Low cost GNSS receiver for ionospheric monitoring

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ICTP

Outline

Who are we?

The Atmosfiller project: Smartphone meets the ionosphere

Low cost GNSS receivers: Rokubun MEDEA GNSS computer

The AMIC project: Filling the gaps in ionospheric monitoring

Rokubun is a Market driven
Navigation Technology Hub
for ubiquitous, accurate
and scalable solutions

Atmosfiller: Smartphones for ionospheric monitoring

ESA Contract aimed at filling the gaps in Numerical Weather Prediction (tropo) and Space Weather (iono) using data of opportunity
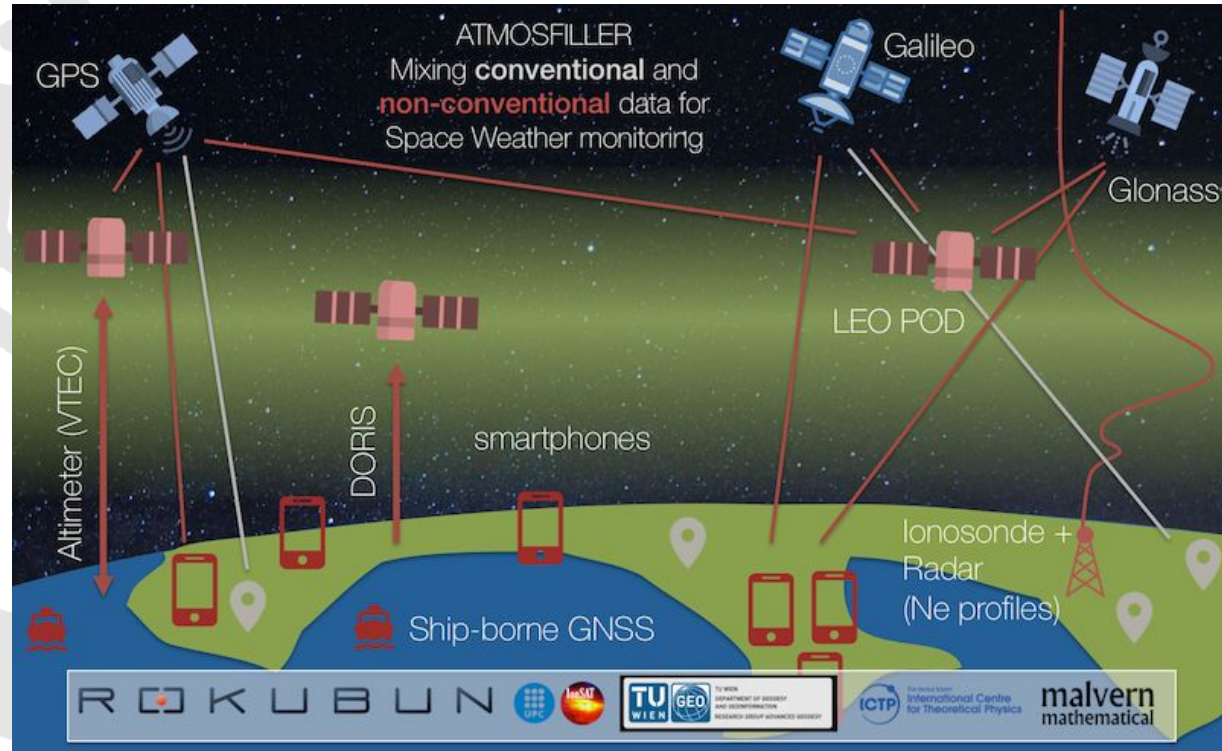
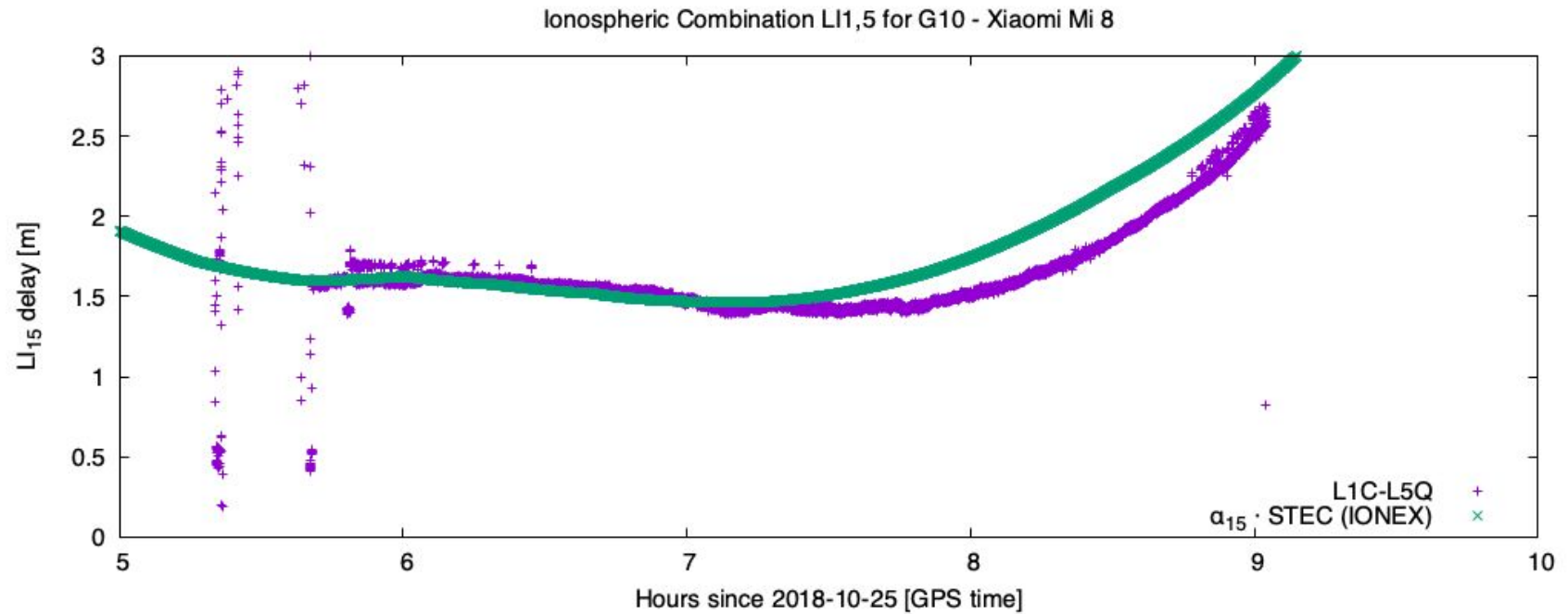## Atmosfiller: Smartphones for ionospheric monitoring

