



ESA/ESOC GNSS Observation station Network (EGON) Status and Progress



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Introduction

ESA/ESOC continues to improve, maintain and expand its worldwide network of GNSS stations for the benefit of the international community through participation in the IGS and the EUREF, plus internal ESA efforts to enhance the data coverage worldwide.

From 2014 to 2022 a series of worldwide station deployments took place to strengthen the ESA/ESOC station network for internal project use.

More recently, the initiation of new agreements is well underway for additional stations in Canada (see insert below). All ESOC stations provide multi-GNSS 15min, Hourly and Daily RINEX 4 files for all available constellations.

ESA/ESOC Station Network

The station network map below shows the ESA GNSS station network, which currently comprises 25 stations, excluding 3 "UTC" stations (ES13/14/17). A total of 10 stations are deployed at ESA ESTRACK core/cooperation locations; Kourou (KOUR), Redu (REDU), Maspalomas (MAS1), Cebreros (CEBR), Villafraña (VILL), Kiruna (KIRU), Malargue (MGUE), New Norcia (NNOR), Malindi (MAL2) and Santa Maria (SNTM).

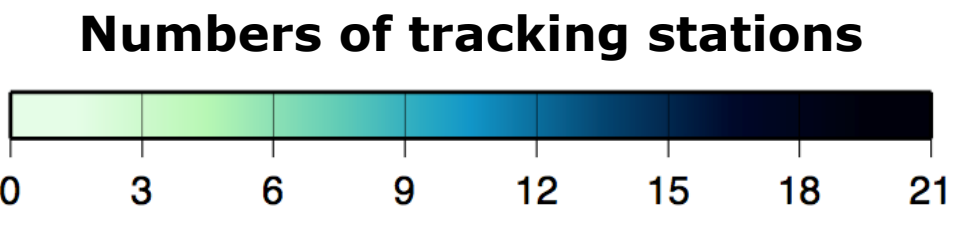
In addition, two dual receiver stations are deployed at ESA/ESOC's premises in Darmstadt (ESOC/ES13 and ES14/ES17), connected to ultra-stable H-masers. Finally, 14 stations are deployed at third party sites; Awarua (AWAR), Banting (BANT), Bishkek (BSHK), Cachoeira Paulista (CHPE), Cartago (CTGO), Cordoba (CETT), Dubai (DUBA), Tahiti (FAA1), Hartebeesthoek (HRTB), Matjesfontein (MTJF), Raufarhofn (RAUF), Reykjavik (RYKJ), Santiago de Queretaro (SDQM) and Tsukuba (TSBA).

Over recent years, all stations displayed data availability figures very close to 100%. The data's arrival is monitored every 15 minutes, and it is processed in the ESOC IGS processing (Ultras, Rapids and Finals) allowing for data quality, station position, and clock stability to be monitored.

