EGNOS

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GNSS and EGNOS for farming: all you need to know from this European free service

ESSP-MEMO-24322

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- Overview of EGNOS system and services
- EGNOS performance
- Benefits of EGNOS in agriculture
- EGNOS configuration in agricultural equipment
- EGNOS user support

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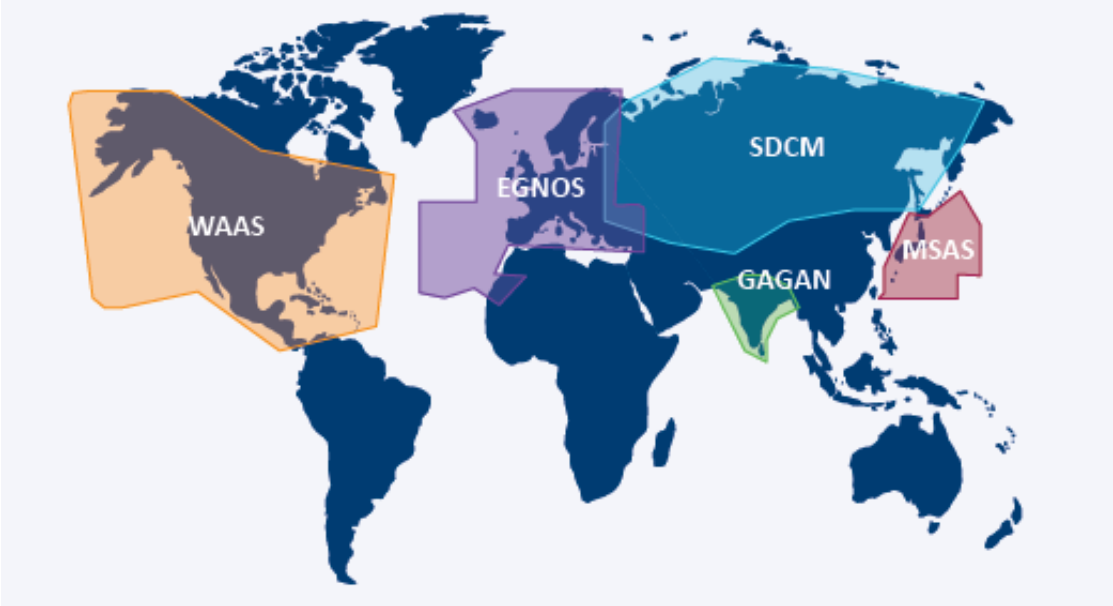
EGNOS background

EGNOS (European Geostationary Navigation Overlay Service) is the **free** European satellite-based augmentation system (SBAS) over the L1 signal of GPS

EGNOS was designed for aviation purposes, complying with the requirements of the International Civil Aviation Organization (ICAO)

EGNOS is interoperable with the SBAS systems of other regions (see map below).



In the future (>2023):

- **EGNOS** will augment also **Galileo**
- **EGNOS** will broadcast dual-frequency corrections: **L1/E1** and **L5/E5**

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EGNOS system

2 x MCC

Mission Control Centres

40 x RIMS

Ranging & Integrity Monitoring Stations

GPS signals

4 x NLES

Navigation Land Earth Stations

EGNOS

EGNOS application area

2 Geostationary Satellites

EGNOS signal in space (SiS) coverage footprint

ESSP premises

ESSP within the EGNOS ecosystem

EGNOS services

- OS service release: **1 October 2009**
- EGNOS OS Service Definition Document (SDD)
- Agriculture, maritime, road, train, GIS/mapping, location based services (LBS)…
- No regulatory framework

- SoL service release: **2 March 2011**
- EGNOS SoL Service Definition Document (SDD)
- Regulatory framework that obliges to use certified EGNOS equipment
- Aviation: LPV landing approaches without ground infrastructure

- EDAS service release: **26 July 2012**
- EDAS Service Definition Document (SDD)
- Provision of EGNOS/GPS/GLONASS data through the Internet
- DGNSS and RTK corrections in the surroundings of the RIMS

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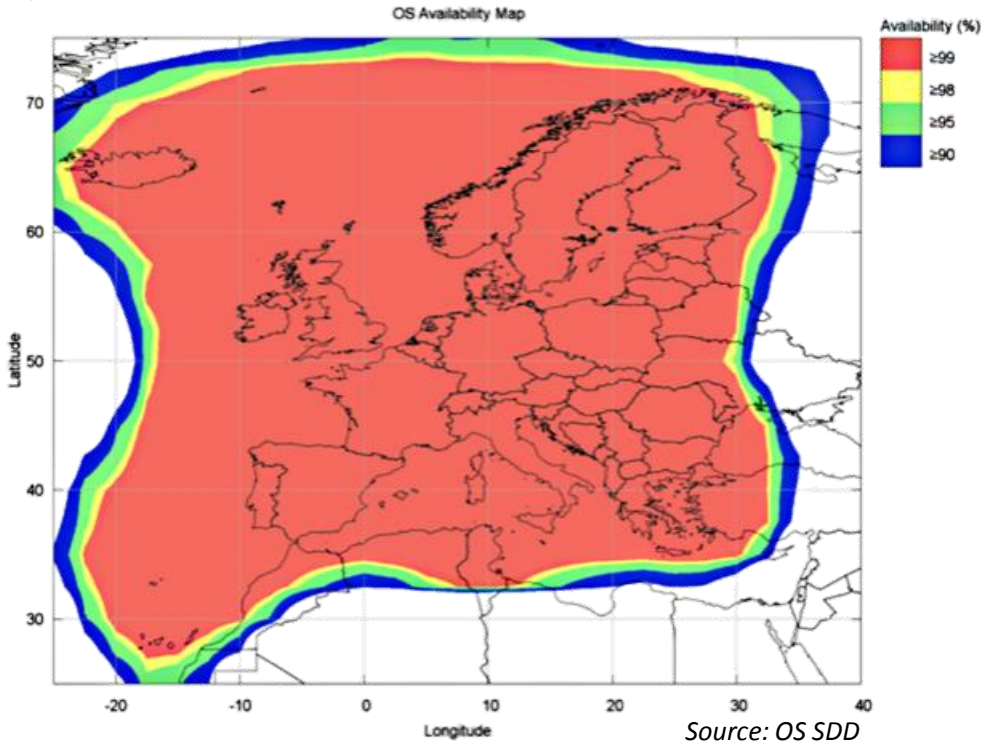
EGNOS accuracy (1/2)

EGNOS Open Service application area

Figure 6.1 EGNOS OS compliance area



Source: OS SDD

Measured values

RIMS	HNSE 95%	VNSE 95%
Aalborg	0.6 m	1.5 m
Berlin	0.7 m	1.2 m
Málaga	0.8 m	1.0 m
…	…	…

May 2019 (monthly reports)

