Precise Positioning Key Enabler for Smart Agriculture

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Arnaud Le Lannic, Director of Business Development Industrial
u-blox AG

Arnaud Le Lannic, Director of Business Development Industrial

Arnaud Le Lannic is Director of Business Development Industrial at u-blox, based in Thalwil, Switzerland. With over 20 years of experience in the semiconductor industry, including 11 years specializing in GNSS and connectivity at u-blox, Arnaud plays a key role in driving strategic growth and partnerships across industrial markets.

His current focus includes enabling scalable and reliable GNSS technologies for autonomous systems in agriculture, helping drive innovation in precision farming.

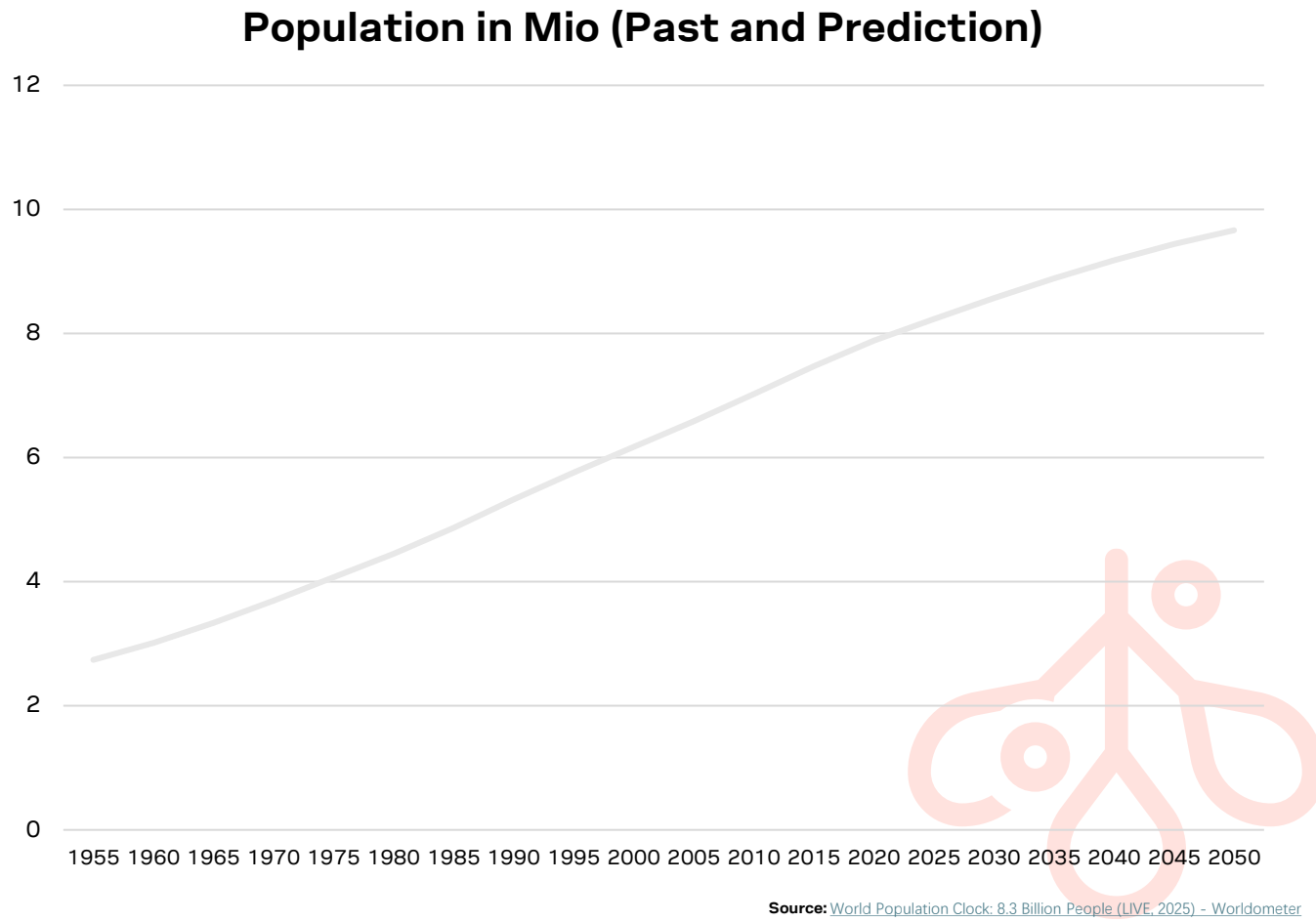
Arnaud Le Lannic

Director of Business Development Industrial

Agenda

- Trends and challenges
- Application & requirements
- Technology
- u-blox offering

World population



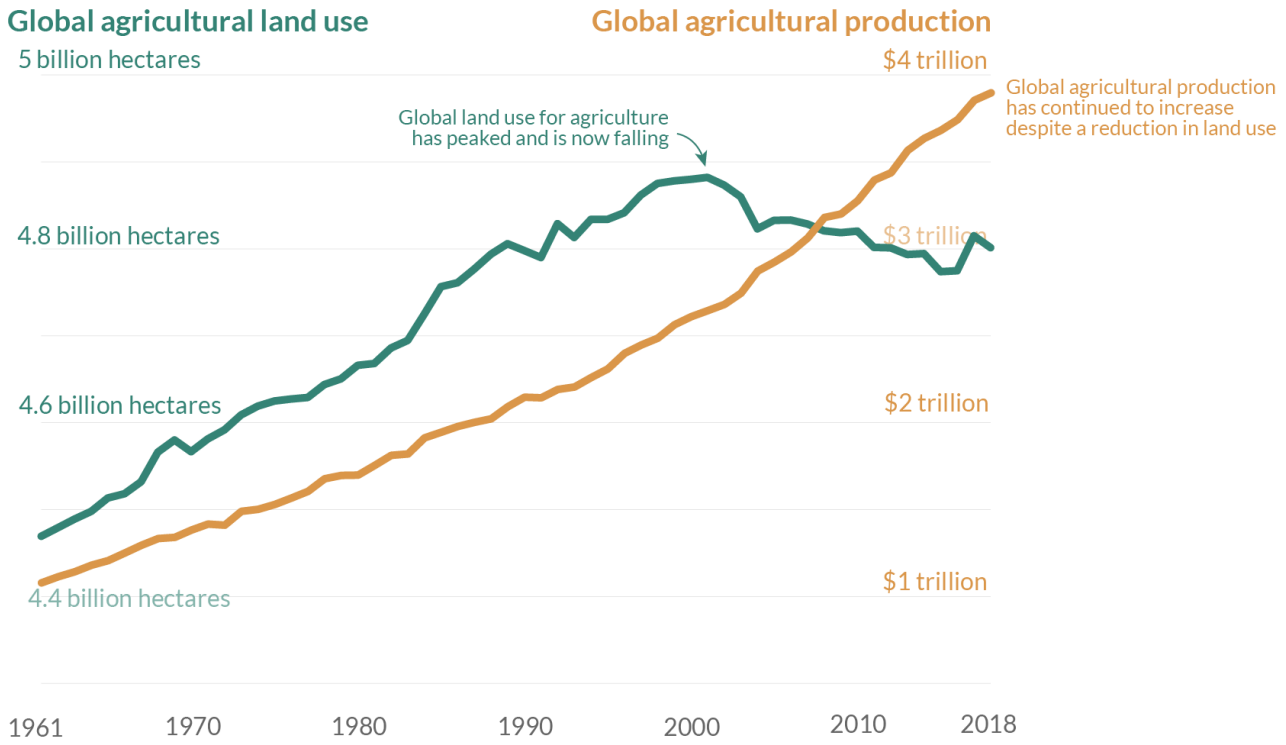
Source: World Population Clock: 8.3 Billion People (LIVE, 2025) - Worldometer