Advent of carrier-phase tracking dual-frequency smartphones (Xiaomi Mi 8) allow for ionospheric monitoring.

Smartphones are not GNSS receivers (impact in quality), but triggers possibility of data crowdsourcing.
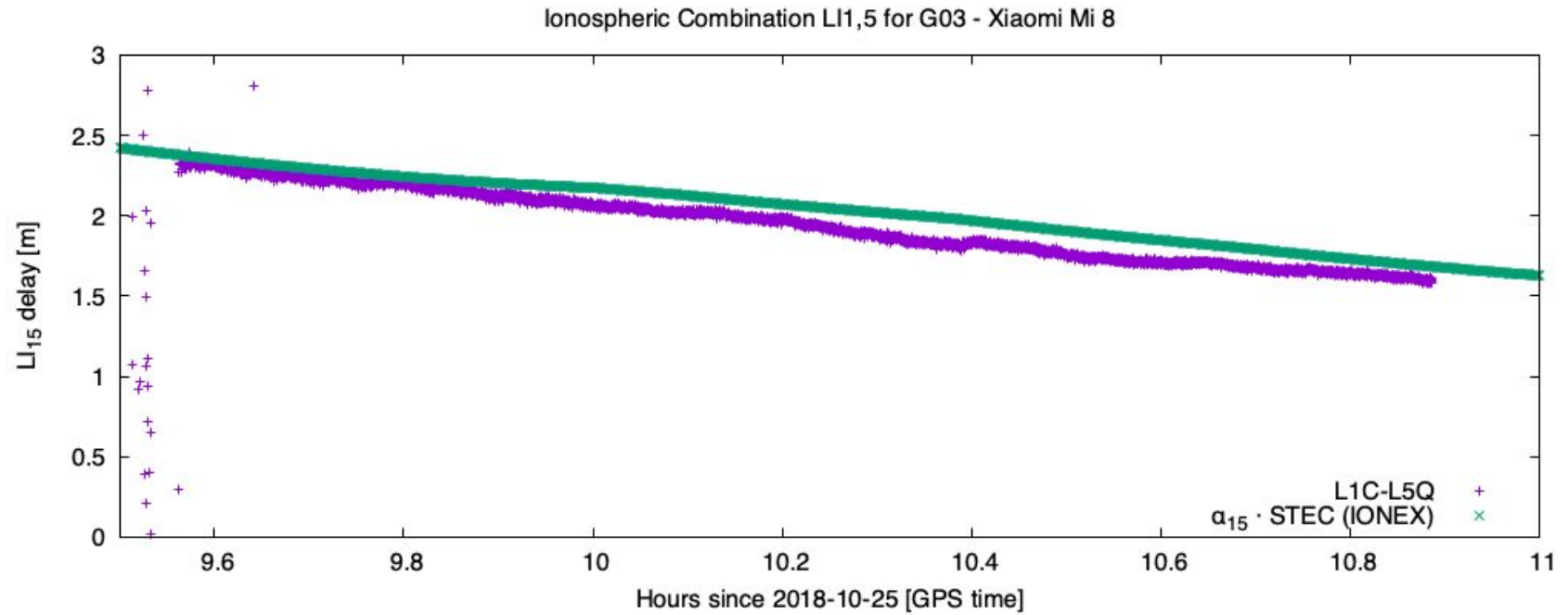
https://www.rokubun.cat/dual-frequency-gnss-observables-from-smartphones-ionosphere-and-multipath/

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List of GNSS capabilities for smartphones, thanks to @sjbarbeau:
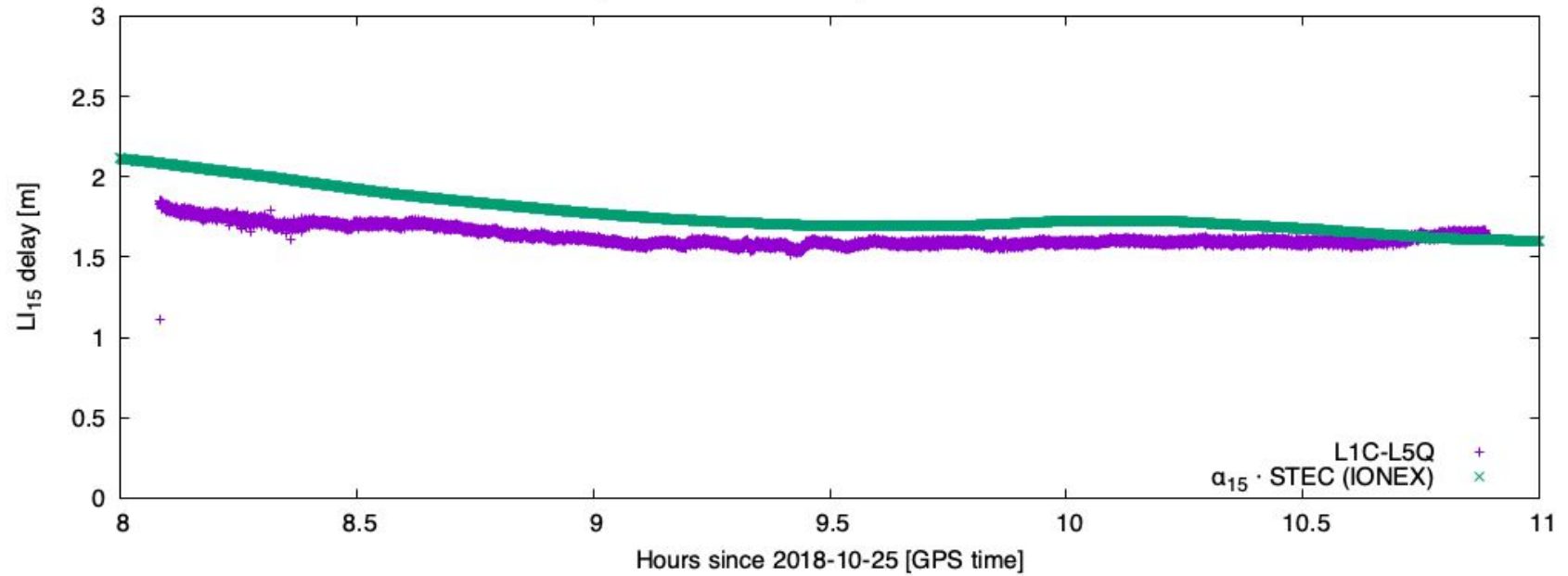https://barbeau.medium.com/crowdsourcing-gnss-capabilities-of-android-devices-d4228645cf25

