNIT	S	ESTIMATED_VALUE	STD_DEV			
244	STAX	CEBR00ESP	A	1	14:228:43184	m	2	0.484666487763101E+07	.266990E-02			
245	STAY	CEBR00ESP	A	1	14:228:43184	m	2	-.370195106795309E+06	.103238E-02			
246	STAZ	CEBR00ESP	A	1	14:228:43184	m	2	0.411692957563304E+07	.222837E-02			
...												

In this proposal mixing old and new names would be possible inside the same solution file for stations that only submit Rx2 data files, or only Rx3 data files.

It could also be possible to create a new SINEX block for naming equivalency, but that may be more complicated.

5.3 Tropo files

As with the SINEX format, from which Tropo derives, almost all the SITE blocks are affected in the Tropo format. Also the filenames will need to be changed as the IGS Tropo files use the 4 character ID as part of the individual station tropo estimation files.

From this;							
+TROP/SOLUTION							
*SITE	EPOCH	TROTOT	STDEV	TGNTOT	STDEV	TGETOT	STDEV
MAS1	13:150:00000	2539.4	2.8	-3.106	0.407	0.059	0.474
...							
Using filename;							
mas1150.13zpd							
To this;							
+TROP/SOLUTION							
*SITE	EPOCH	TROTOT	STDEV	TGNTOT	STDEV	TGETOT	STDEV
MAS100ESP	13:150:00000	2539.4	2.8	-3.106	0.407	0.059	0.474
...							
To using filename;							
MAS100ESP150.13zpd							

6. Timeline