Less surface more output

Global decoupling of agricultural land and food production

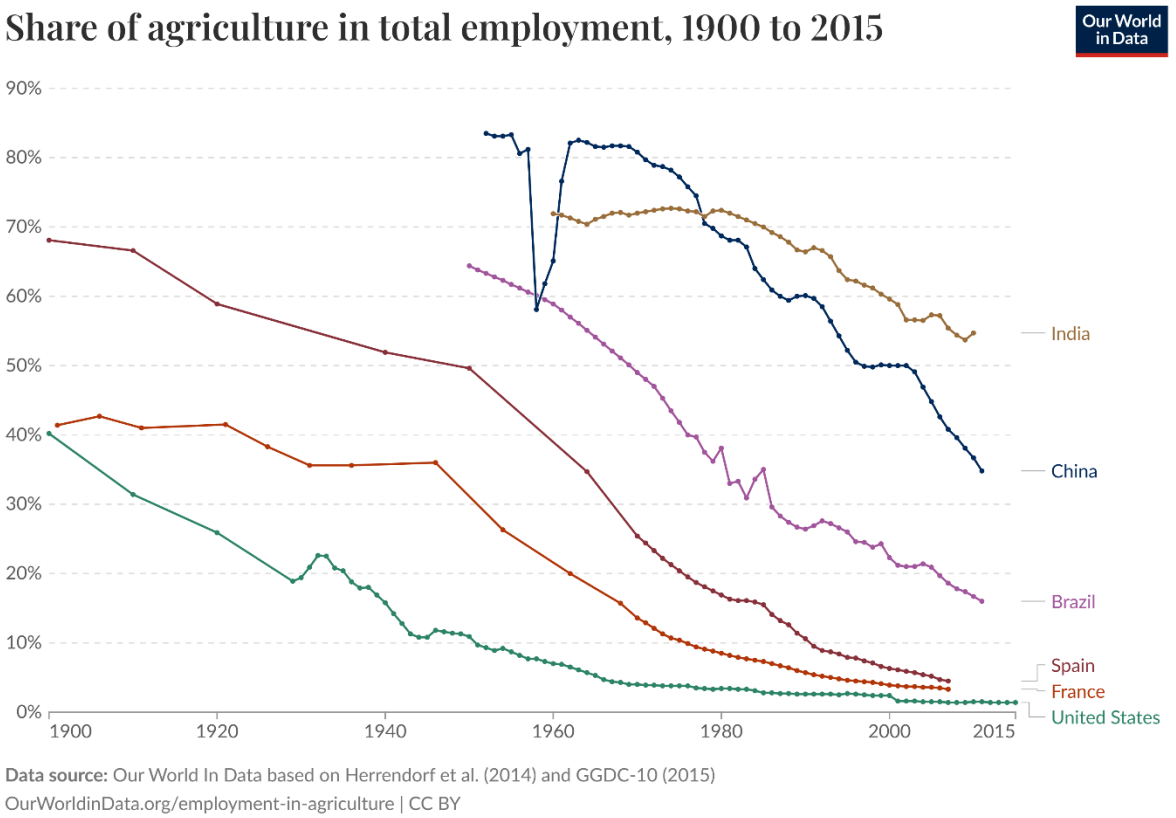
Our World in Data

Agricultural land is the sum of cropland and pasture for grazing livestock.
Production is measured in constant 2015 international-dollars, which adjusts for inflation. Includes all crops and livestock.



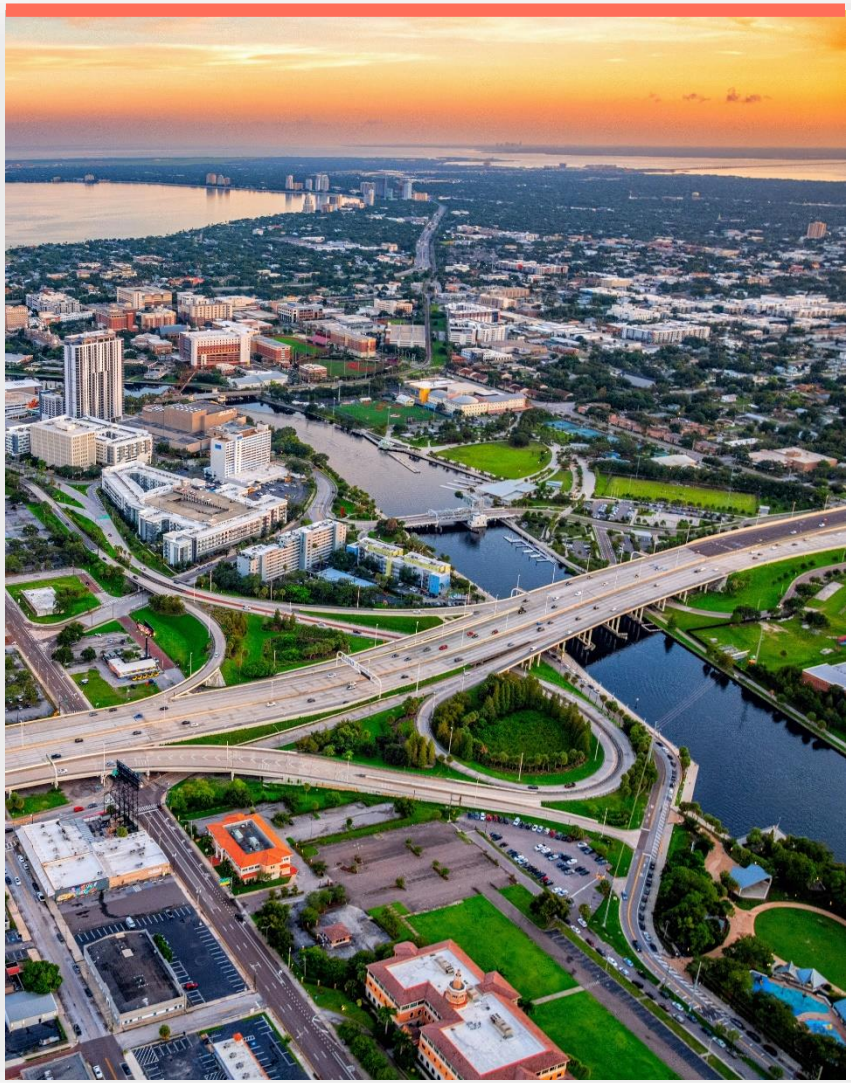
Data source: Food and Agriculture Organization of the United Nations.
OurWorldinData.org – Research and data to make progress against the world's largest problems.

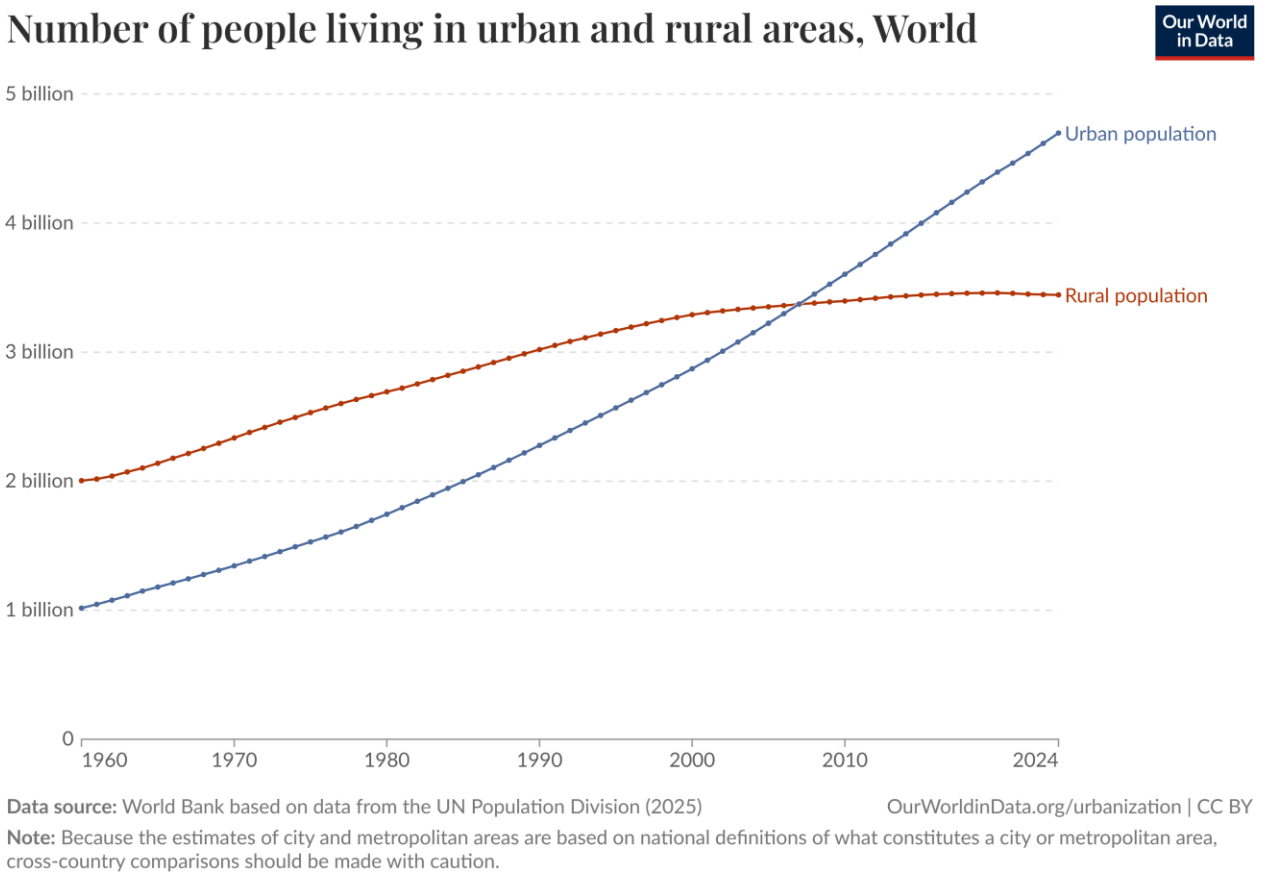
Less workforce



According to the International Labour Organization, in 1991 agriculture accounted for 43 per cent of global employment. By 2023, this share declined to 26 per cent.