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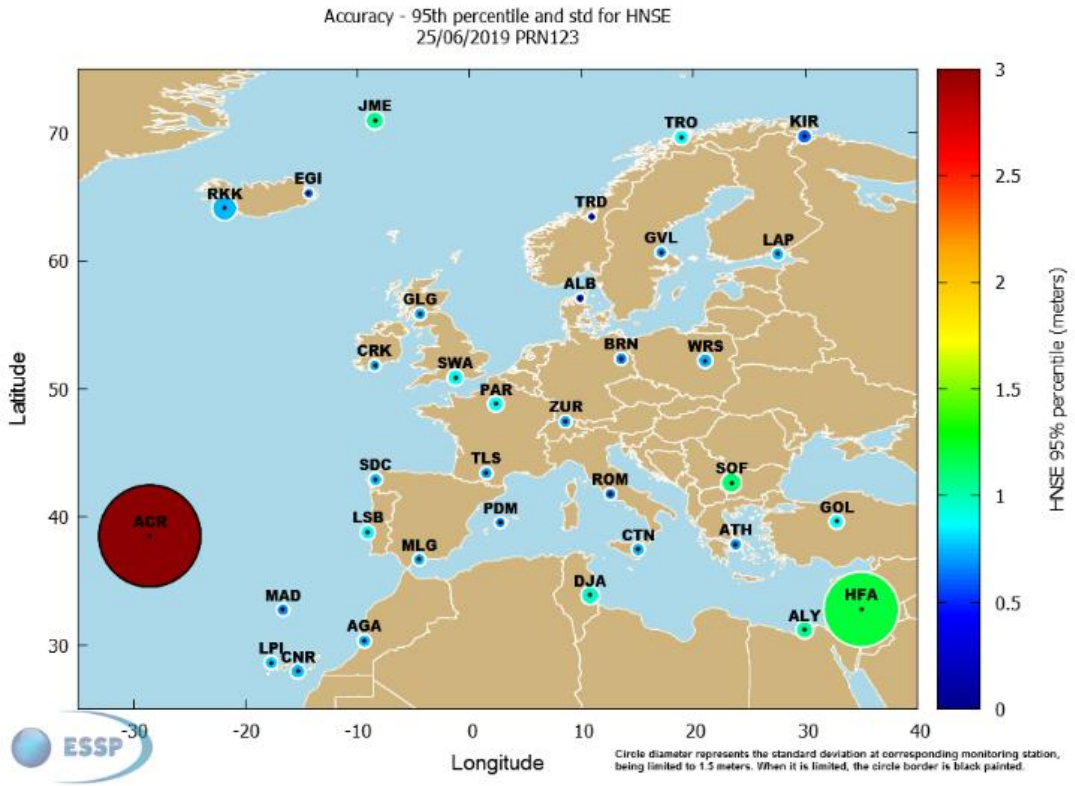
EGNOS accuracy (2/2)

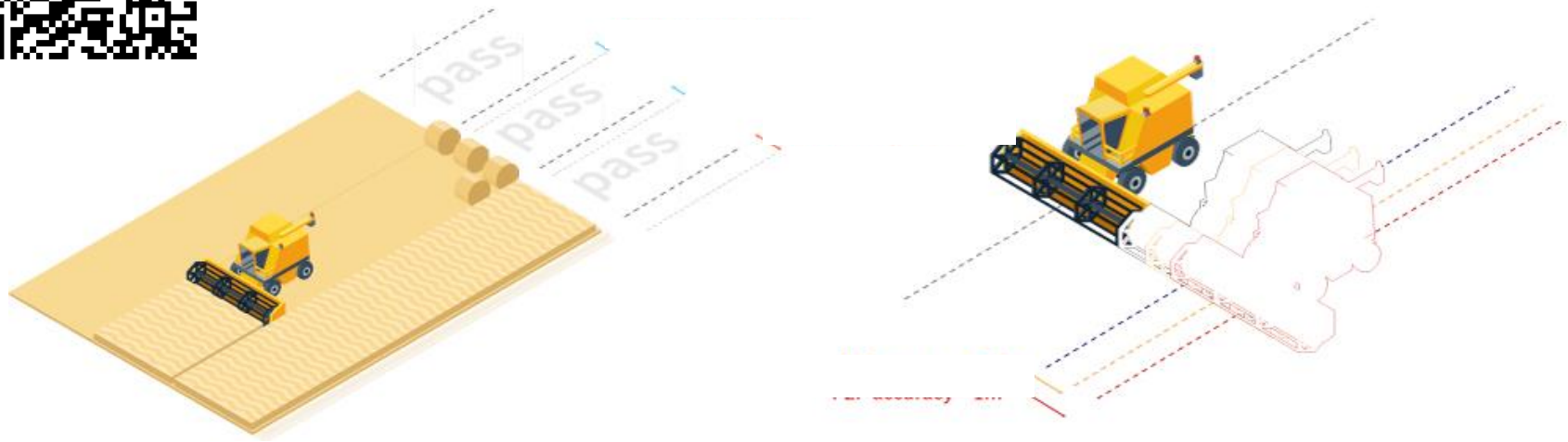
2. Measured performance:

EGNOS accuracy (95% confidence bound) is measured [daily]