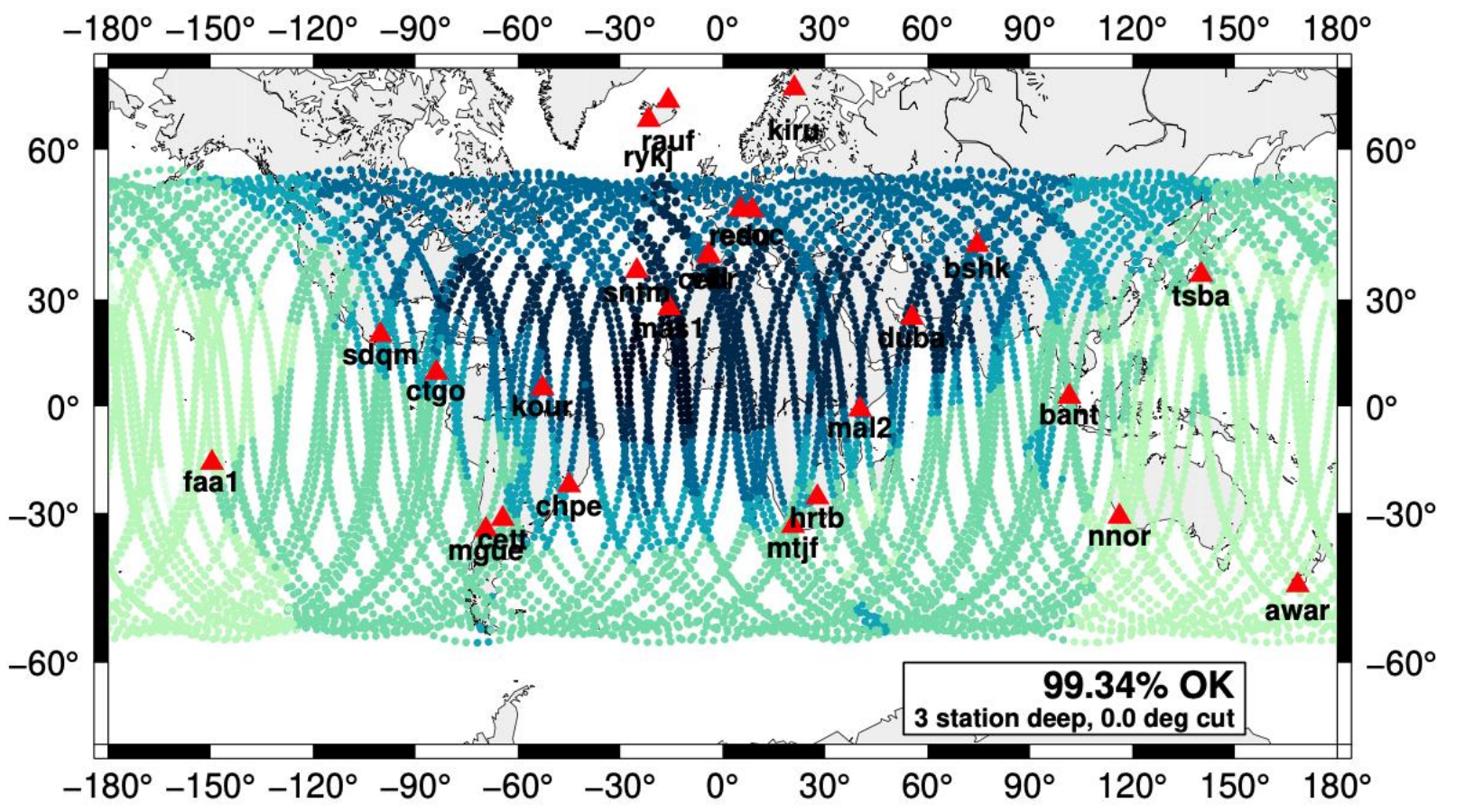
ESOC Multi-GNSS Data

The station network is permanently monitored to ensure the data return from each site is complete. Specifically checking "triple station coverage" for each active GNSS satellite in every 24-hour period to detect problems and weak coverage areas. Dual frequency data for NavIC has been added from our public and private stations since mid-2025

All GNSS Constellations are covered with at least three EGON stations >99% of the time as seen in the plots below for a recent day:

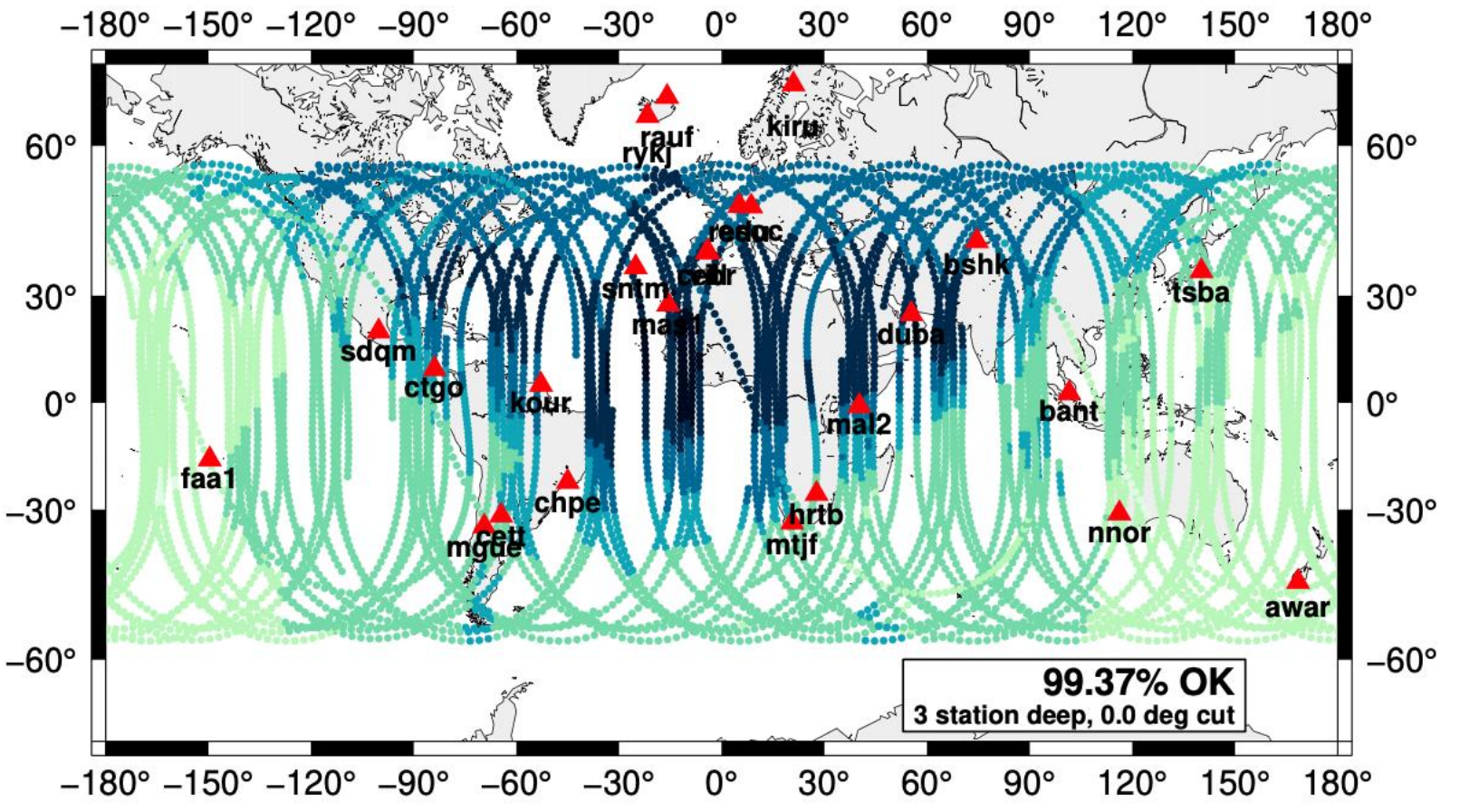


'G' Coverage - Rnx3Obs - 26099