Less candidates





Aging workforce and attractiveness

Farms are declining across the world, and farmers are aging. **The average age of a farmer in the world is 55 years** (source: WEF), closer to the retirement age.

At the same time, there seems to be less interest among the youth to take up farming.

According to the European Commission, the average age of an EU farmer in 2025 is 57, and only 12% are under 40.

Trade-off yield and environment

Compensate for natural soil replenishment

Fertilizers

Prevent crop losses and stabilize food supply

Pesticides

Improve plant resilience and productivity

Growth Regulators & Biostimulants

Global agriculture uses millions of tons of chemical fertilizers and pesticides annually

Cost & Sustainability

Runoff & Water Pollution, Soil Degradation, Human Health Risks

Precision technology as part of the solution

Workforces

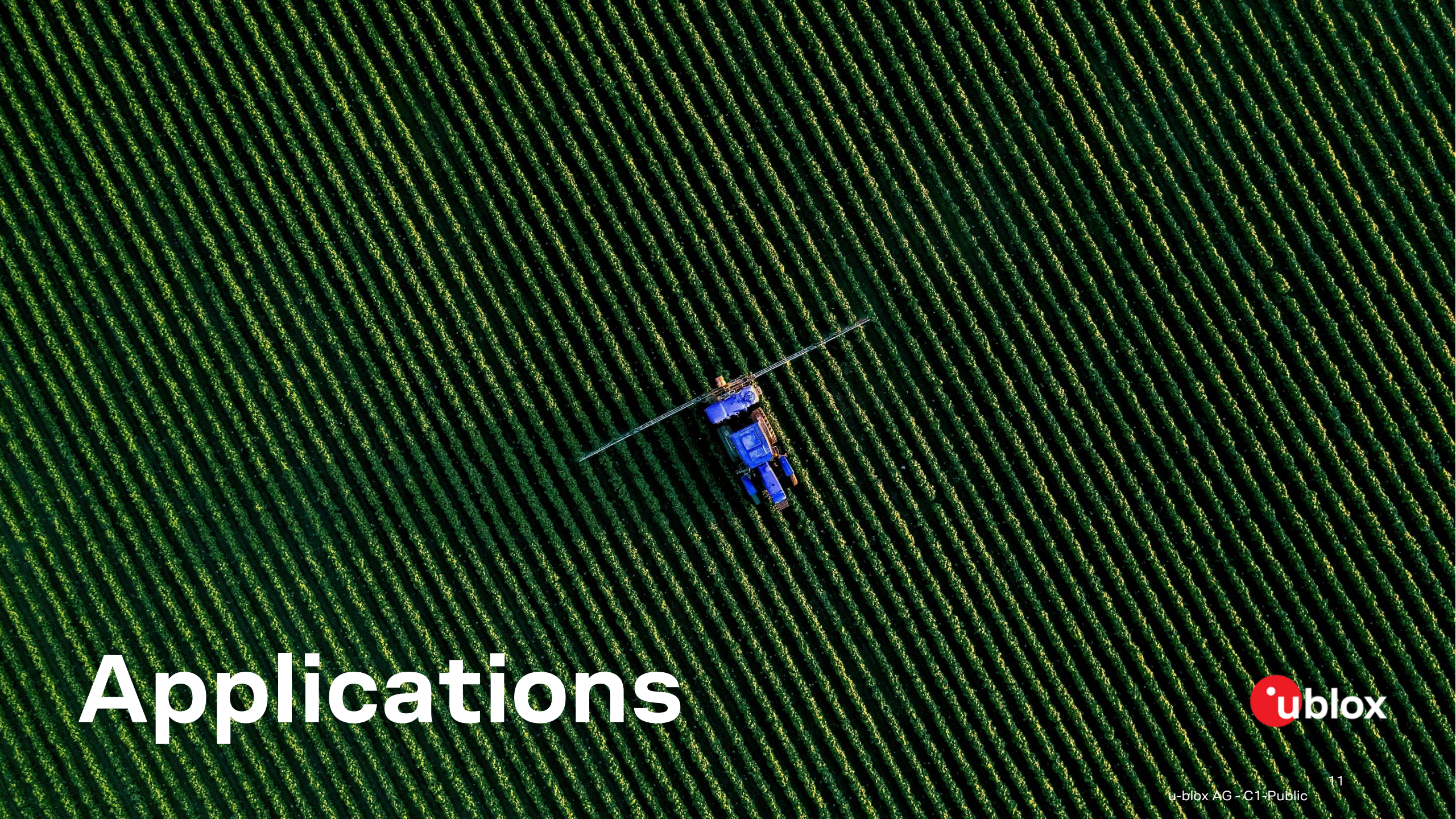
- Increases work efficiency and enables better working conditions
- Enable farmers to parallelize activities

Machines work precisely; humans focus on the important

Yield, cost, and environment

- Planters, precisely plant and locate seeds
- Precise sprayers and drones apply chemicals only where and what is needed

No dual spreading and no over-spraying

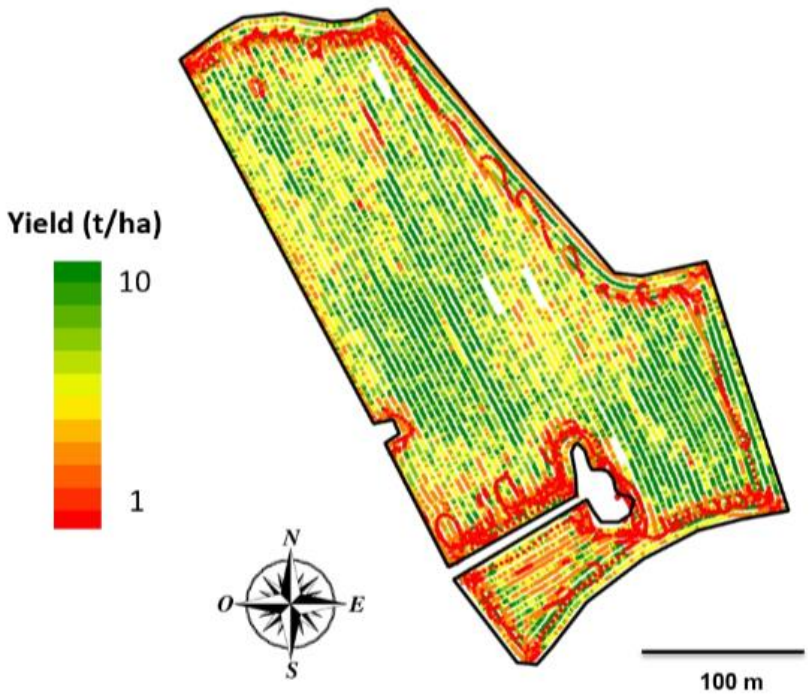


Applications

Yield monitoring and mapping

Use Case

Process of combining yield monitor measurements with GPS location data to create a spatial map showing how productivity varies across the field.



GNSS Requirements

Accuracy

±1m (sufficient for mapping as of today)

System Type

DGNSS or SBAS (RTK optional for detailed maps and going forward)

Update Rate

1–5 Hz

Hardware

- GNSS receiver connected to the yield monitor
- Compatible onboard data logger

Picture source: Aspexit, *"Yield Maps in Precision Agriculture"*, https://www.aspexit.com/yield-maps-in-precision-agriculture/

Variable rate application

Use Case

Adjusting input rates like fertilizer or seed based on position and soil maps.