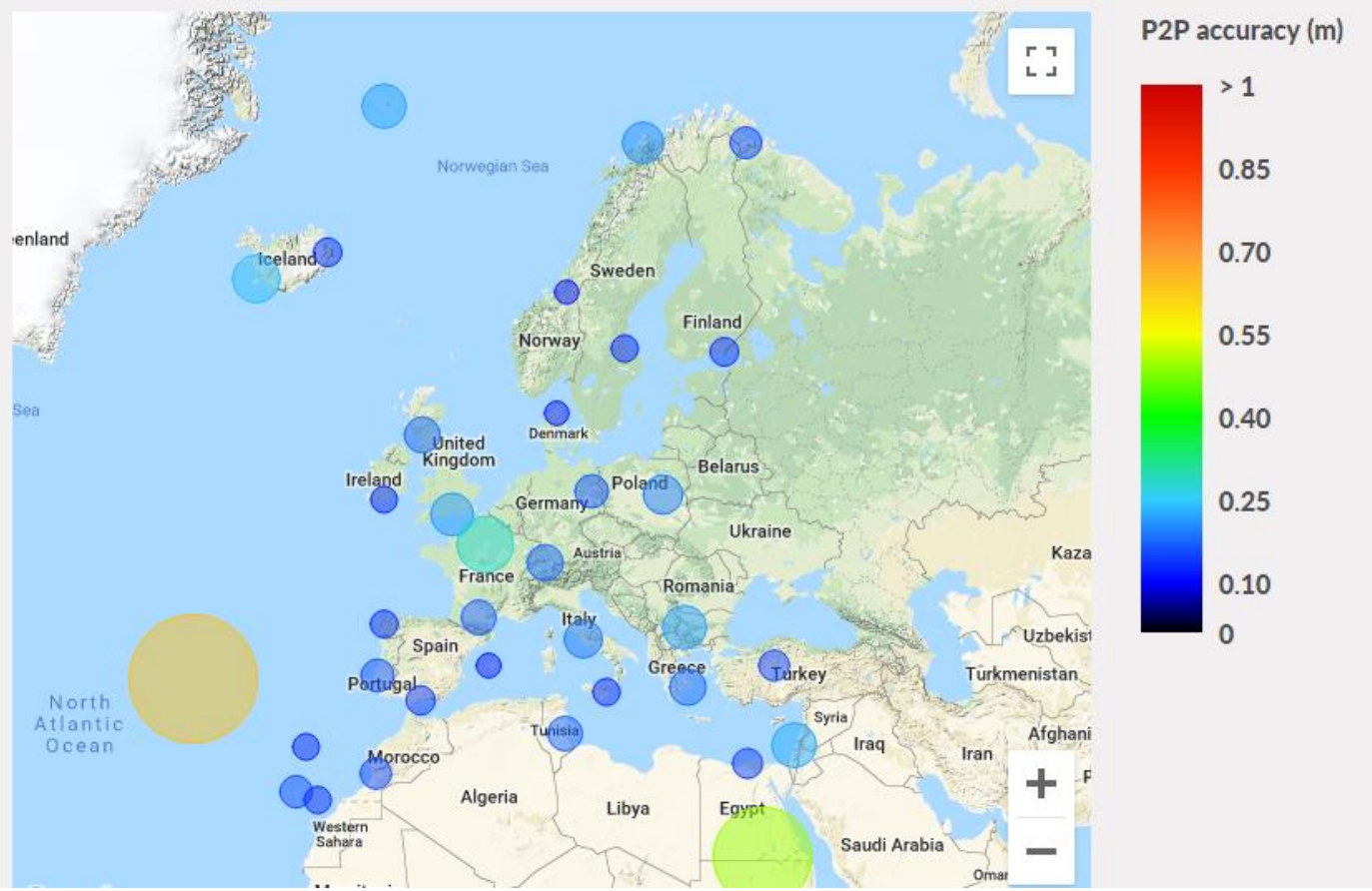
The actual errors are significantly lower than the aforementioned specifications: **submetre accuracy (measured with 95% confidence level)**

EGNOS accuracy for agriculture: Pass to Pass (1/2)



Pass2Pass accuracy monitored every day and available in this link
https://egnos-user-support.essp-sas.eu/new_egnos_ops/pass_to_pass

EGNOS accuracy for agriculture: Pass to Pass (2/2)



EGNOS Pass2Pass accuracy is ~20-30 cm

Recent publication testing EGNOS performance (~13 cm)

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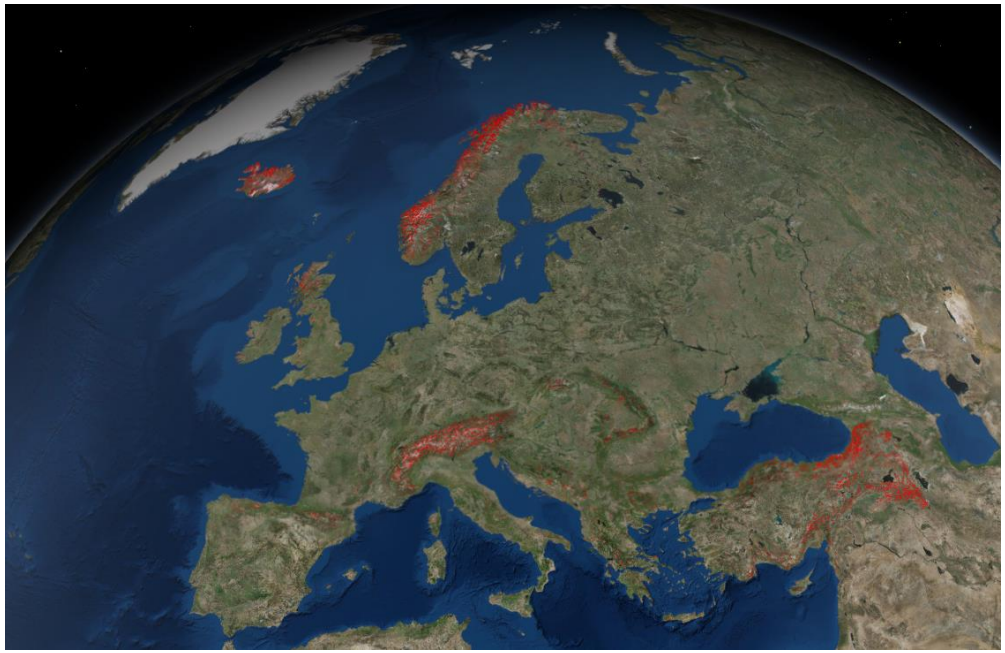
EGNOS visibility maps (1/2)

EGNOS is available over all Europe, but the terrain orography could affect the visibility of EGNOS satellites. **Visibility maps are provided in the EGNOS User Support Website**



