



A Data Center for Operation of Multi-GNSS Data

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Abstract

The package of various satellite navigation systems is also known as Global Navigation Satellite System (GNSS). New satellite constellations such as Galileo, COMPASS and QZSS are presently going to be deployed in addition to the fully deployed GPS and GLONASS. With the new satellites new signal types and frequencies arrive, which aren't considered in legacy data format standards. The GNSS Data Center (GDC) at BKG accepts the challenge and implemented the operation of new data formats, e.g., RINEX version 3. Galileo, COMPASS and QZSS tracking data are now publicly available at GDC, while ensuring that tracking data of long-term projects will stay unaffected. This was achieved by creating additional data directories. GDC also supports the IGS Multi GNSS Experiment (M-GEX) that has been launched at the beginning of February 2012 and an M-GEX project directory was set up accordingly. A new tool for editing and analyzing RINEX version 2 as well as version 3 files is under development. A draft program version is now applied at GDC to concatenate hourly RINEX version 3 files into daily files, to convert RINEX version 2 into version 3 and vice versa, and also for multipath analysis.

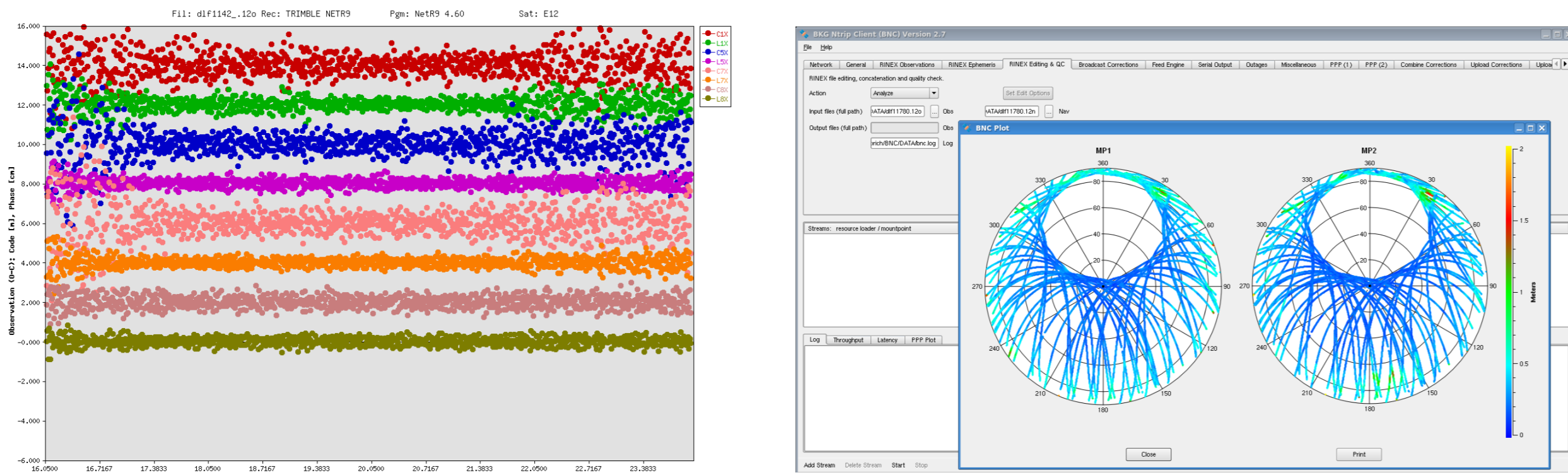
IGS Multi-GNSS Experiment (M-GEX)

47 multi-GNSS tracking stations are currently set up in the MGEX project directory of the data center. Some stations were newly established, where others are existing IGS or EUREF sites. Daily RINEX observation files of 32 stations are available and those are listed below. They are sorted by the RINEX creation program, which supplies a hint about included data signals.