GNSS Requirements

Accuracy

5–30 cm, depending on the technology and the input data, like mapping

System Type

PPP, Galileo HAS, Madoca, BeiDou B2b, RTK for higher precision going forward

Update Rate

5–10 Hz

Hardware

- GNSS receiver with correction capability
- Equipment with variable-rate control interface

UAV/Drone-based mapping and scouting

Use Case

Aerial imaging for crop health and growth, soil quality, and topography.

GNSS Requirements

Accuracy

<10 cm to control the drone as well as geotag and post-process the collected images

System Type

RTK, PPP-RTK, historical usage of PPK (Post-Processed Kinematic)

Update Rate

1–10 Hz (depends on flight speed and altitude)

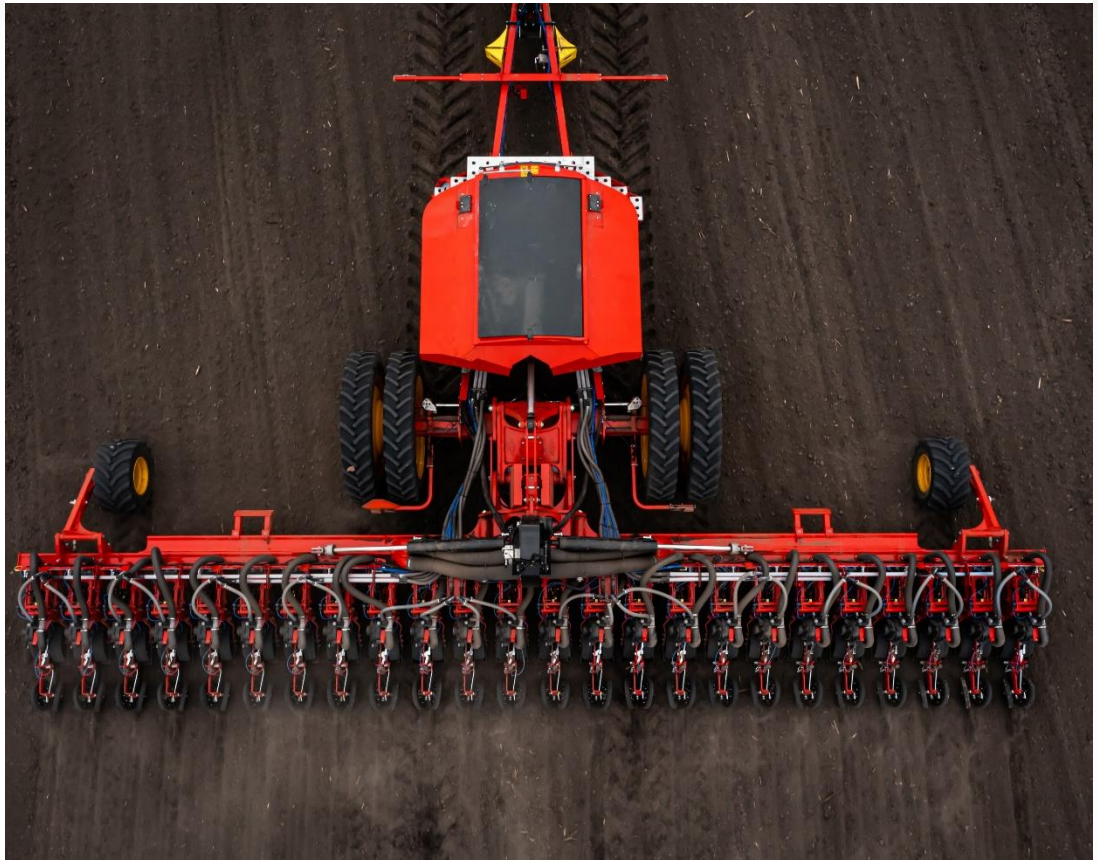
Hardware

- Drone with RTK/PPP-RTK-compatible GNSS module
- Multispectral or RGB camera
- Optional ground station or GNSS base for RTK

Precision planting

Use Case

Exact placement of seeds to optimize spacing and yield as well as limit waste of seeds.



GNSS Requirements

Accuracy

<15cm ideally, enabling **repeatability** for future plant care

System Type

RTK GNSS with repeatability support (important for returning to same field lines)

Update Rate

10 Hz or more

Hardware

- High precision GNSS with optional inertial navigation for precise movement and orientation
- Integrated control system with planting equipment

Autonomous tractor guidance

Use Case

Automated tractor navigation for tilling, harvesting, and unloading the harvester.

GNSS Requirements

Accuracy

<5 cm or better reference for system awareness of up to 20-25 meter radius

System Type

RTK GNSS with base station or network corrections (NTRIP)

Update Rate

10–20 Hz for smooth, responsive steering

System up time

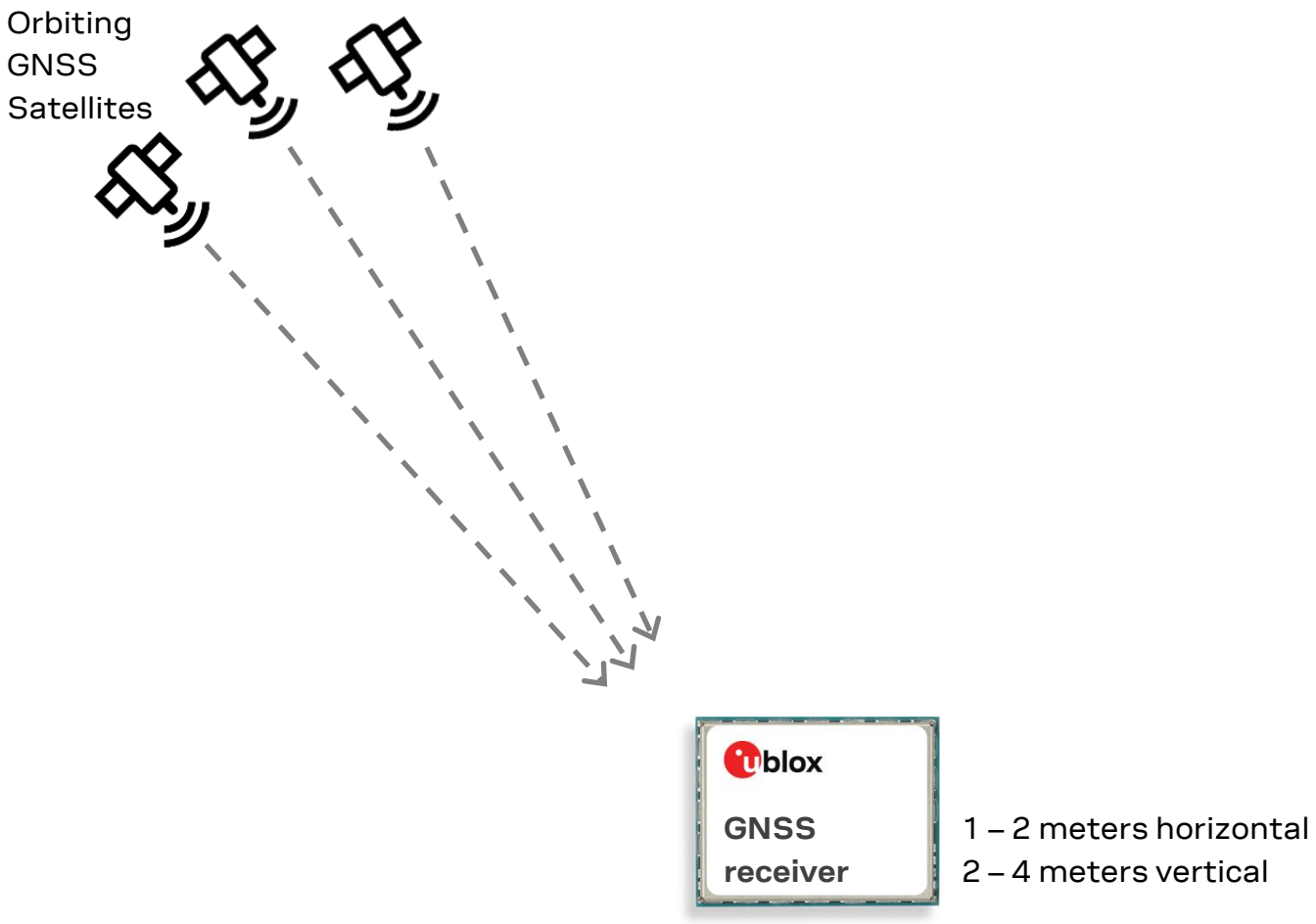
To fulfill its role, the system cannot afford downtime. Reliability in extreme conditions