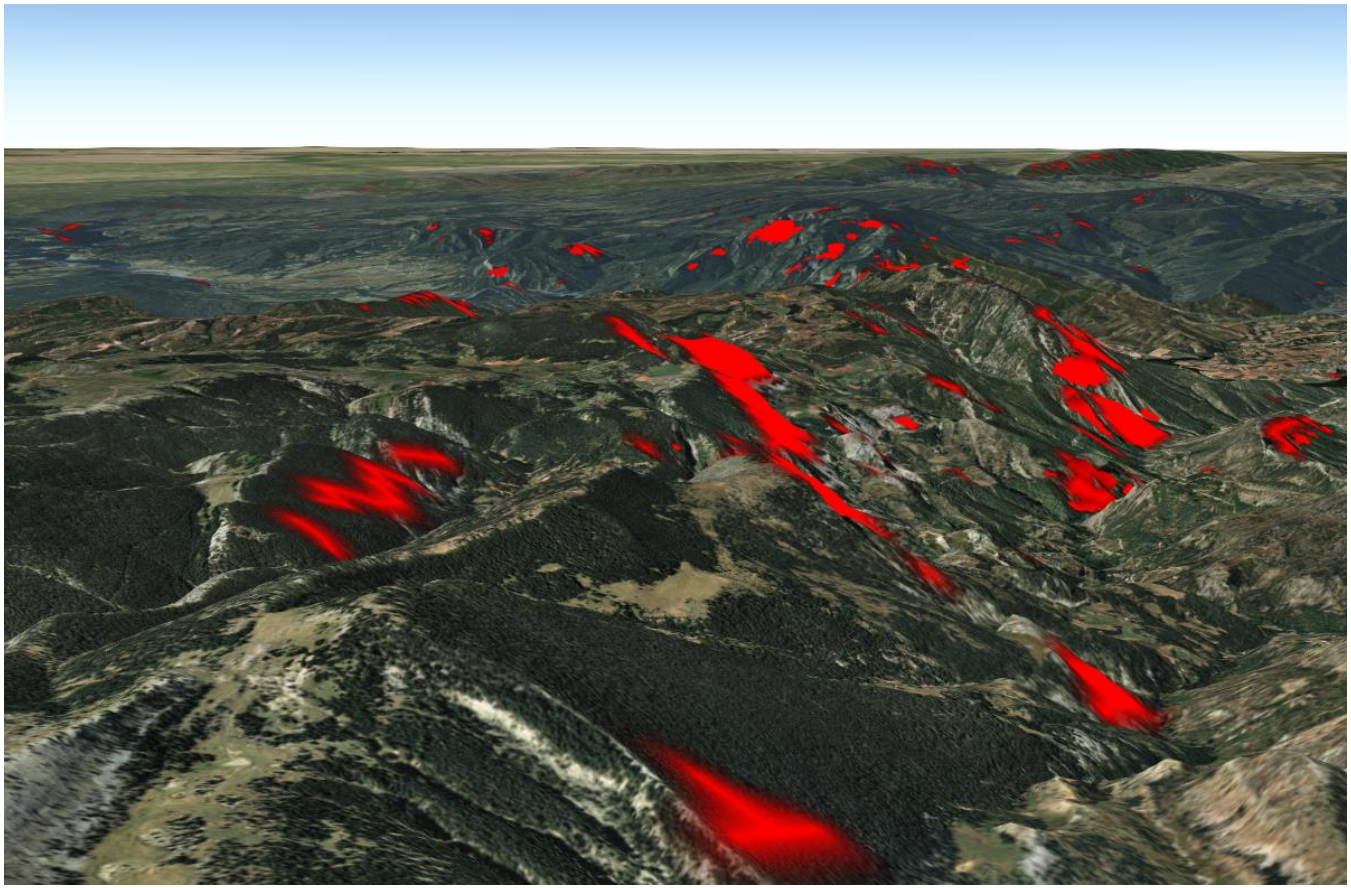
https://egnos-user-support.essp-sas.eu/new_egnos_ops/resources-tools/egnos-visibility-maps

EGNOS visibility maps (2/2)

Users can find EGNOS “shadow areas”

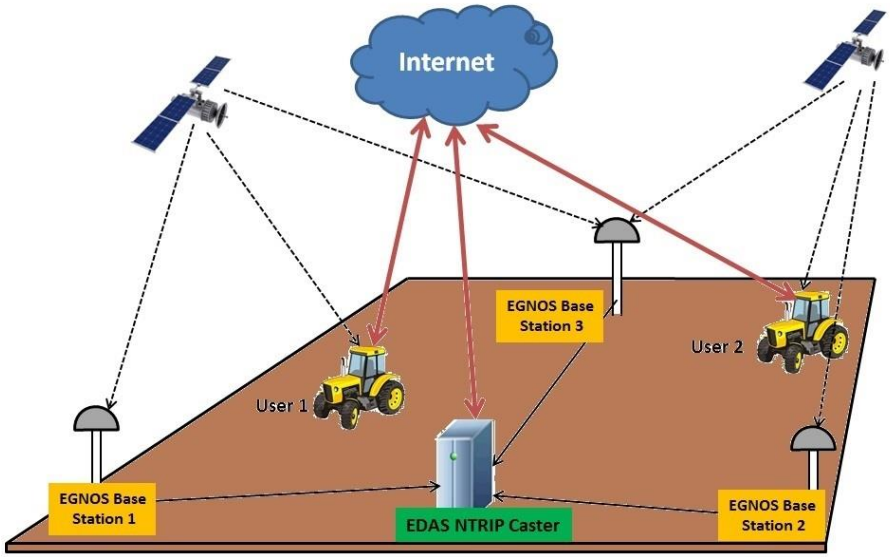
Maps can be zoomed in and out, allowing 3D view.

Possible to select shadow areas for one GEO or for both



EDAS NTRIP Service

EDAS NTRIP provides through the Internet free DGNSS and RTK corrections in the surroundings of the multiple EGNOS RIMS



A DGNSS and/or RTK receiver compatible with the NTRIP protocol is required (*Note: EDAS Ntrip service based on Ntrip v1.0 over http)*

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EDAS NTRIP application

Farming activities must be carried out close enough to any of the EGNOS reference stations (see map) to achieve the suitable accuracy

DGNSS corrections	RTCM 2.1 y 2.3	< 260 km
RTK corrections	RTCM 3.1	< 50 km

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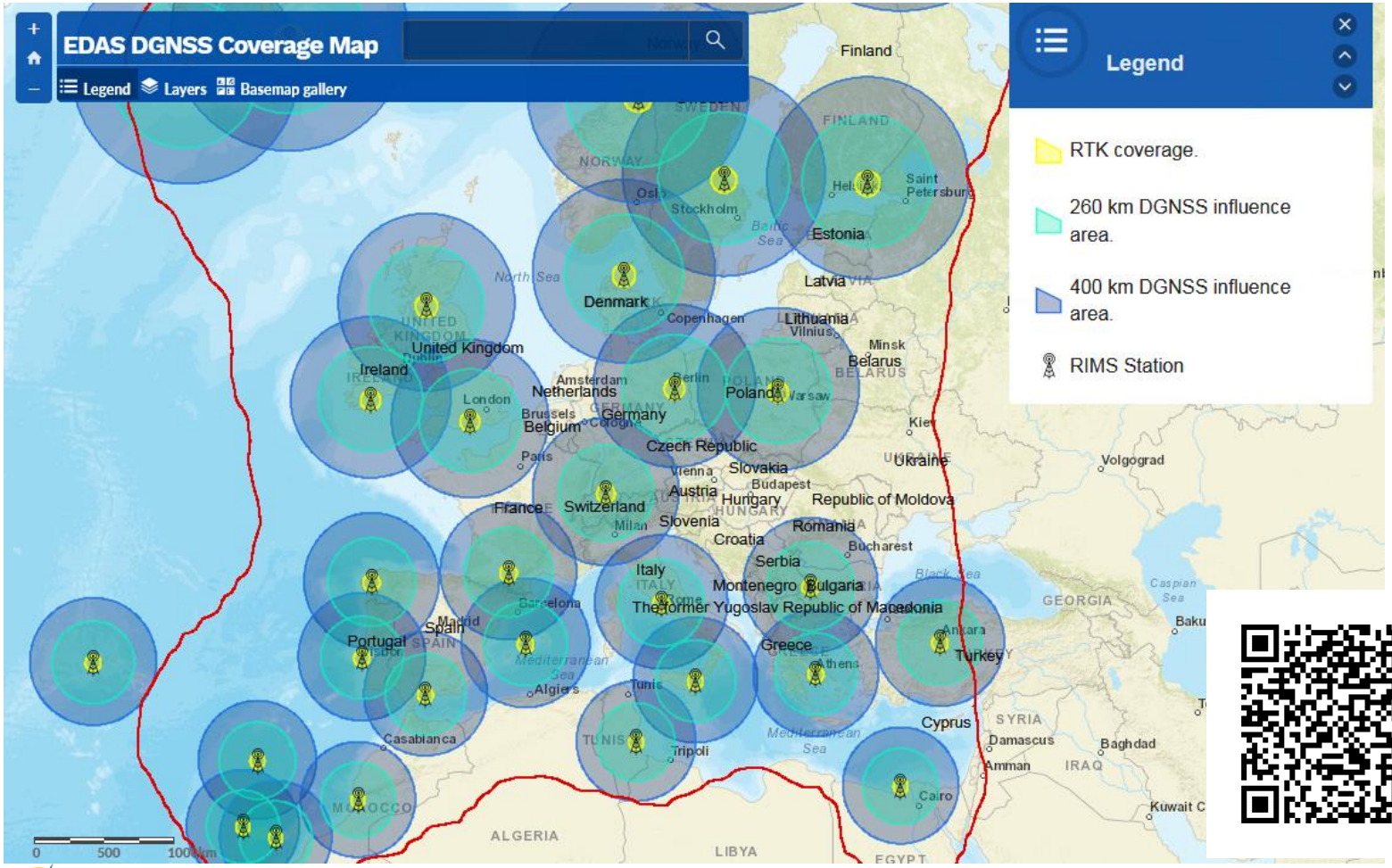
EDAS RTK and DGPS coverage