Ionospheric Combination LI1,5 for G10 - Xiaomi Mi 8

Ionospheric Combination LI1,5 for G03 - Xiaomi Mi 8

Ionospheric Combination LI1,5 for G01 - Xiaomi Mi 8

MEDEA GNSS computer

- Based on u-blox ZED-F9P
    - GPS L1,L2
    - Galileo E1, E5b
    - Glonass R1, R2
    - Beidou B1, B2
    - QZSS and SBAS
- Up to 20 Hz rate (enable scintillation monitoring?)
- Application processor (ARM7) that allows uploading your own application
- Ethernet, USB-B/C ports, SD card for data logging
- Multiple RF inputs for possible future upgrades (e.g. heading Rx)
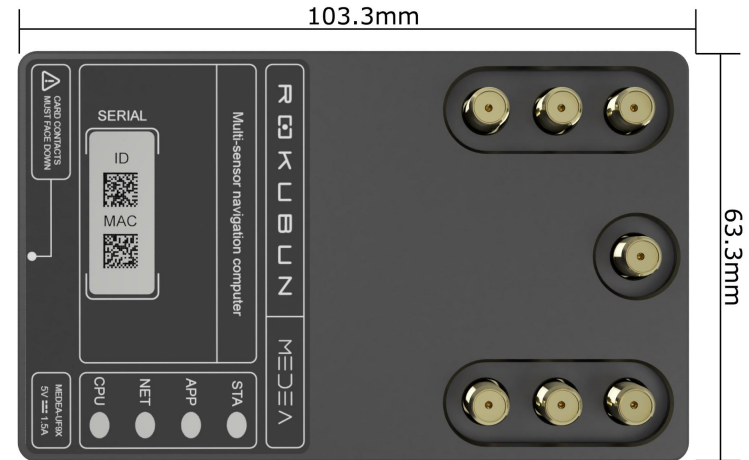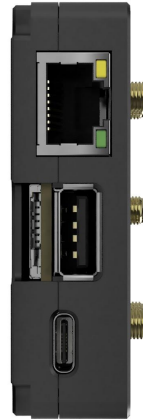
GNSS MEDEA Receiver (front-end demo)