Hardware

- 2 dual- or multifrequency GNSS receivers
- 2 high precision GNSS antennas mounted symmetrically to the center of the tractor
- Lidar, Stereo Cameras (up to 8/vehicle), 100s of Sensors

Technology

Let’s start with the basics



Stand-alone GNSS position

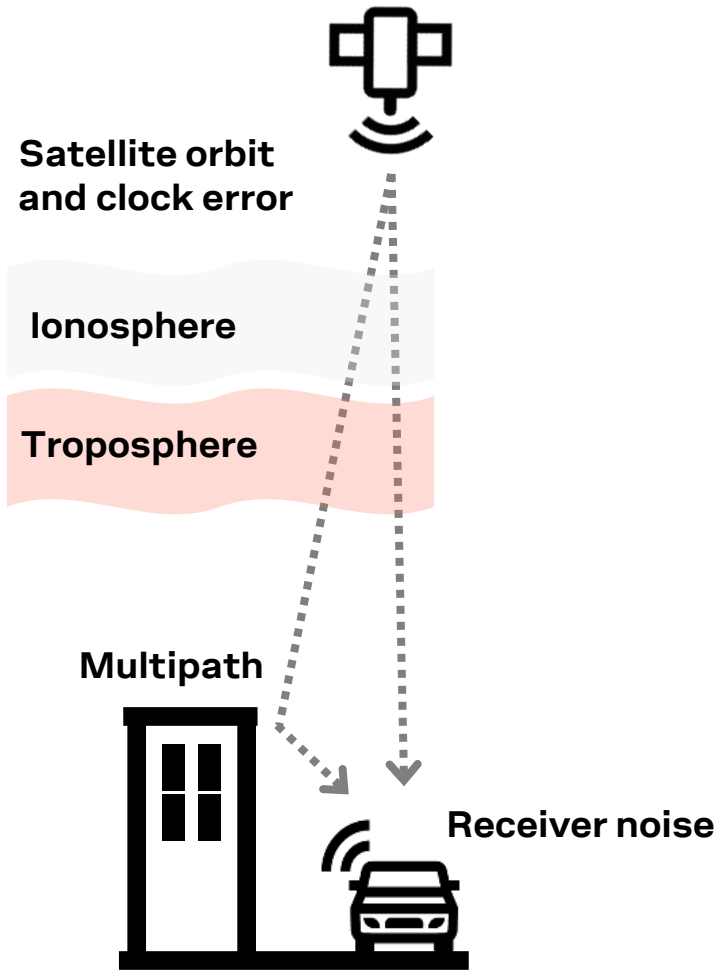
Ideal for asset-tracking, aftermarket telematics, and for wearable devices

Not suitable for high precision use cases like autonomous vehicles, precision agriculture, service robots, or robotic lawn mowers

Low accuracy (meter-level)

High accuracy requires **corrections**

Why only meter-level accuracy in standalone GNSS positioning?



GNSS signals travel through various atmospheric layers

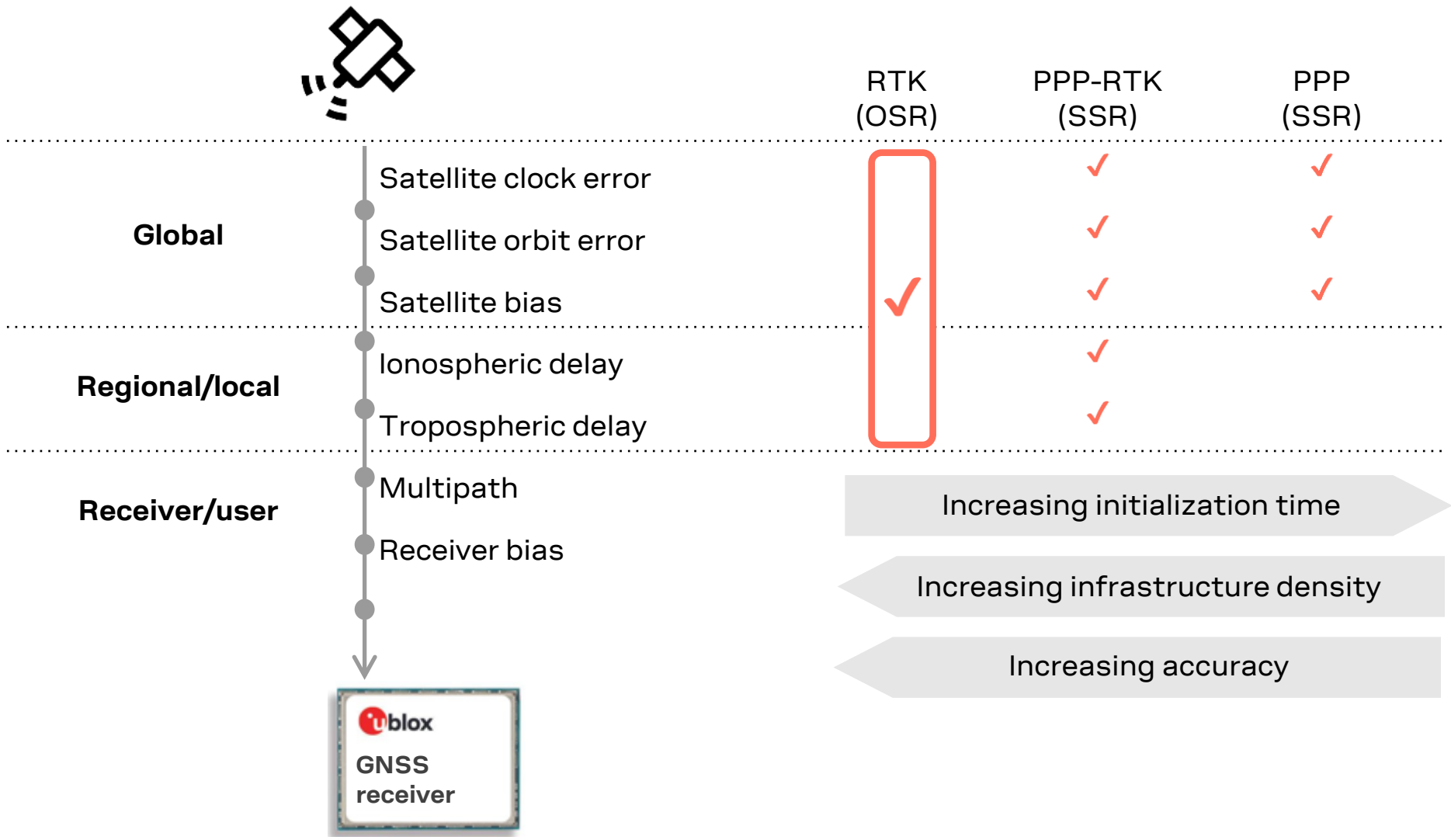
The ionosphere impacts signal propagation, and introduces measurement errors

Standalone receivers are unable to correct these errors on their own

Limiting accuracy to the meter level

GNSS error sources		
Satellite based	• Sat. orbit error • Sat. clock error • Ionosphere • Troposphere	~2.5m ~1.5m ~5m ~1m
Environment & Receiver based	• Multipath • Receiver noise	~2-20m ~0.5m

Which errors are corrected?