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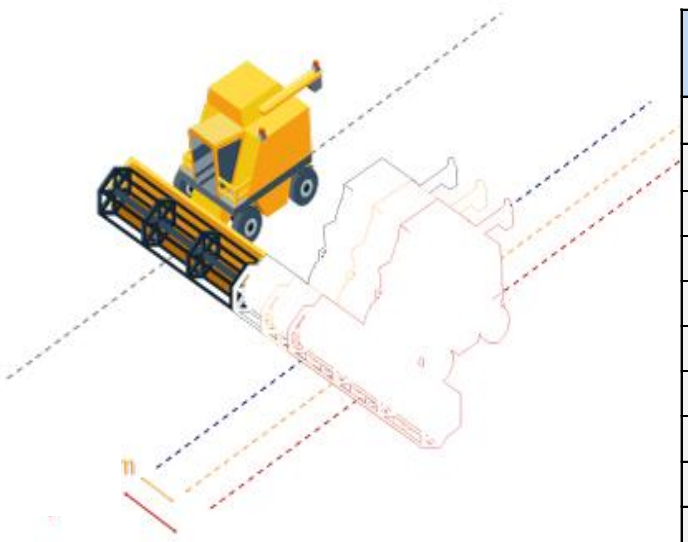
EDAS DGNSS: Pass to Pass results



From 2nd July to August 6th 2016.
Solutions with horizontal accuracy (percentile 95th) < 1 m

Location	Solution	Pass to Pass -15 min. 95th-
La Palma (Spain)	LPAL0_LPIA	13,9 cm
La Palma (Spain)	LPAL0_CNRA	10,1 cm
Cascais (Portugal)	CASC0_LSBA	15,7 cm
Hoe n (Iceland)	HOFN0_EG IA	12,4 cm
Onsa	BA	10,1 cm
Me lla (Spain)	GA	11,2 cm
Oberpfaffenhofen (Germany)	OBE40_ZURA	20,6 cm
Borowiec (Poland)	BOR10_BRNA	13,7 cm
Ciboure (France)	SCOA0_TLSA	18,6 cm
Toulouse (France)	TLSE_TLSA	16,5 cm

Pass to pass $\lessapprox$ 20 cm

Static data, percentile 95th, 15 minutes time window.

ISO 12188-1, Tractors and machinery for agriculture and forestry-Test procedures for positioning and guidance systems in agriculture-Part1: Dynamic testing of satellite-based positioning devices

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EGNOS farming activities

Farming applications		Accuracy
	Livestock positioning and virtual fencing Agricultural stations and sensors	< 5 m
	Geo-traceability Post harvest pick-up	< 2.5 m
	Boundary mapping and updating Field measurement	< 1.5 m
	Machinery guidance for dry soil crops Variable rate application	< 1 m

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Benefits of EGNOS in agriculture

EGNOS is the basic service for machinery guidance in Europe

Almost 80% of farming guidance systems integrate EGNOS (*)

(*) 2015 GNSS Market Report

EGNOS advantages w.r.t. GPS alone:

- Enhance accuracy
- Avoid waste of fertilisers and herbicides
- Save time and money
- Reduce fatigue
- Optimize crop yields
- Increase profit margins

EGNOS advantages w.r.t. other high-accuracy solutions:

- No subscription fee (w.r.t. commercial services)
- No radio base station (w.r.t. RTK)
- No dependency on GPRS coverage (w.r.t. NTRIP)

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GPS/SBAS receivers in agriculture

Almost all the GPS agricultural receivers are EGNOS enabled

Septentrio satellite navigation

AvMap SATELLITE NAVIGATION

Ag Leader®

Trimble®

TOPCON

CLAAS

satplan

Leica Geosystems

TeeJet® TECHNOLOGIES

ALTUS POSITIONING SYSTEMS

NovAtel

Outback GUIDANCE by Hemisphere GPS

NAVCOM A John Deere Company

EGNOS EGNOS, it's there. Use it.

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Example: TOPCON AGI-4 Receiver

TOPCON

Model: AGI-4

- EGNOS enabled
- GPS/SBAS receiver integrated in the antenna
- **X30** display

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Example: Ag Leader GPS6500 Receiver

Ag Leader®

Model: GPS6500

- EGNOS enabled
- GPS/SBAS receiver integrated in the antenna
- **InCommand** display

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Example: Trimble CFX-750 Receiver

Model: CFX-750

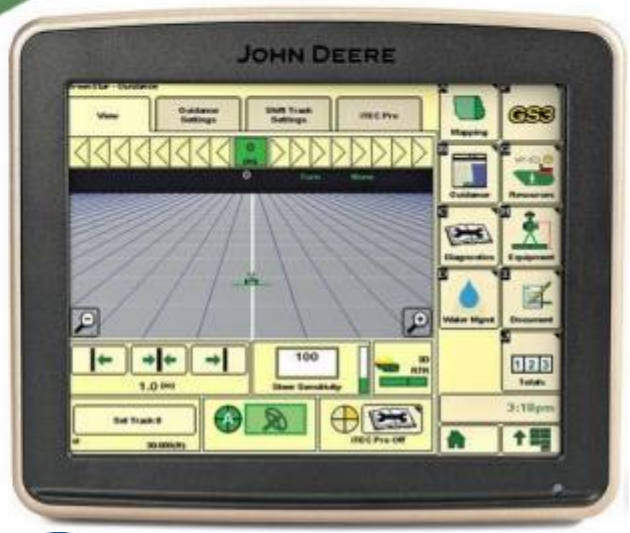
- EGNOS enabled
- GPS/SBAS receiver integrated in the display

Example: John Deere SF 3000

JOHN DEERE

Model: SF 3000

- EGNOS OS enabled
- GPS/SBAS receiver integrated in the antenna
- Greenstar 3 display



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Guide how-to configure (some) EGNOS enabled receivers

There is a free guide (English) to explain how to configure EGNOS in the above mentioned equipment.