MEDEA GNSS computer

Main purpose of MEDEA GNSS computer:
- Showcase Rokubun SDK for positioning
- Offer a technology enabler of highly accurate and scalable navigation systems or GNSS-based monitoring services (e.g. AMIC).
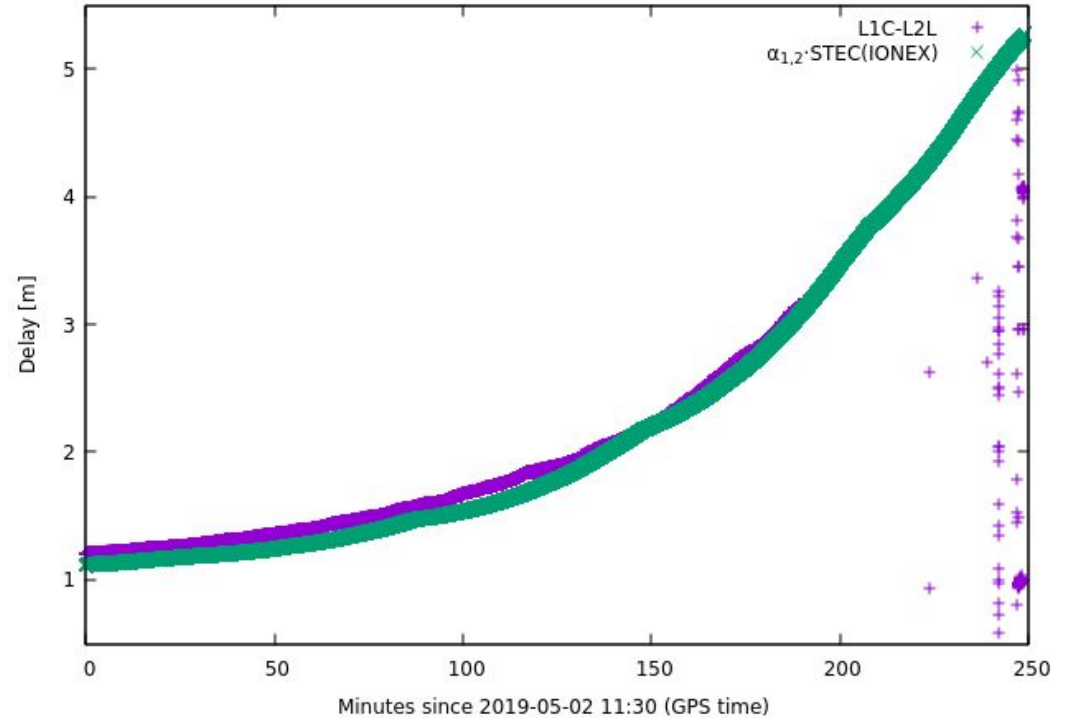
https://www.rokubun.cat/medea-performance-as-cors-gnss-receiver/

MEDEA GNSS receiver CORS station few units of ~2k€ (including antenna)
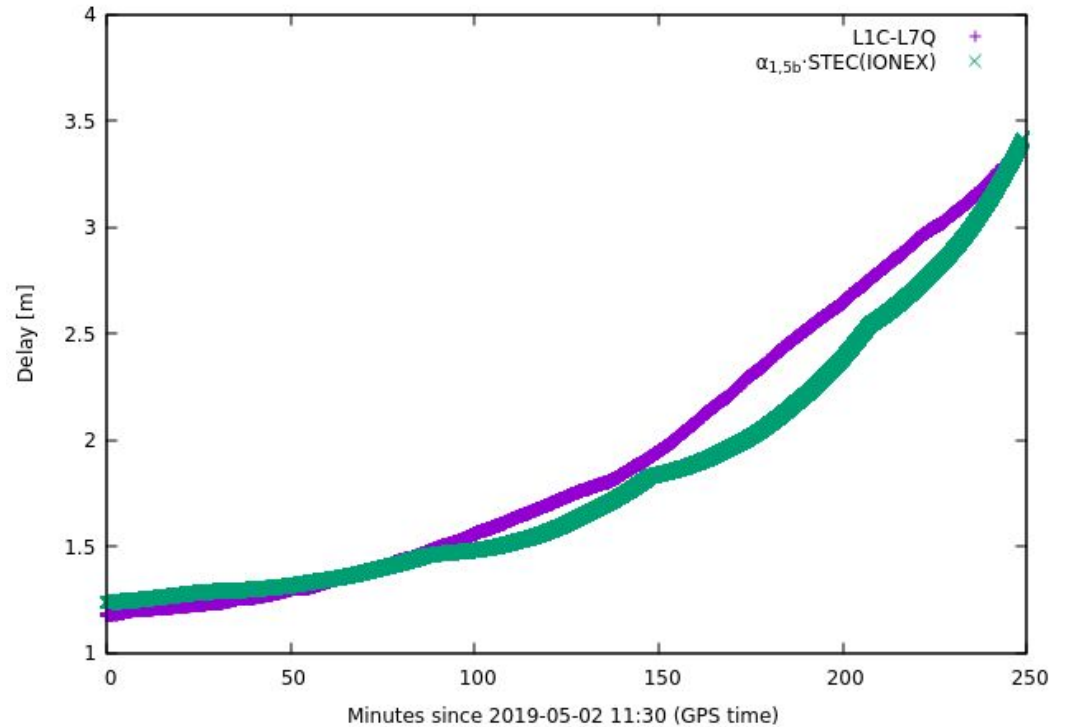
MEDEA GNSS computer (ionospheric combination)