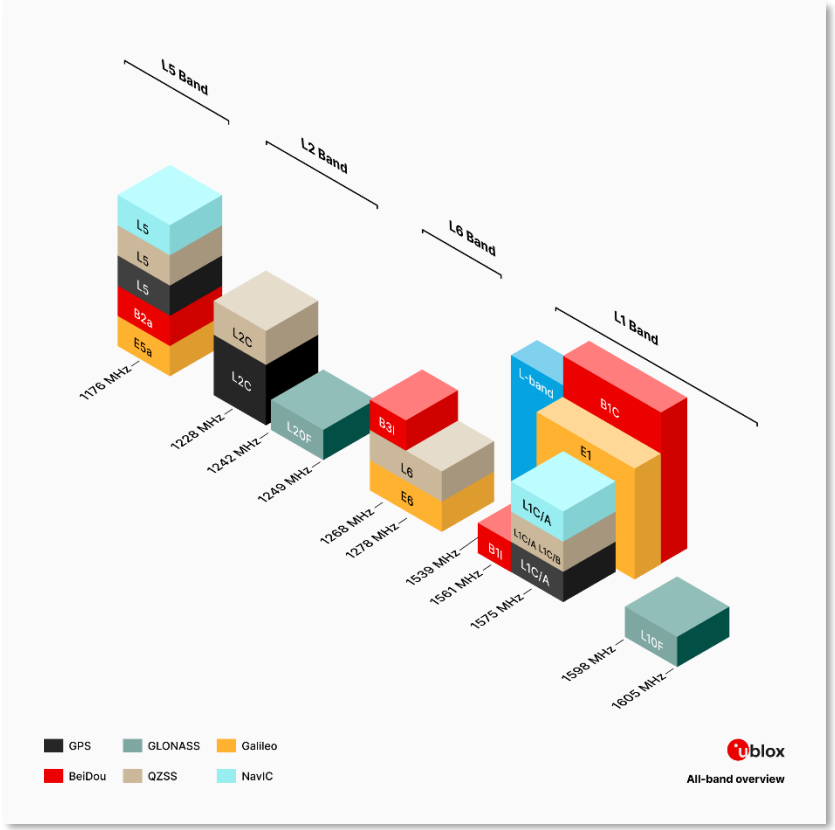
All-band benefits

L1 / L2 / L5 / L6

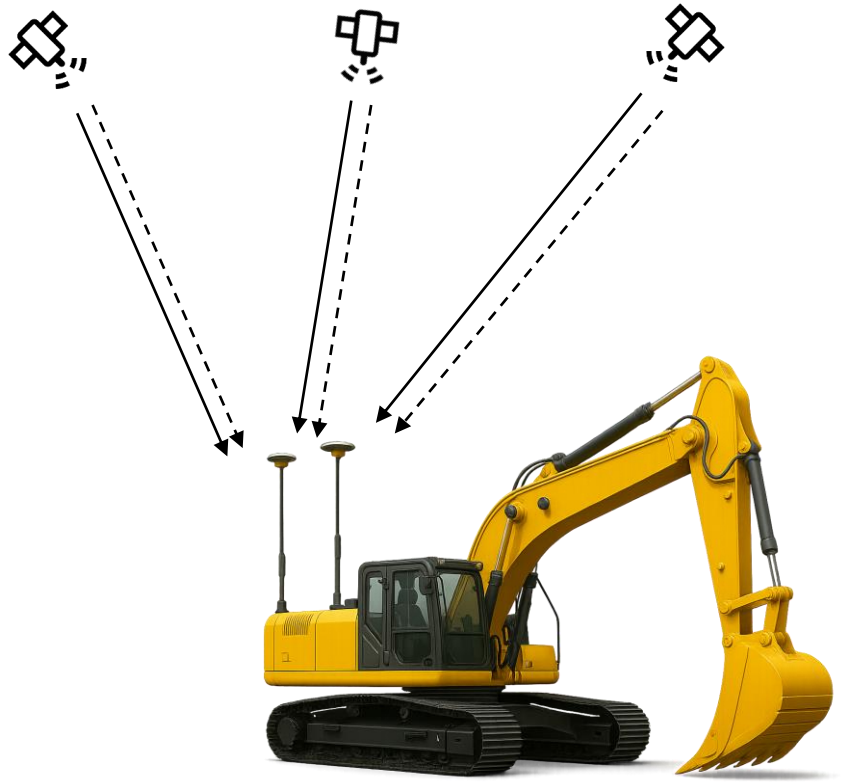
- Brings access to all constellations and all GNSS bands
- Brings the best availability of the best accuracy
- Brings built-in access to correction services, both on L-band, as well as PPP services
- Brings PPP performance relevant to mass market applications
- Brings GNSS integrity

GNSS infrastructure evolved

Civilians' frequencies and satellite constellations increased significantly.



All signals and corrections can be received globally from satellites.




u-locate
ublox

u-blox locate, fast and easy go-to-market

Complete solution that brings together leading hardware, services, and support, covering the entire lifecycle from successful go-to-market to ongoing support throughout the solution's lifetime.

Advanced high-precision receiver

High-performance antenna

Best fit correction service

Leading expertise & support

ZED-X20P: u-blox X20 high precision GNSS module

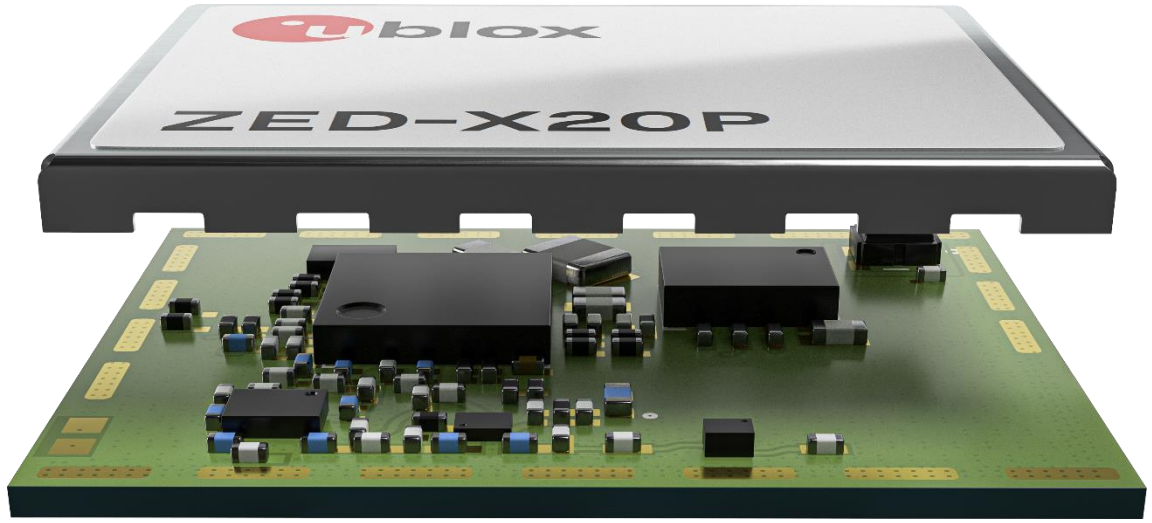
Raising performance worldwide

All-band GNSS and cm-technology integrated in a small module (L1/L2/L5/L6 + L-band)

World leading RTK, PPP-RTK and PPP support including Galileo High Accuracy Services (HAS)

u-blox End-to-end Security providing Confidentiality, Integrity, and Authentication from satellites to the host

Single chip design for a robust hardware and reliable supply chain



Importance of antennas in GNSS system

Antenna - critical part of GNSS receiver design

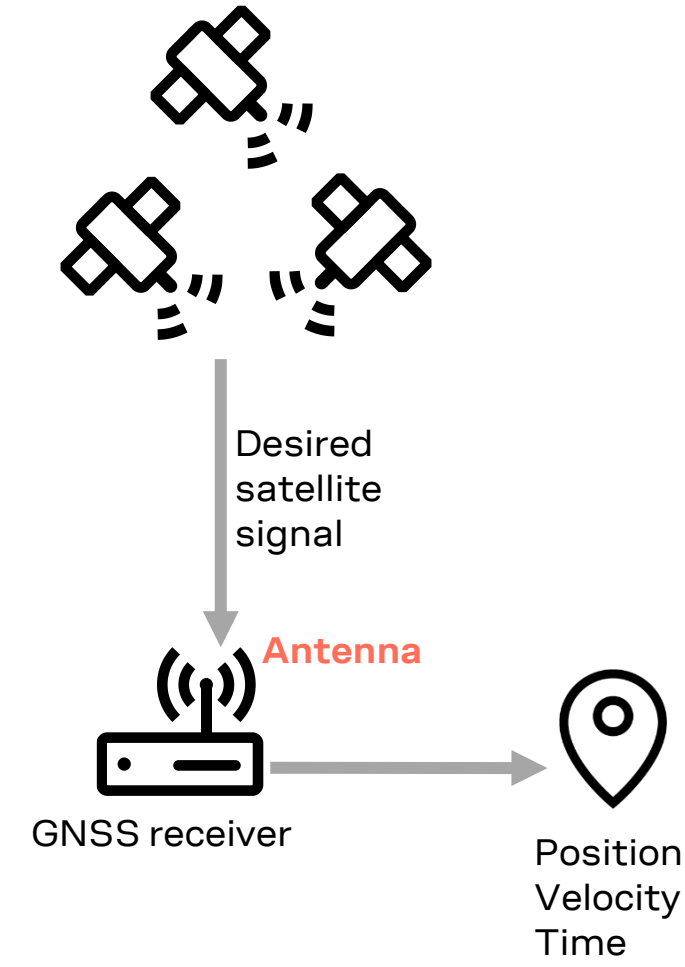
GNSS signals are extremely weak, and unique antenna demands.