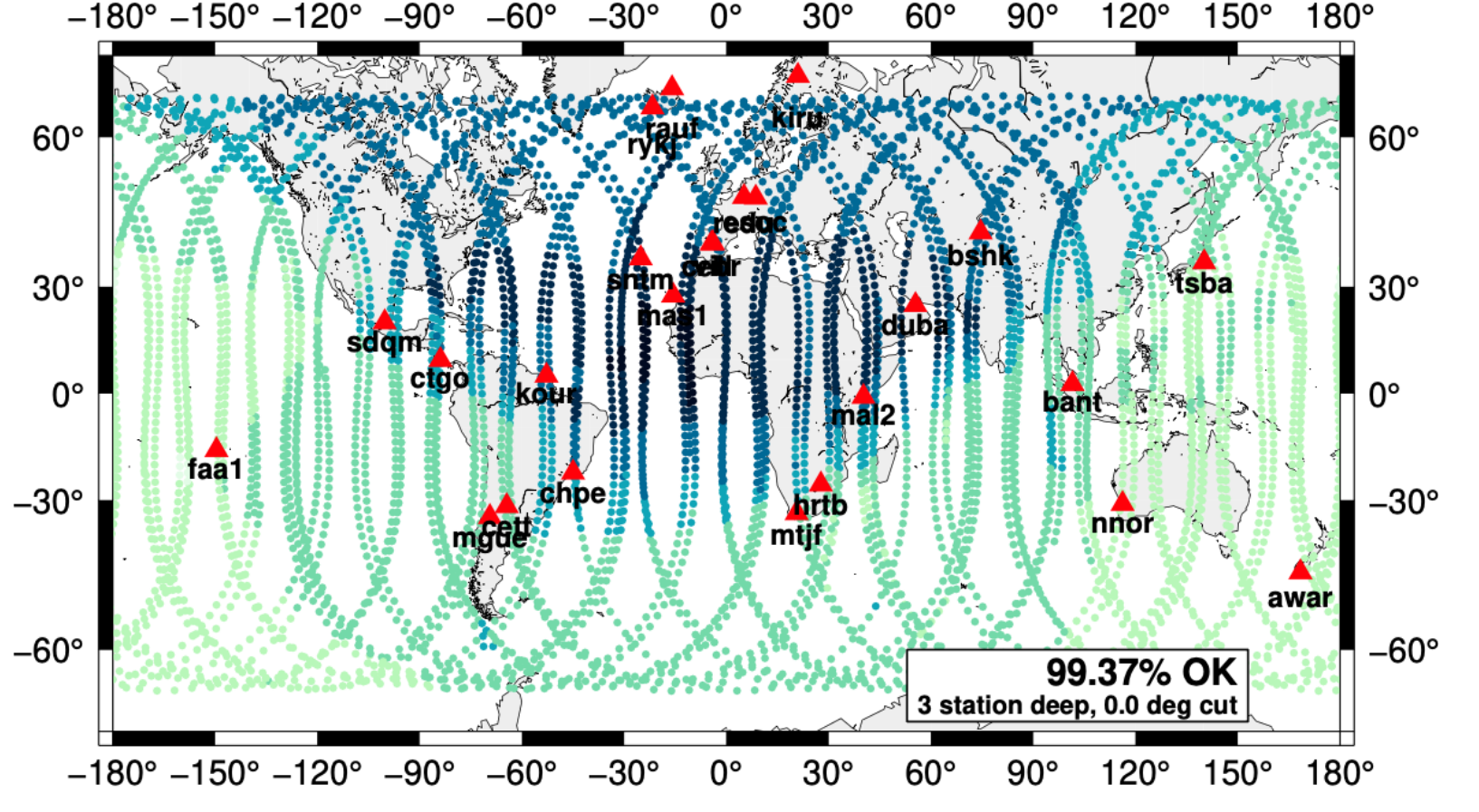
ESOC Network GPS triple station coverage