Ionospheric combination LI1,2 for G25

MEDEA GNSS computer (ionospheric combination)

ESA AMIC project

Affordable Monitoring of the Ionosphere and Observable Characterization

Deployment of MEDEA GNSS computer to:
- Continuous log GNSS raw data (pseudoranges, carrier-phase, Doppler, C/N0)
- Automatically upload to ESA COSMOS data repository

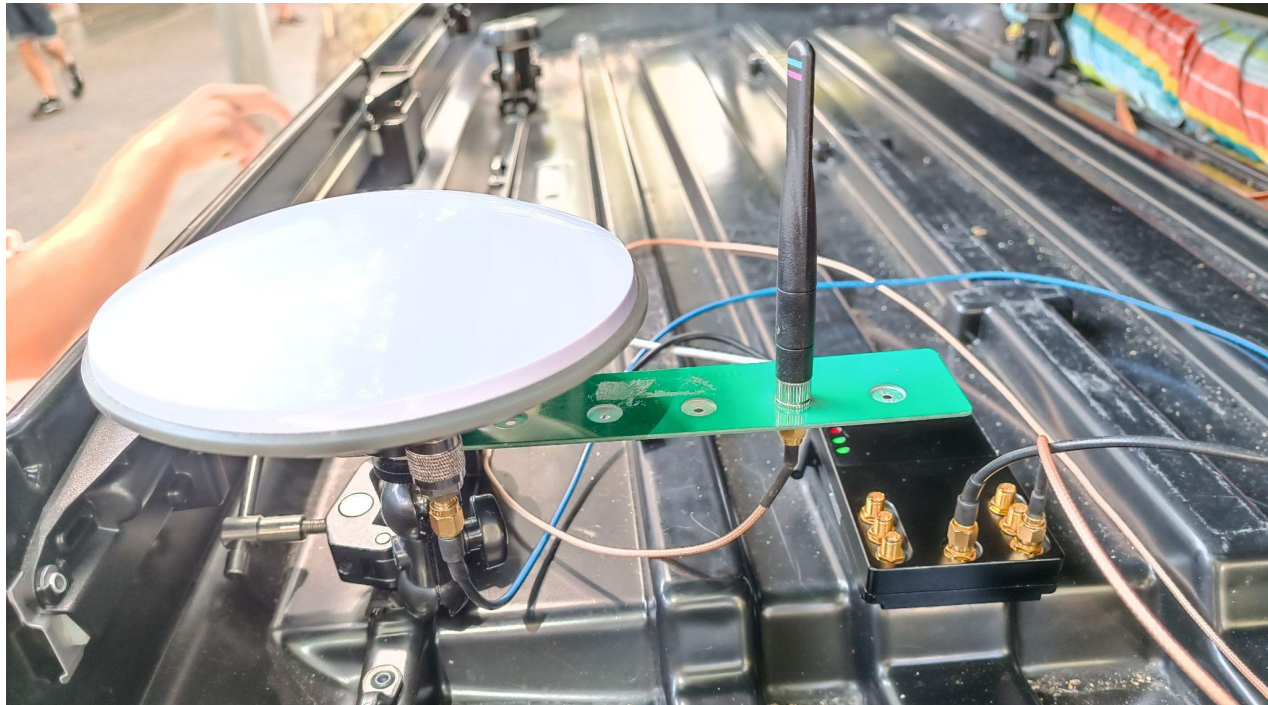Main target: minimal "hands & eye" needs in remote areas