Antenna choice and implementation play a significant role in GNSS performance.

Even the best receiver cannot bring back what is lost due to a poor antenna, in-band jamming, or a bad RF design.

Challenges from modern multi-band GNSS system

- Wide frequency coverage
- Antenna size, performance (multipath effects, interference & coupling, etc.)
- Affordable price

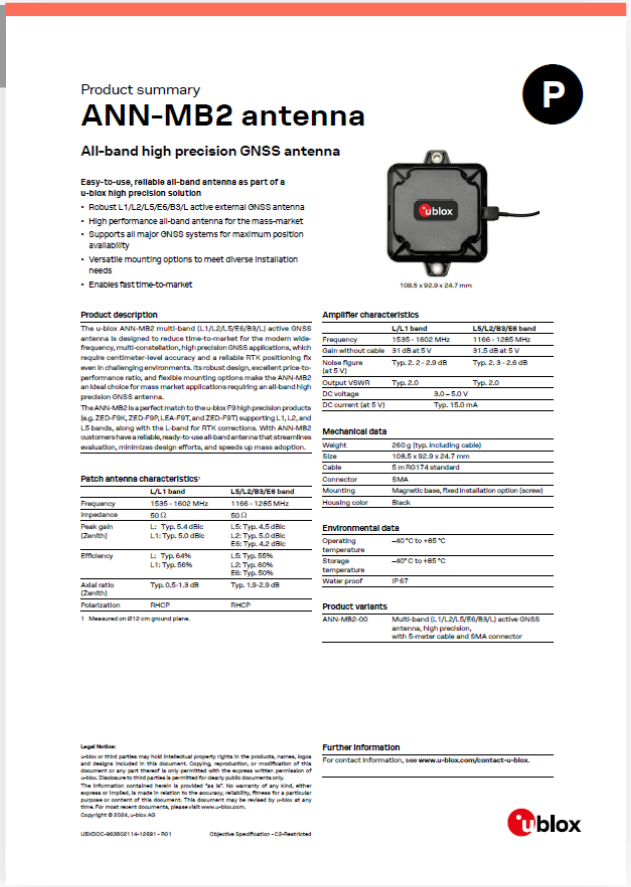


ANN-MB2 – our all-band antenna

Developed according to the u-blox all-band antenna specification, tuned for the u-blox X20 high precision GNSS platform.

ANN-MB2	
	**92.9x108.5x24.7mm, 5m cable with SMA connector**
Band/application	**L1, L2, L5/E5/B2/NavIC, E6/B3, L-band** **High Precision**, with RTK
Suitable u-blox products	ZED-F9T-20B & other F9 customers need triple/wide-band antennas ZED-X20P, ZED-F20P & other upcoming X20/F20 products
Product status	Mass production!

Excellent performance



Product summary

ANN-MB2 antenna

All-band high precision GNSS antenna

Easy-to-use, reliable all-band antenna as part of a u-blox high precision solution

- Robust L1/L2/L5/E6/B3/L active external GNSS antenna
- High performance all-band antenna for the mass-market
- Supports all major GNSS systems for maximum position availability
- Versatile mounting options to meet diverse installation needs
- Enables fast time-to-market

Product description

Amplifier characteristics

	L/L1 band	L5/L2/B3/E6 band
Frequency	1535 - 1602 MHz	1166 - 1285 MHz
Gain without cable	31 dB at 5 V	31.5 dB at 5 V
Noise figure (at 5 V)	Typ. 2. 2 - 2.9 dB	Typ. 2. 3 - 2.6 dB
Output VSWR	Typ. 2.0	Typ. 2.0
DC voltage	3.0 – 5.0 V	
DC current (at 5 V)	Typ. 15.0 mA	

Patch antenna characteristics[1]

	L/L1 band	L5/L2/B3/E6 band
Frequency	1535 - 1602 MHz	1166 - 1285 MHz
Impedance	50 Ω	50 Ω
Peak gain (Zenith)	L: Typ. 5.4 dBic L1: Typ. 5.0 dBic	L5: Typ. 4.5 dBic L2: Typ. 5.0 dBic E6: Typ. 4.2 dBic
Efficiency	L: Typ. 64% L1: Typ. 56%	L5: Typ. 55% L2: Typ. 60% E6: Typ. 50%
Axial ratio (Zenith)	Typ. 0.5-1.3 dB	Typ. 1.9-2.9 dB
Polarization	RHCP	RHCP

1. Measured on Ø12 cm ground plane.

Mechanical data

Weight	260 g (typ. including cable)
Size	108.5 x 92.9 x 24.7 mm
Cable	5 m RG174 standard
Connector	SMA
Mounting	Magnetic base, fixed installation option (screw)
Housing color	Black

Environmental data

Operating temperature	–40°C to +85°C
Storage temperature	–40° C to +85 °C
Water proof	IP-67

Product variants

ANN-MB2-00	Multi-band (L1/L2/L5/E6/B3/L) active GNSS antenna, high precision, with 5-meter cable and SMA connector

Legal Notice:

Further information

For contact information, see www.u-blox.com/contact-u-blox.

ANN-MB2

Easy-to-use, reliable all-band antenna as part of u-blox high precision solution

Maximum position availability
as it supports all major GNSS systems

High performance
mass-market solution

Robust all-bang GNSS antenna
Including L1/L2/L5/E6/B3/L

Versatile mounting options
for diverse installation requirements

Easy deployment
that enables fast time-to-market

Fast, centimeter-level positioning services

PointPerfect Live

Superior performance for the most demanding applications on a highly reliable and dependable network.

Network RTK

1cm–2cm <10 seconds

Construction, surveying, precision agriculture, mining

PointPerfect Flex

Scalable and flexible solutions for wide-ranging use cases.
Unbeatable performance / price balance.

PPP-RTK

3cm-6cm <30 seconds

Mobile outdoor robotics, automotive, precision agriculture, UAVs

PointPerfect Global

Seamless worldwide coverage for truly global solutions and use cases operating in remote areas.