'E' Coverage - Rnx3Obs - 26099



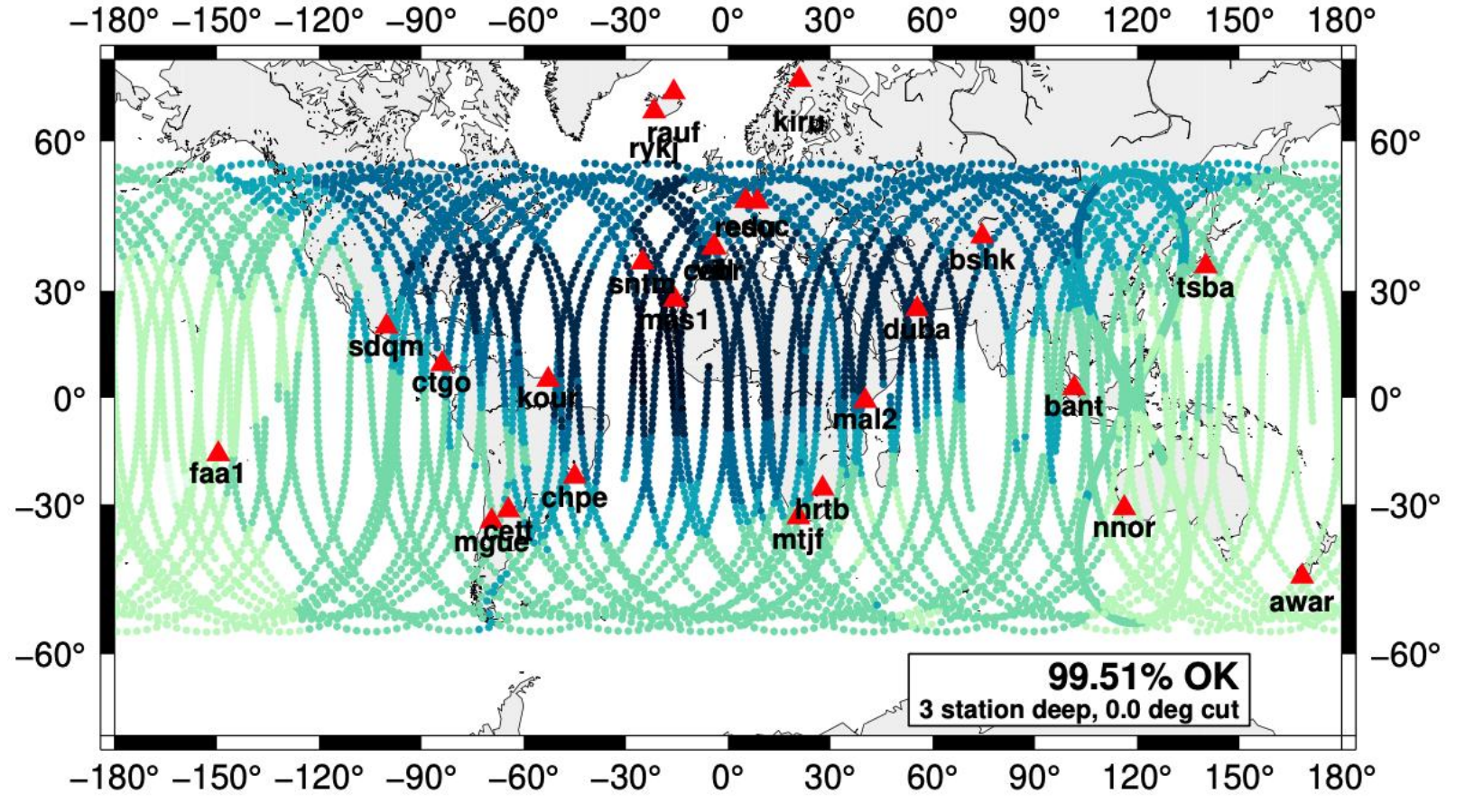
ESOC Network Galileo triple station coverage