Interested in hosting a site? Fill out this form: https://forms.gle/ggZD213GyEHtWVr89
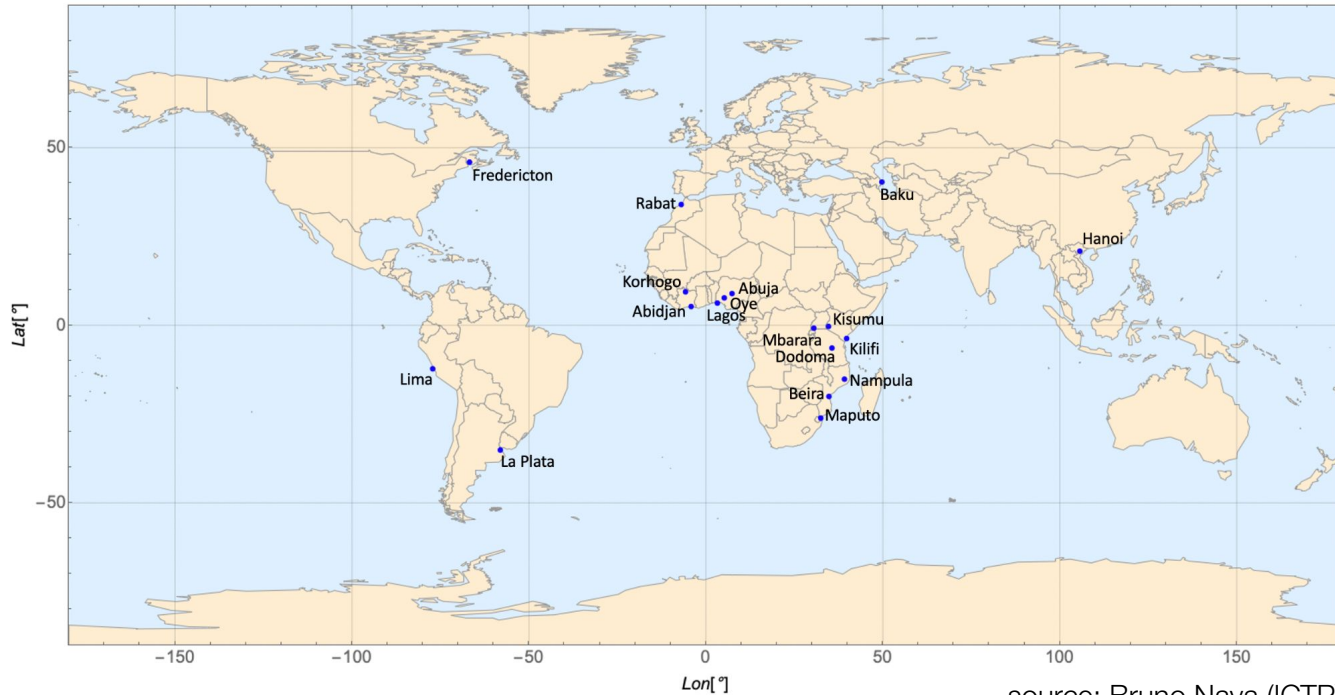
ESA AMIC project

ESA AMIC project

ESA AMIC project (deployment plan)

source: Bruno Nava (ICTP)

ESA AMIC project

Affordable Monitoring of the Ionosphere and Observable Characterization

Tasks to be performed:
- Hardware procurement 15 to 18 units
- Network deployment
- Ionospheric data analysis (ICTP)

ESA AMIC project

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Thanks!

Further questions?

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