PPP-AR

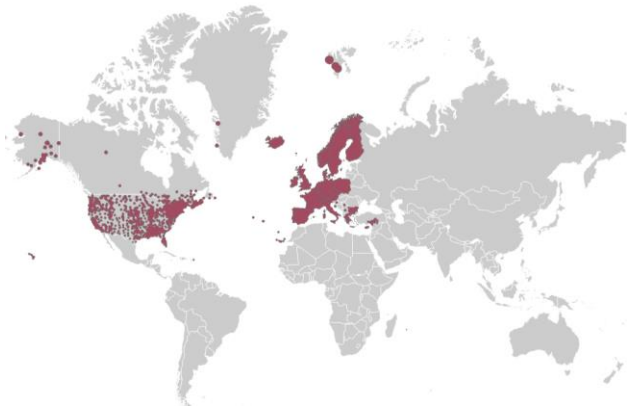
<10cm ~2 minutes

Precision agriculture, outdoor robotics, UAVs

PointPerfect: Service coverage

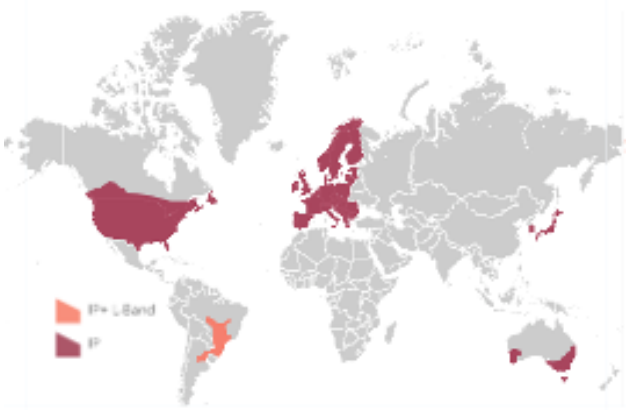
PointPerfect Live

Superior performance for the most demanding applications



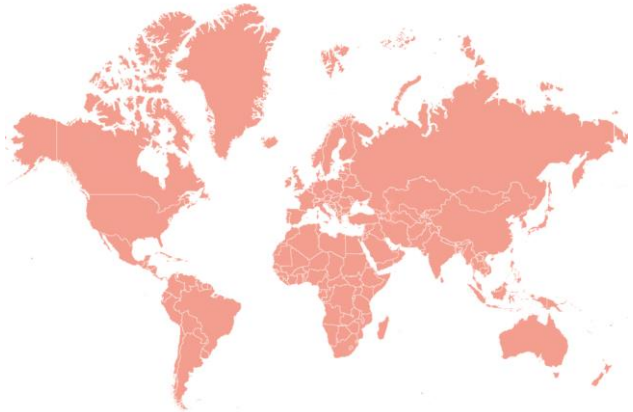
PointPerfect Flex

Scalable and flexible solutions for wide-ranging use cases



PointPerfect Global

Seamless worldwide coverage for truly global solutions



Upcoming service to be launched during 2026

https://www.u-blox.com/en/pointperfect-service-coverage

IP+ L-Band IP

Application example: UAV

UAV flight

using **u-blox locate solution**

in Sjökulla / Kirkkonummi / Finland

ANN-MB2

ZED-X20P

Point Perfect

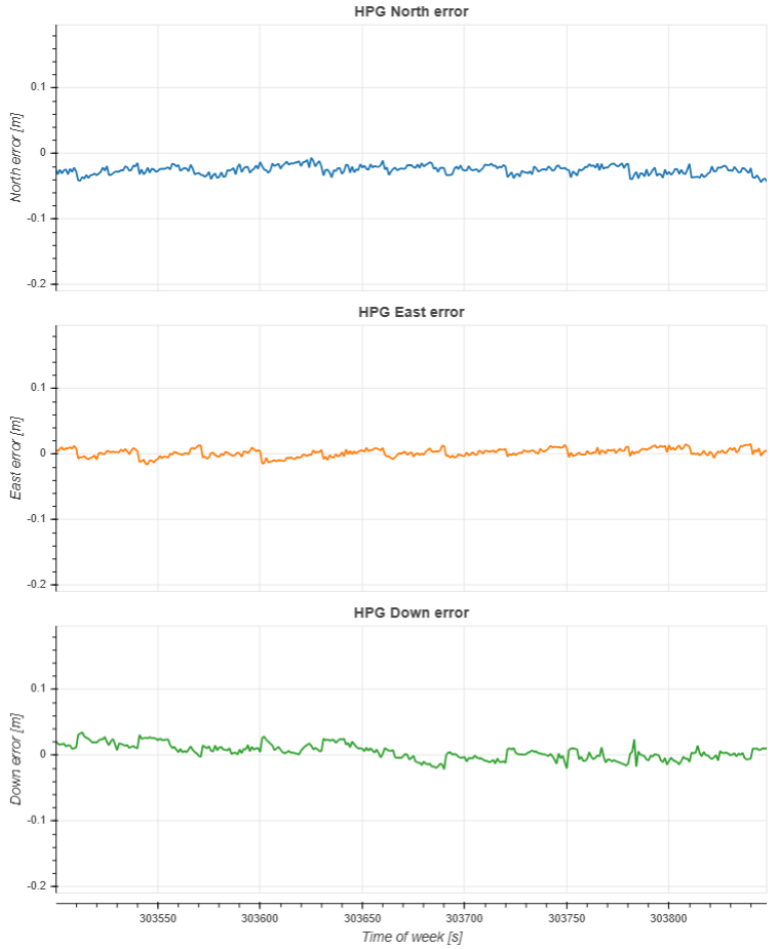
Dynamic testing - UAV

PointPerfect Live (VRS)

2D one-sigma: 1.2cm
3D one-sigma: 1.9cm
Max error (p100%, abs) components during flight:
N 2.2cm, E 2.3cm, D 3.6cm

PointPerfect Flex (PPP-RTK)

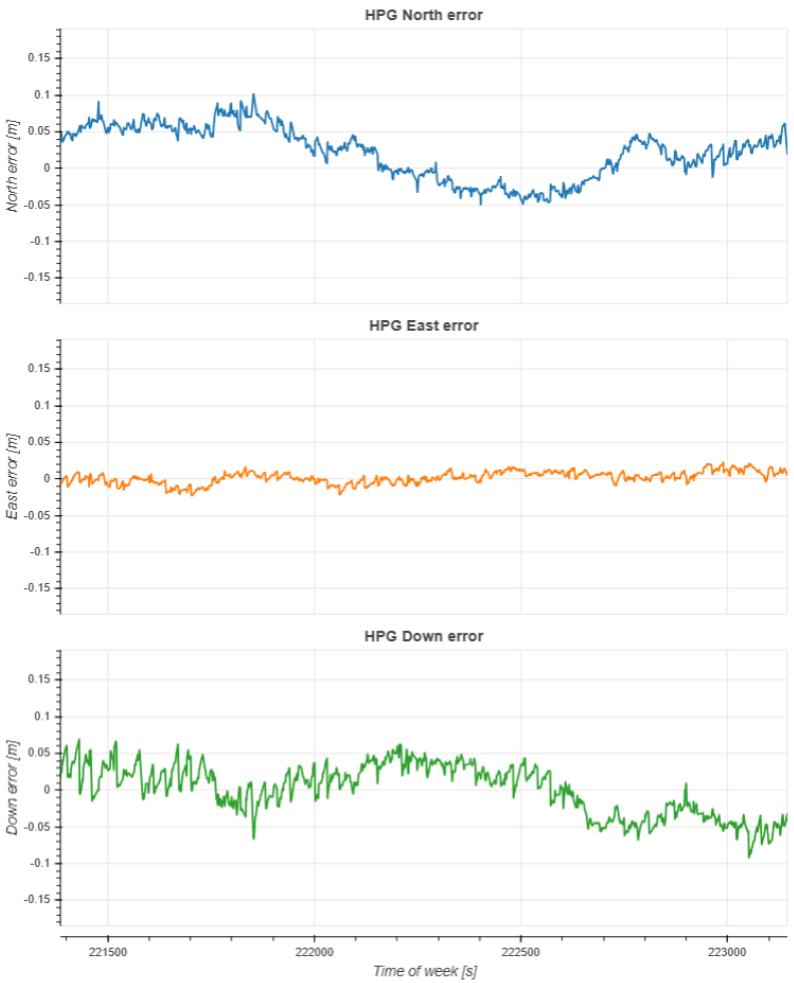
2D one-sigma: 3.3cm
3D one-sigma: 3.4cm
Max error (p100%, abs) components during flight:
N 5.6cm, E 2.8cm, D 6.0cm



PointPerfect Flex (PPP-RTK)
Zoom in (5-6min) on the NED accuracies during flight

Static testing – with PointPerfect Live (VRS) service

VRS / PointPerfect Live for 1 hour:
2D one-sigma:6.0cm (N 4.4cm, E 2.3cm)



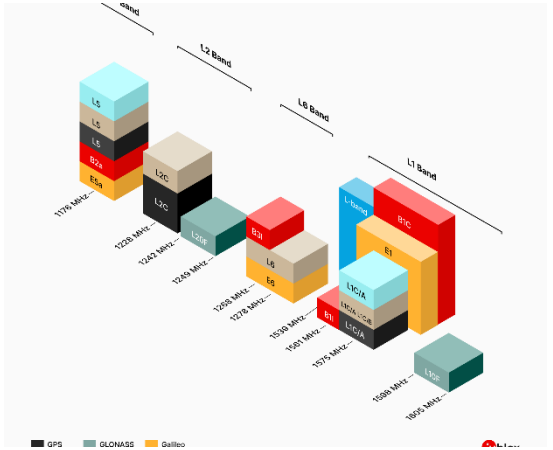
More information on u-blox.com

Precision agriculture

https://www.u-blox.com/en/precision-agriculture

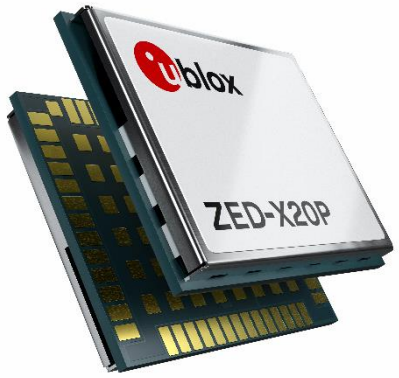
PointPerfect portfolio

https://www.u-blox.com/en/iot-location-service#High-precision-positioning



All-band whitepaper

https://www.u-blox.com/en/publication/white-paper/all-band-whitepaper



Technology page

https://www.u-blox.com/en/technologies/high-precision-positioning

Q&A