'R' Coverage - Rnx3Obs - 26099



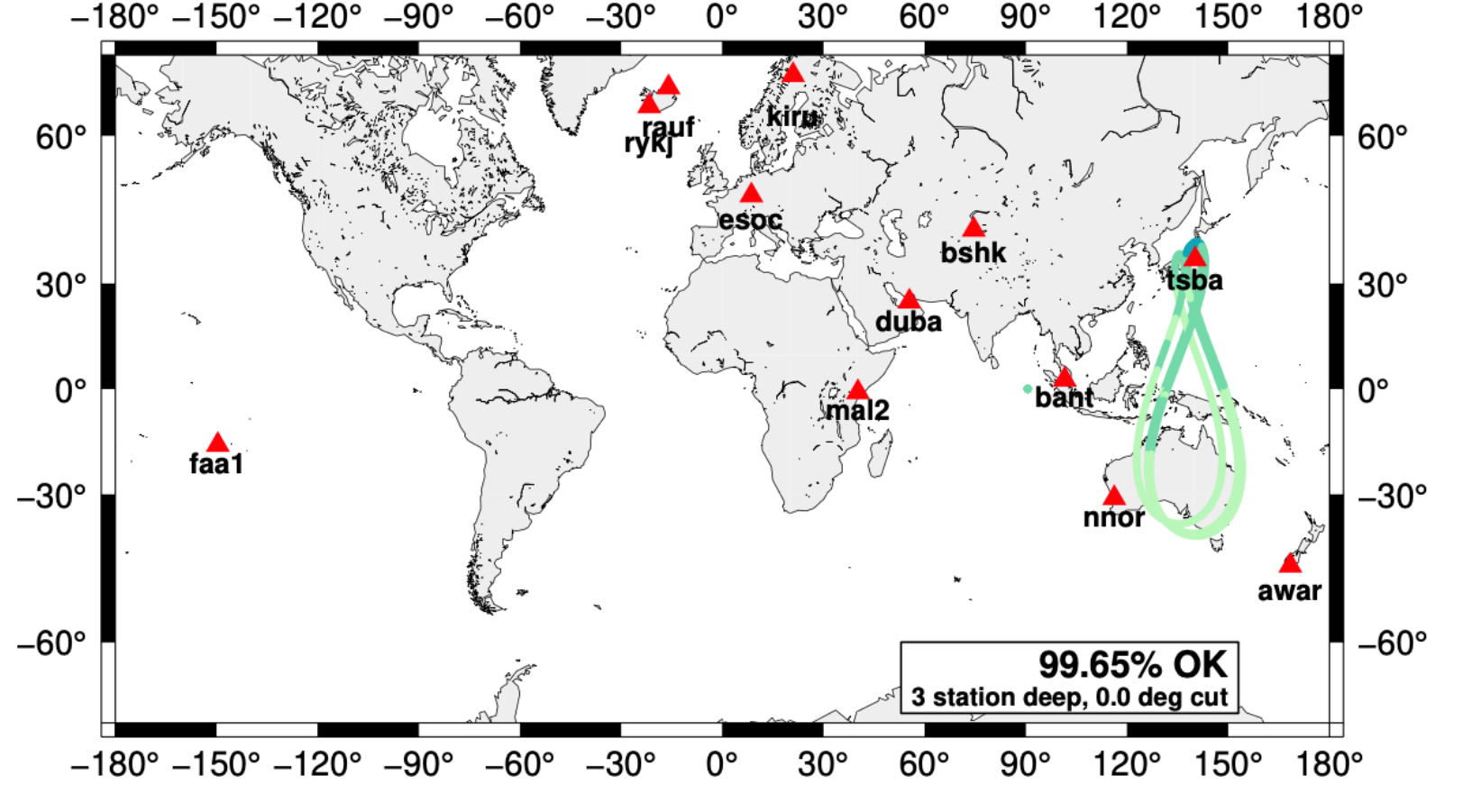
ESOC Network GLONASS triple station coverage