| 4-Char | Name | Receiver | Firmware | RINEX PGM |
|--------|--|----------------------|--------------------|---------------------|
| ABMF | Aéroport du Raizet-LES ABYMES - France | TRIMBLE NETR9 | 4.60 | BNC2.6 |
| BRST | Brest | TRIMBLE NETR9 | 4.60 | BNC2.6 |
| LMMF | Aerop. Alime CESAIRE-LE LAMENTIN-France | TRIMBLE NETR9 | 4.60 | BNC2.6 |
| NKLG | N' KOLTANG (GABON) | TRIMBLE NETR9 | 4.60 | BNC2.6 |
| REUN | La Reunion - Observatoire Volcanologique | TRIMBLE NETR9 | 4.60 | BNC2.6 |
| WARN | Warnemuende | JPS LEGACY | 2.6.1 JAN_10_2008 | BNC2.6 |
| DYNG | DIONYSOS | TRIMBLE NETR9 | 4.60 | convTORINEX2.12.0 |
| HARB | Hambroerhoek | TRIMBLE NETR9 | 4.42 | convTORINEX2.12.0 |
| TLSE | Toulouse | TRIMBLE NETR9 | 4.6 | convTORINEX2.12.0 |
| USN5 | U.S. Naval Obs. Time Service | NOV OEM6 | OEM06000RNO000 | convert10 |
| MYVA | Reykjahlid / Iceland | LEICA GR10 | 6.110 | GR10V2.50 |
| GOP6 | Pecny, Ondrejov / CZ | LEICA GRX1200+GNSS | 8.51/6.110 | GRX1200+OBSRINEX |
| NURK | Kigali - National University of Rwanda, CGIS | JAVAD TRE_G3TH DELTA | 3.4.400 | MAKERINEX 2.0.10850 |
| NYA2 | Ny Alesund | JAVAD TRE_G3TH DELTA | 3.3.5 | MAKERINEX 2.0.10850 |
| OBE3 | Oberpfaffenhofen | JAVAD TRE_G3TH DELTA | 3.3.5 | MAKERINEX 2.0.10850 |
| OUS2 | Dunedin | JAVAD TRE_G3TH DELTA | 3.4.400 | MAKERINEX 2.0.10850 |
| POTS | Potsdam, Geoforschungszentrum | JAVAD TRE_G3TH DELTA | 3.4.400 | MAKERINEX 2.0.10850 |
| SGOC | Surveyor General's Office Colombo | JAVAD TRE_G3TH DELTA | 3.3.5 | MAKERINEX 2.0.10850 |
| TASH | Tashkent | JAVAD TRE_G3TH DELTA | 3.4.400 | MAKERINEX 2.0.10850 |
| ULAB | Ulaanbaatar | JAVAD TRE_G3TH DELTA | 3.4.1b3 | MAKERINEX 2.0.10850 |
| WUHZ | WUHAN | JAVAD TRE_G3TH DELTA | 3.3.5 | MAKERINEX 2.0.10850 |
| CUTO | Curtin University Bentley | TRIMBLE NETR9 | 4.60 | NetR9 4.60 |
| DLF1 | Delft | TRIMBLE NETR9 | 4.60 | NetR9 4.60 |
| GRAS | GRASSE | TRIMBLE NETR9 | 4.42 | NetR9 4.60 |
| KIR8 | Kiruna | TRIMBLE NETR9 | 4.43 | NetR9 4.60 |
| MAA7 | Maaribo | TRIMBLE NETR9 | 4.43 | NetR9 4.60 |
| ONS1 | Onsala | TRIMBLE NETR9 | 4.43 | NetR9 4.60 |
| BRUX | Brussels | SEPT POLARXTR | 2.3-t1120216-34012 | sP2Zin-8.1.0 |
| USN4 | U.S. Naval Observatory Time Service | SEPT POLARXTR | 2.3 | sP2Zin-8.1.0 |
| GRAB | Graz_B | IFEN SX_NSR_RT_800 | 2.4 | SX-NSR |
| CONZ | Conception-TIGO | LEICA GRX1200+GNSS | 8.51/6.110 | ViewLB2 v1.3.7.0 |
| CHIX | O' Higgins / Antarctica | LEICA GRX1200+GNSS | 8.50/6.110 | ViewLB2 v1.3.7.0 |