Download it and use it!

Why should a farmer use EGNOS?

EASE (Egnos sAvingS in agriculturE) is a **free tool** that allows to perform **cost-benefit analyses** on the introduction of EGNOS for machinery guidance in some of their typical agricultural labours.

GEAR : (eGnos dEmonstrator for agRiculture)

Visit EGNOS stand and try it!

You can download it for **free**

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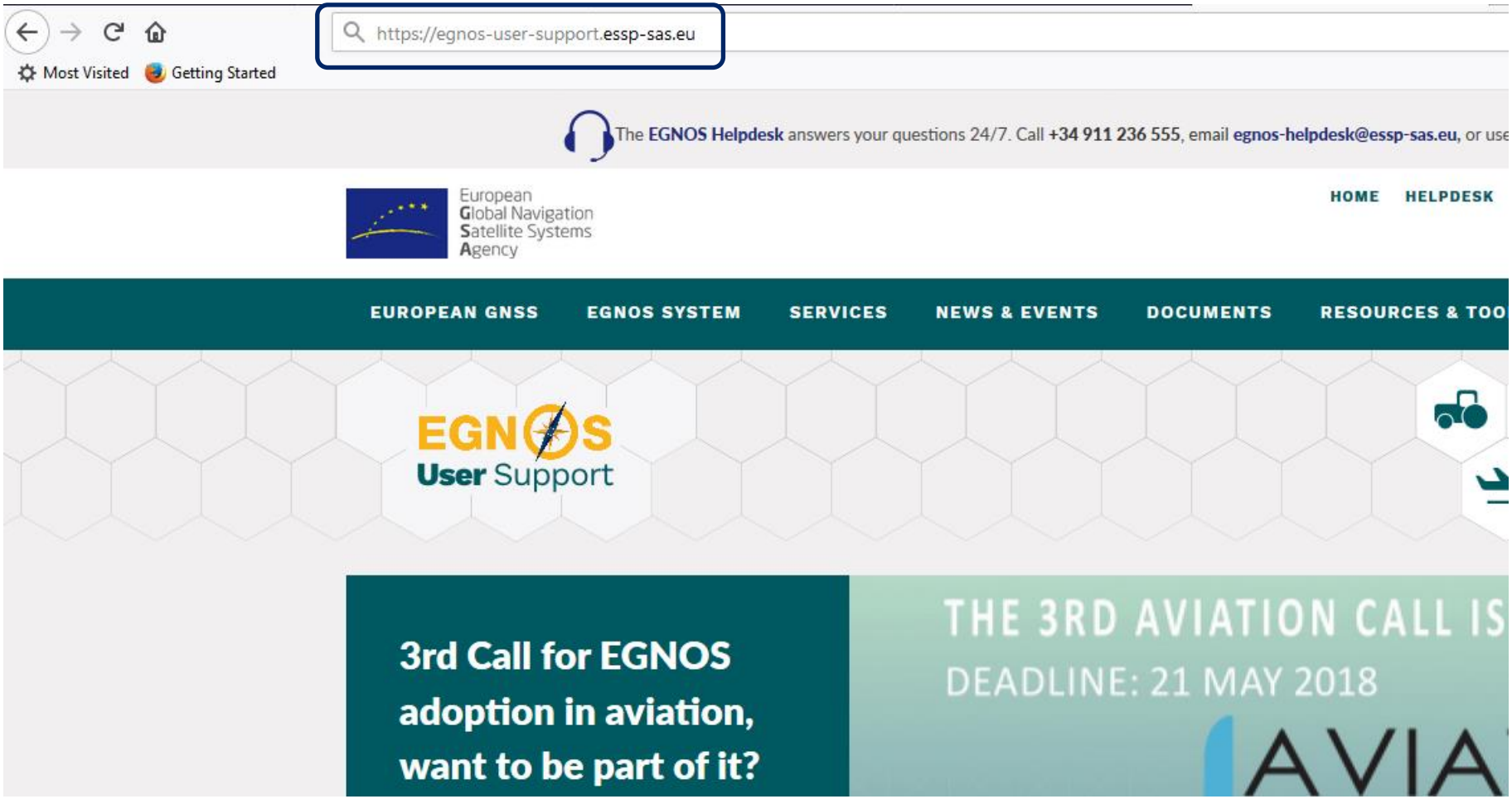
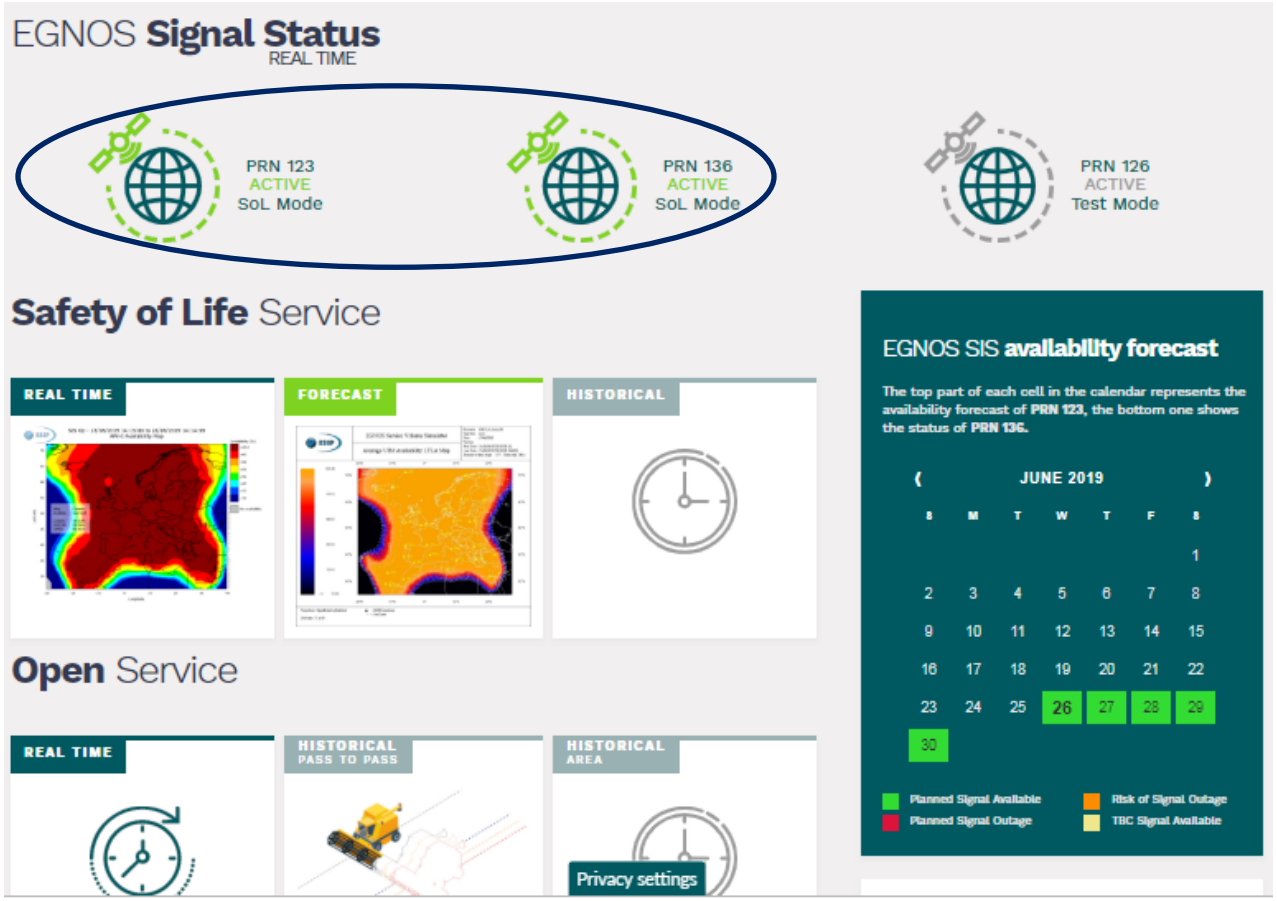
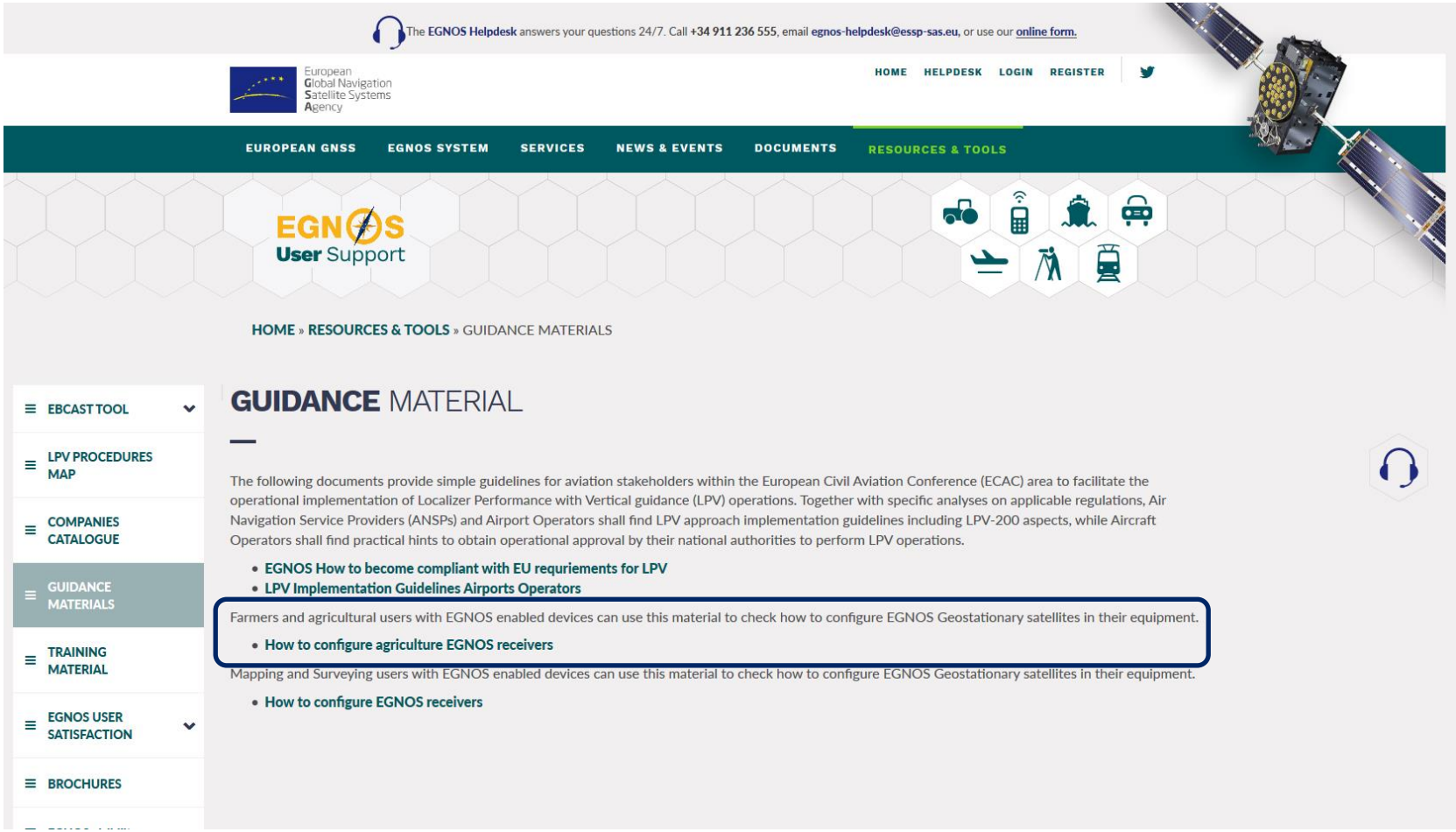
EGNOS User Support Website



EGNOS satellites availability



EGNOS adoption material



EGNOS Pass to Pass accuracy

EGNOS User Support