'C' Coverage - Rnx3Obs - 26099

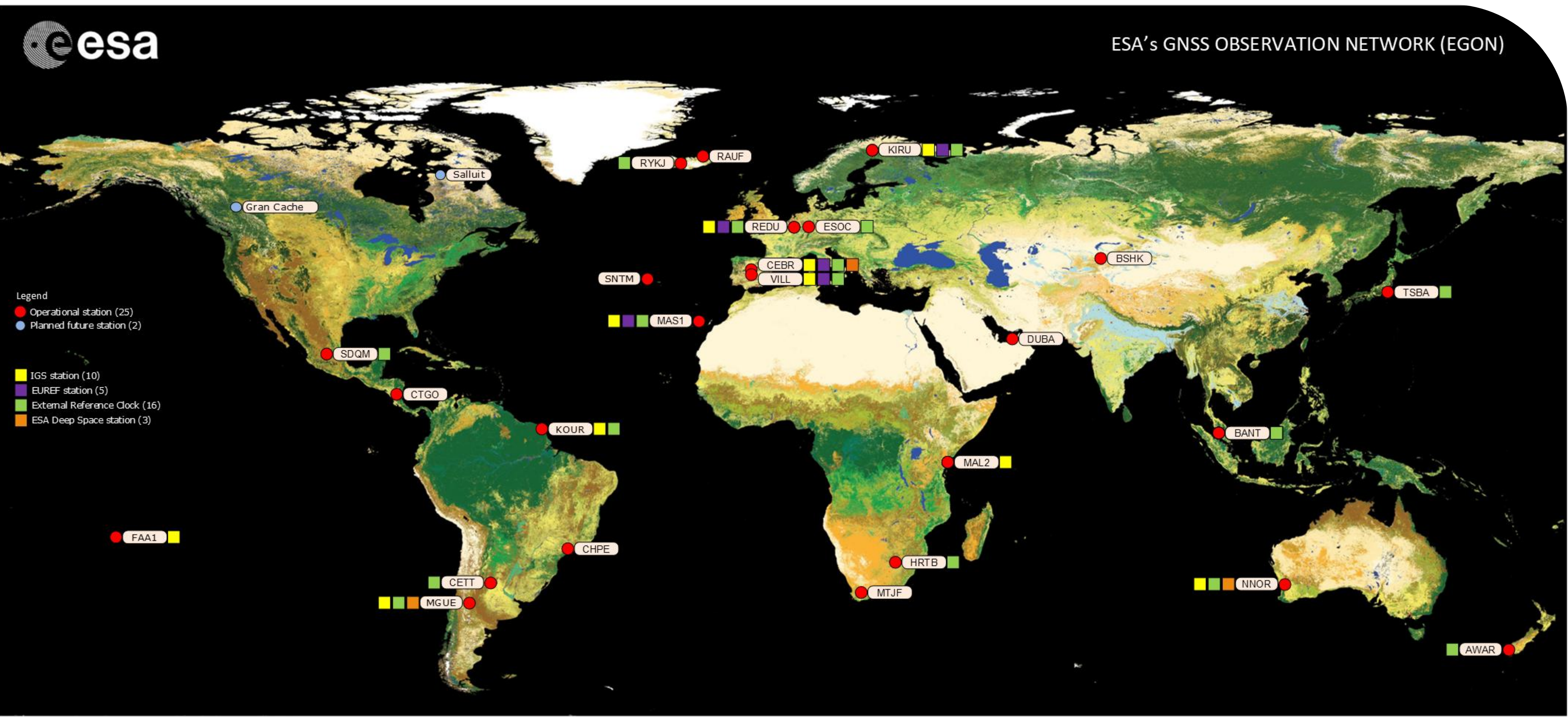


ESOC Network BeiDou triple station coverage

'J' Coverage - Rnx3Obs - 26099



ESOC Network QZSS triple station coverage

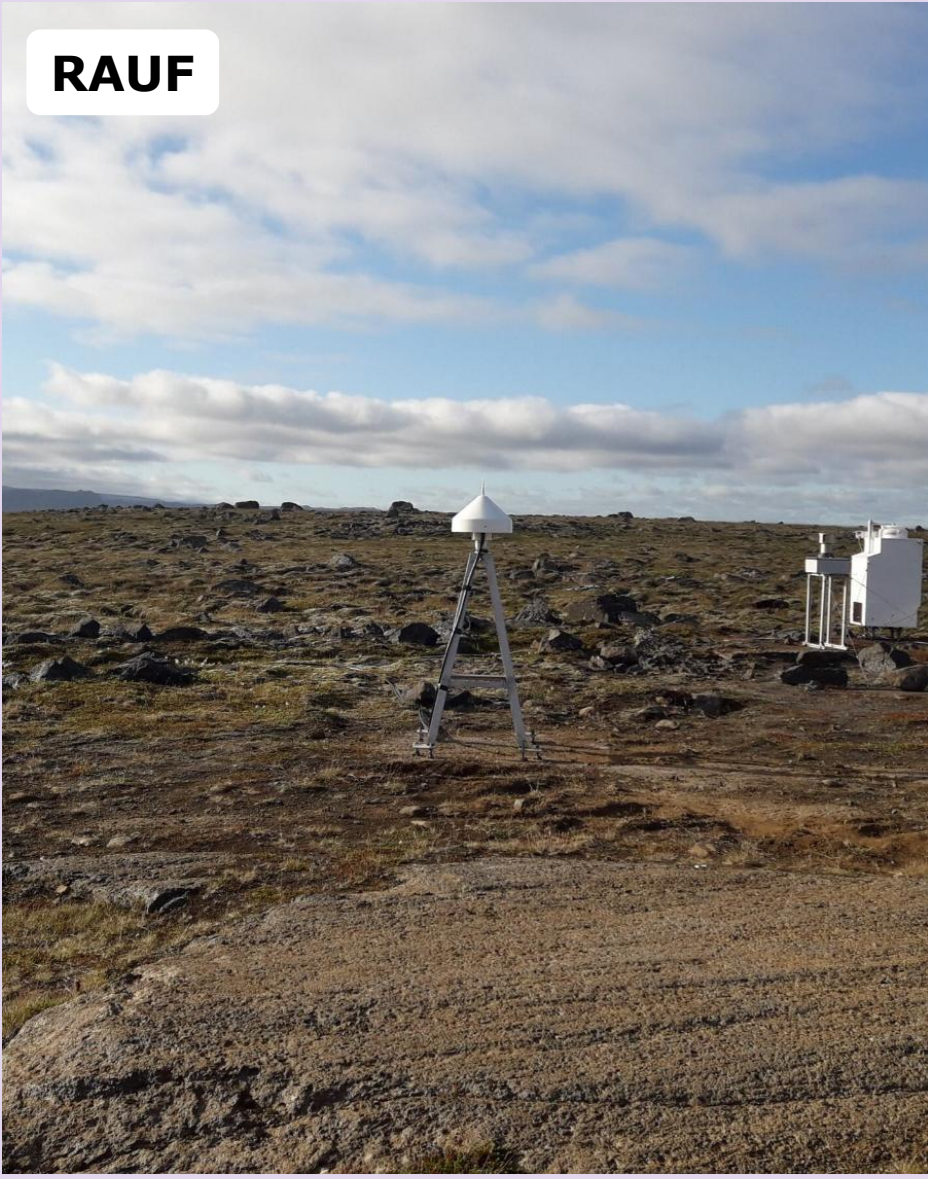


ESOC Station Network Upgrade 2014-2026

ESOC is committed to provide worldwide data for all GNSS constellations during this year as a result of having completed the upgrade of the equipment for the 'legacy network' in 2012-2013, as well as focusing on the establishment of collaborations with third parties to install new stations at various new locations if agreements can be reached with the corresponding organizations. As such, following the completion of the upgrade, new stations were deployed in 2014 (SNTM, AWAR), 2015 (BANT, DUBA, TSBA, ESOB, ESOC), 2016 (BSHK), 2017 (HRTB), 2018 (MTJF), 2019 (SDQM, CHPE, CETT, RYKJ), 2020 (RAUF) and 2022 (CTGO).

The entire ESA GNSS network now operates Septentrio PolaRx5 receivers (standard and TR) and either PolaNt Choke Ring antennas (most sites) or Leica AR25 antennas (used at MGUE, MAL2, MAS1 and FAA1). The Septentrio receivers provide code, phase, SNR and Doppler observations for all available signals from the current GNSS constellations: GPS, GLONASS, Galileo, QZSS, BeiDou and NavIC, as well as SBAS for a limited number of stations. As of mid-2013, ESOC has been contributing with daily, hourly and high rate multi-GNSS RINEX 3/4 data to the IGS network. In addition to the operational stations shown in the above map, the first steps towards an agreement with NRCAN are currently being established, which is expected to result in at least 2 new stations in Canada, complemented with high-stability external references for the timing.

RAUF



ESA/ESOC Stations in Iceland and Costa Rica

The latest two additions to the ESOC Station Network are in Iceland (2019 and 2020) and Costa Rica (2022). The former agreement results in now having high quality measurements for two homogeneous GNSS station set-ups deployed on the western and eastern sides of the Mid-Atlantic Ridge in Iceland. Both stations are hosted by Neyðarlínan (112 Iceland), the official national emergency service.

The latter agreement provides a bridge in geographical coverage between the stations in Mexico and French Guyana. This station is hosted by the Costa Rica Institute of Technology (ITCR) which is a university specializing in engineering and advanced science and research.

CTGO



Conclusions

ESA/ESOC is fully engaged in supporting the modernization of GNSS data formats and data transfers through our involvement in the RINEX Working Group. ESOC remains involved and committed to support the provision of Rinx 4 data from all our stations. The ESA/ESOC Navigation Support Office is committed to providing the highest quality GNSS data by maintaining, improving and expanding the existing station network with modern Septentrio receivers and antennas, providing measurements for all 6 GNSS-constellations; GPS, Galileo, GLONASS, BeiDou, QZSS and NavIC.