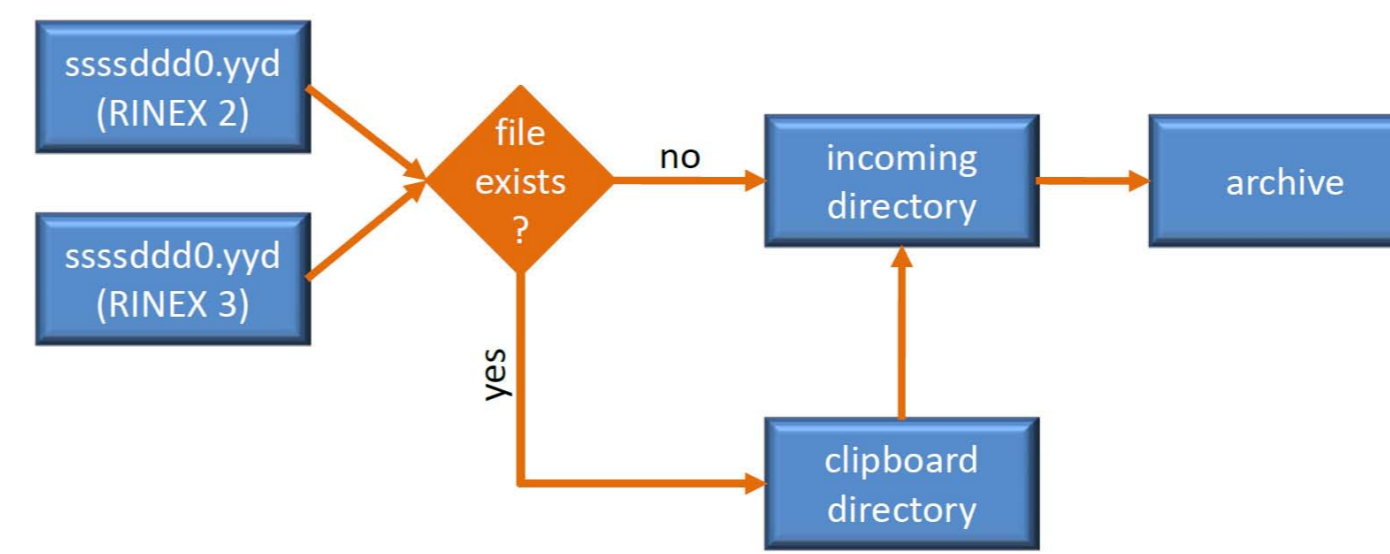
Trial Data Screening and Multi-Path

A simple data screening of RINEX version 3 observation files compares the measurement of a single epoch to the computed number, which results from an interpolation of adjacent epochs. The L8X signal is shown in the bottom line for Galileo satellite 12 and appears to have the smallest noise especially for low elevation. GPS multi-path MP1 and MP2 were analyzed with the BNC tool from RINEX 3 observation/navigation files.