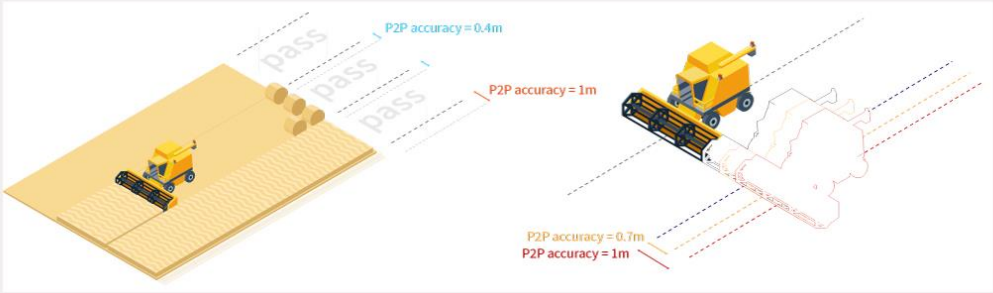
HOME » PASS TO PASS

- SoL SAFETY of LIFE SERVICE
- OS Open Service
  - PRECISION DEVIATION (Realtime)
  - HISTORICAL PERFORMANCE
    - GPS vs GPS/EGNOS
    - POSITION ERROR
    - PASS TO PASS
- EDAS EDAS SERVICE

PASS TO PASS

Pass to Pass accuracy is the term used by farmers to describe their user needs in relation with accuracy; and the term used by GNSS manufacturers to describe the accuracy the equipment can provide. Pass-to-pass accuracy is defined as the accuracy which can be achieved over a 15 minute window, being 15min the approximate time to make a pass in a typical field. **Standard ISO 12188** describes in detail how to compute this quantity.