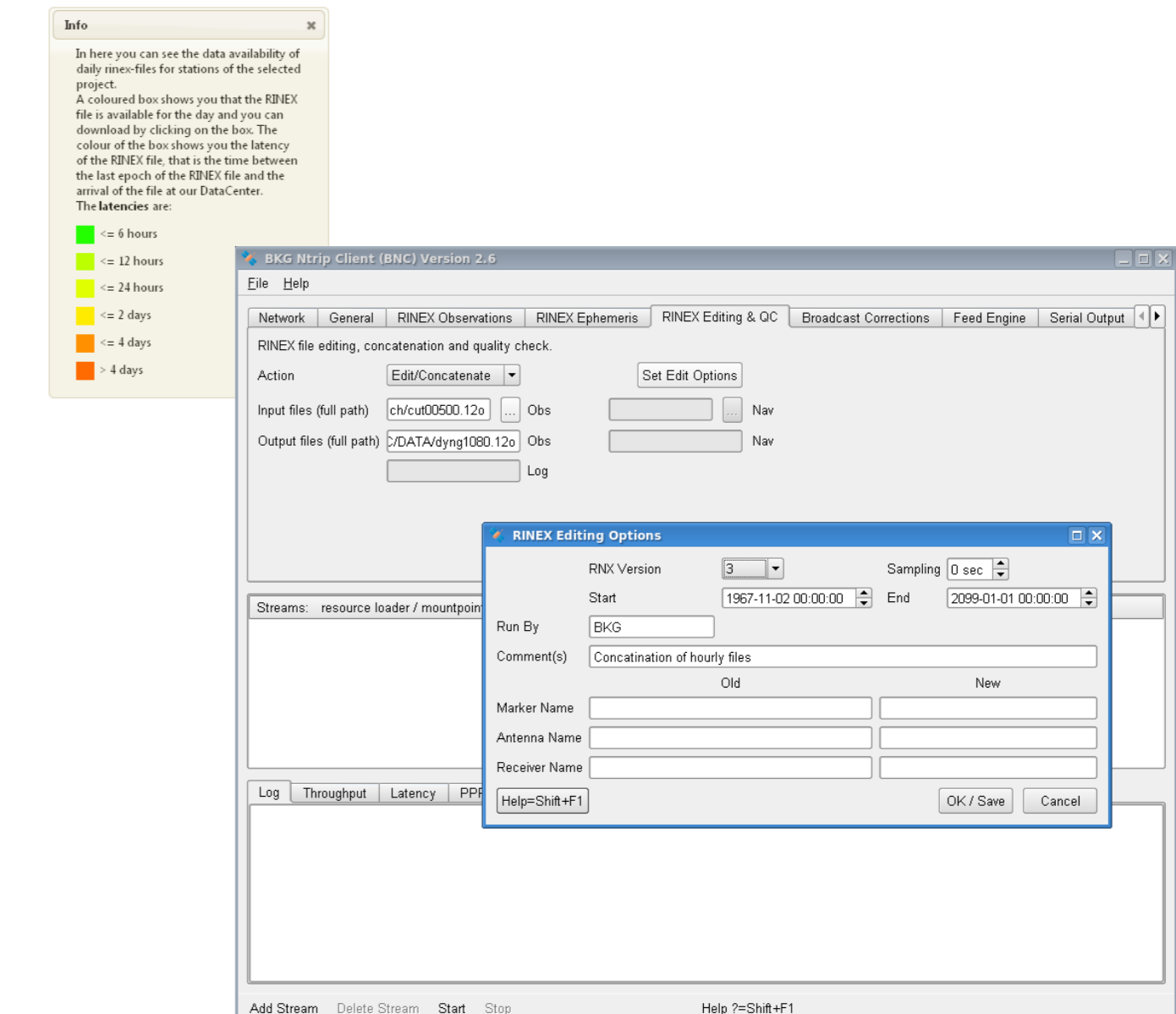
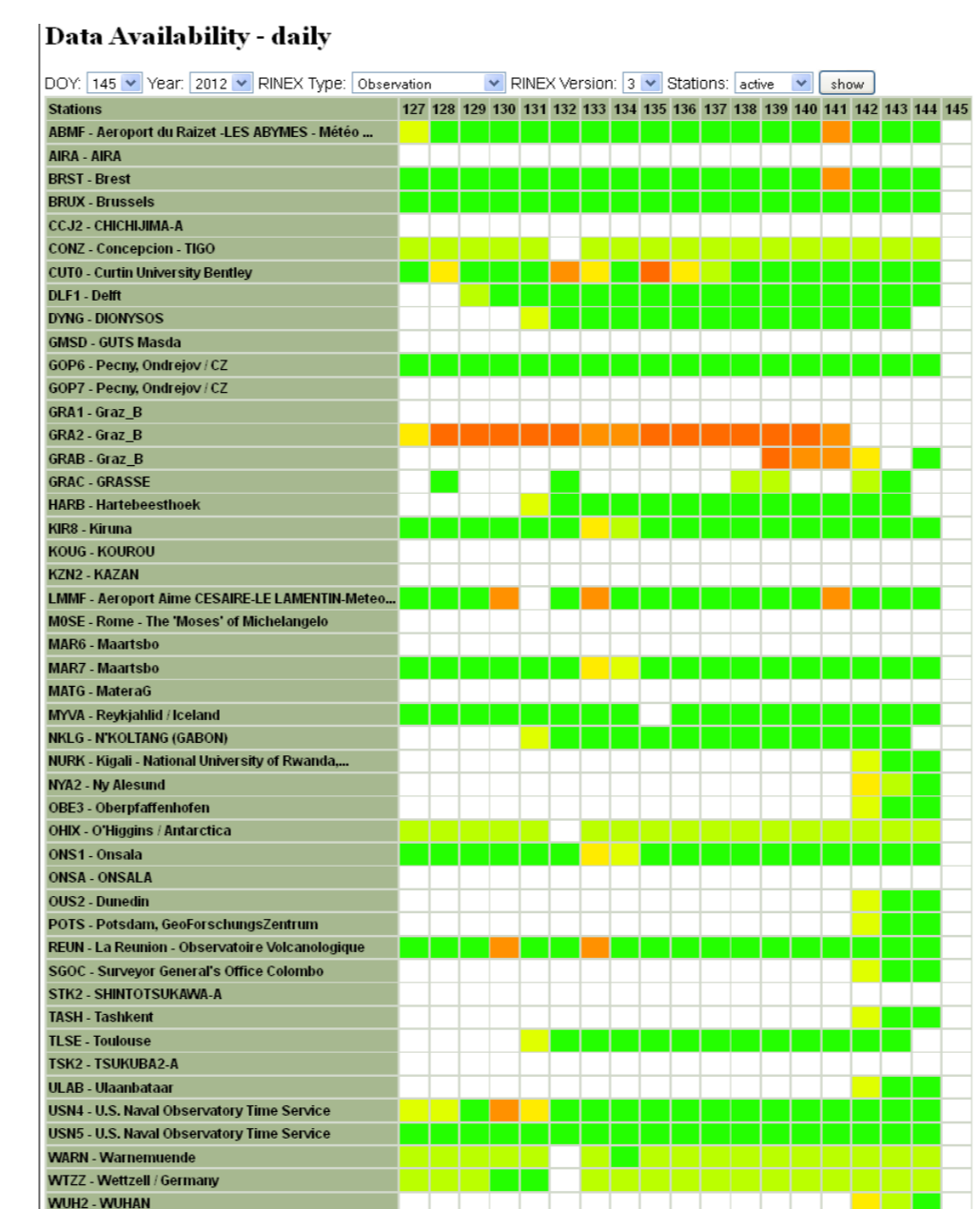
File Browser and Clipboard

The integrated File Browser allows to view and download the RINEX files in compressed and plain text format. Long-term projects stay unaffected, because of the new "obs_v3" directory. Parallel upload of RINEX v2 and v3 files (identical filenames) is allowed and handled by a clipboard.



Data Availability and Concatenation

The summary of available daily and hourly RINEX files is now also given for the format version 3. The concatenation of hourly RINEX v3 files is a new option of the BNC Tool and is now implemented.



Outlook

The huge diversity of satellite constellations and signal types that are now present in RINEX version 3 files asks for extended tools for data editing and quality control. BKG further develops the BNC program for these tasks and is going to implement new features into the Data Center.

Options for parallel or exclusive holding of RINEX version 2 and 3 data are under discussion. On-the-fly filtering of "mixed" data files according to user requests and conversion of format version 2 into 3 and vice versa are some of the issues.

Several RINEX creation approaches, such as creation by firmware in the receiver or accumulation of RTCM data streams, showed up with the launch of the M-GEX experiment. The validation of RINEX files becomes thus an important task of a Multi-GNSS Data Center.

Further Information

<http://igs.bkg.bund.de>



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