Figure below, explains graphically the concept. Once you have done a pass in the field with the tractor, and you return and place it in the same position according to your GNSS equipment, you are not exactly in the same place, there is a bias. This bias is the so called "pass-to-pass" accuracy. To see Pass-to-Pass accuracy provided by EGNOS, select a date and a RIMS station. Note this pass-to-pass accuracy is available in all EGNOS Service Area (not just only in the RIMS station).



Select date *

View

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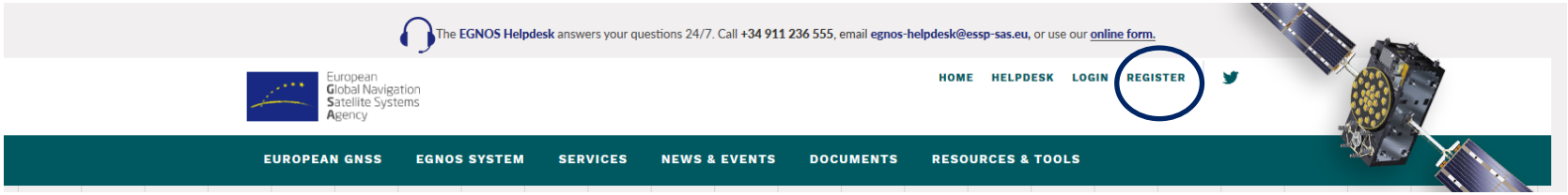
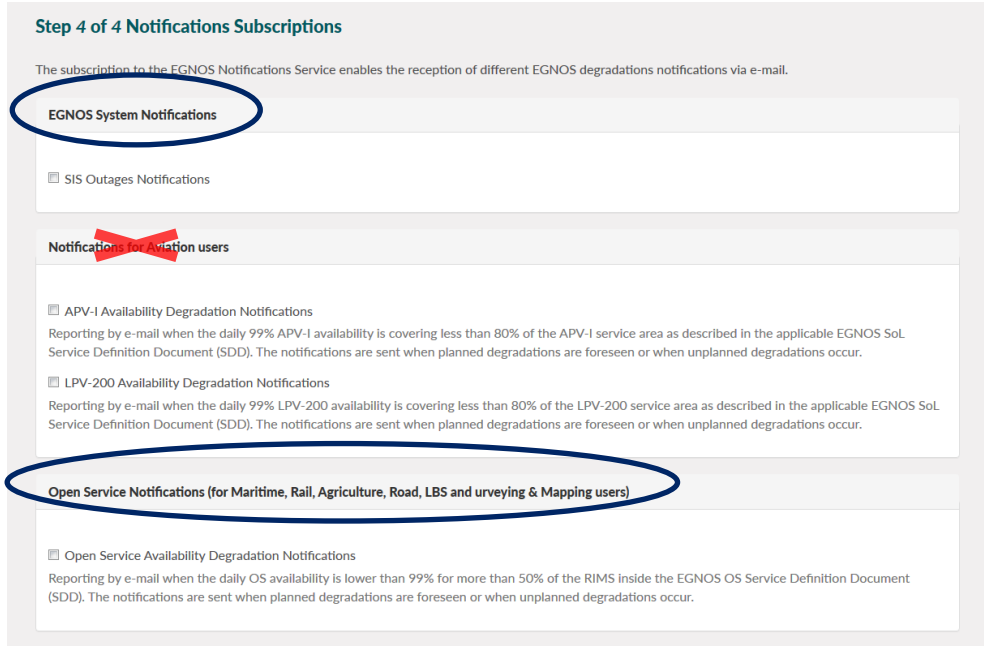
Registration and notification subscription

1. Registration in the EGNOS user support website (top right)



2. Interesting subscriptions to be selected during registration

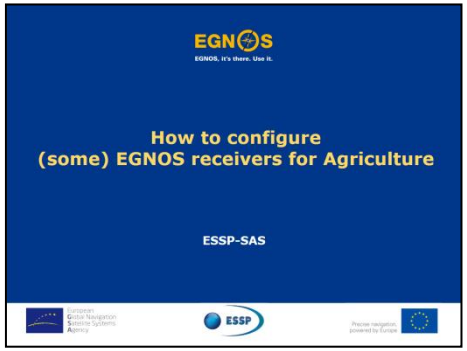
Aviation-related (of no interest for agriculture)

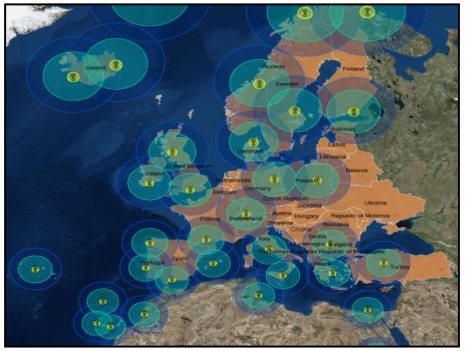


EGNOS links for farming

EGNOS User Support Website: http://egnos-user-support.essp-sas.eu

- Service Notices (e.g. PRN modifications)
- Real-time performance:
  - EGNOS vs GPS
  - EDAS
- Pass to Pass accuracy
- Guidance material
- EASE tool
- EDAS coverage maps
- EGNOS bulletin
- EGNOS helpdesk





EGNOS mobile app

Freely available for **Android** and **iOS**

GET IT ON Google Play

Download on the App Store

EGNOS Helpdesk
Accessible from the app

Signal in Space
EGNOS system information

Docs and tools
Browse official documents & tools

EGNOS performance
SoL, EDAS, OS services

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EGNOS
ANNUAL
WORKSHOP
ROME, ITALY
24-25 SEPTEMBER, 2019
GSA
ESSP
Trust, from space to cockpit,
for one clever sky.
NAVIGATION
MADE IN
EUROPE

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www.essp-sas.eu

http://egnos-user-support.essp-sas.eu

sofia.cilla@essp-sas.eu

egnos-helpdesk@essp-sas.eu

+34 911 236 555 (H24/7)

Corporate Video

THANK YOU FOR YOUR ATTENTION