

TACKLING IONOSPHERE TO ENHANCE GNSS HIGH ACCURACY

Vincenzo Romano^{1,2}

Luca Spogli^{1,2}, Claudio Cesaroni², Ingrid Hunstad²

¹SpacEarth Technology Srl, Rome, Italy

²Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy



European
Global Navigation
Satellite Systems
Agency

HORIZON 2020



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Geofisica e Vulcanologia



SPAC EARTH
TECHNOLOGY

About Us

We are a Spin-off company of Istituto Nazionale di Geofisica e Vulcanologia one of the biggest research body in Italy. We are a team of engineers, physicists and geologist with a long involvement in research and business management with the goal to create value by the results of more than 60 years experience of INGV.

Mission

Our purpose is to:

- design and develop applications, tools, software, hardware components and products for Aerospace, GNSS and Environment sectors in cooperation with major European and Italian Industries, Organizations, Universities and Research Centres.
- bring innovative R&D products to market.

Vision

Our vision is to become an international leader in designing and developing cutting edge technology solutions in selected civil market niches.



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Spacearth Technology

Products and Services

Aerospace



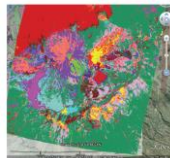
- GNSS high precision
- Space weather
- Earth observation

Marine Monitoring



- Deep sea data acquisition
- System control

Environment



- Remote sensing
- Shallow deep monitoring
- Subsoil imaging



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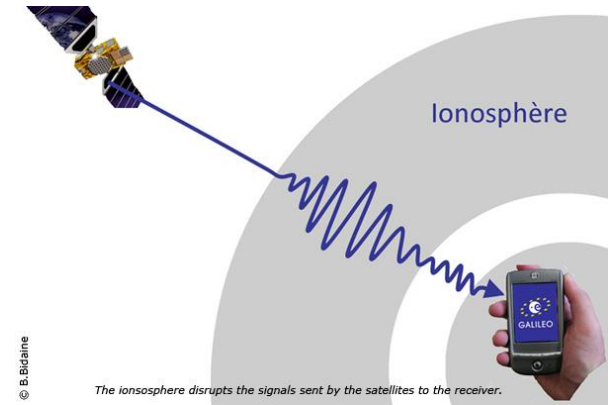
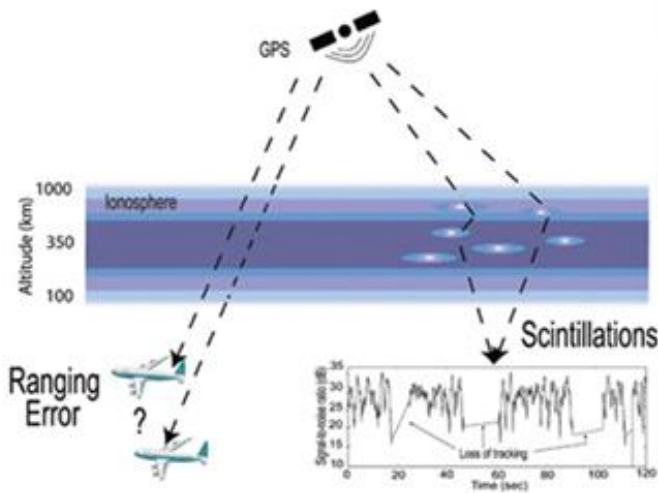
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The Problem

The presence of the ionosphere poses threats on the **availability and reliability of the precise positioning and navigation services**. The major threats posed by ionosphere are gradients of **Total Electron Content (TEC)** and diffraction effects when the signal is received at ground (**scintillation**).



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Our solutions!

SpacEarth Technology is proud to introduce a series of solutions able to nowcast, forecast and mitigate the ionospheric impact on GNSS services.

- ✓ **Mitigation on high accuracy positioning and navigation**
- ✓ **Ionospheric Scintillation and TEC nowcasting**
- ✓ **Long-Term prediction of TEC (24 hours)**
- ✓ **Long-term prediction of scintillation (24 hours)**
- ✓ **Short-term prediction of TEC (30 minutes)**
- ✓ **PPoT: Precise Positioning of Things**



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NAVIGATION IN ARCTIC WITH GNSS HIGH ACCURACY LOW POWER SOLUTION

NARWHALS

NARWHALS is a feasibility study financed by the European Space Agency



User needs

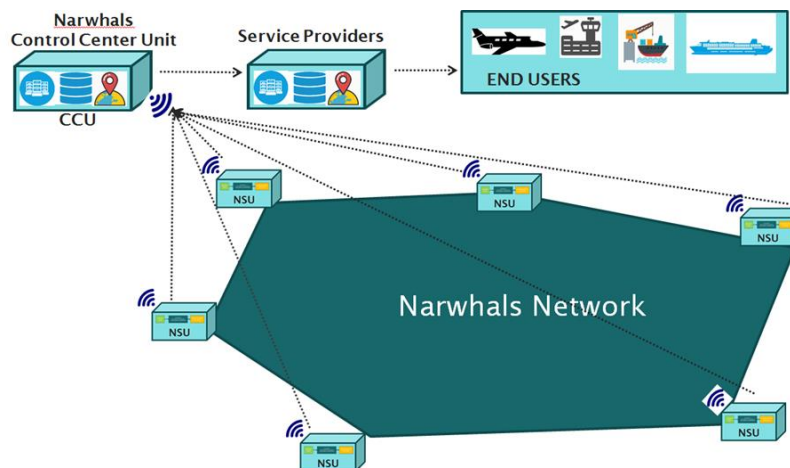
- safety in marine navigation
- efficient and safe port navigation
- cost-effective naval route optimisation
- efficient localisation services for oil&gas and mining companies
- safety in airplane flights

Customers

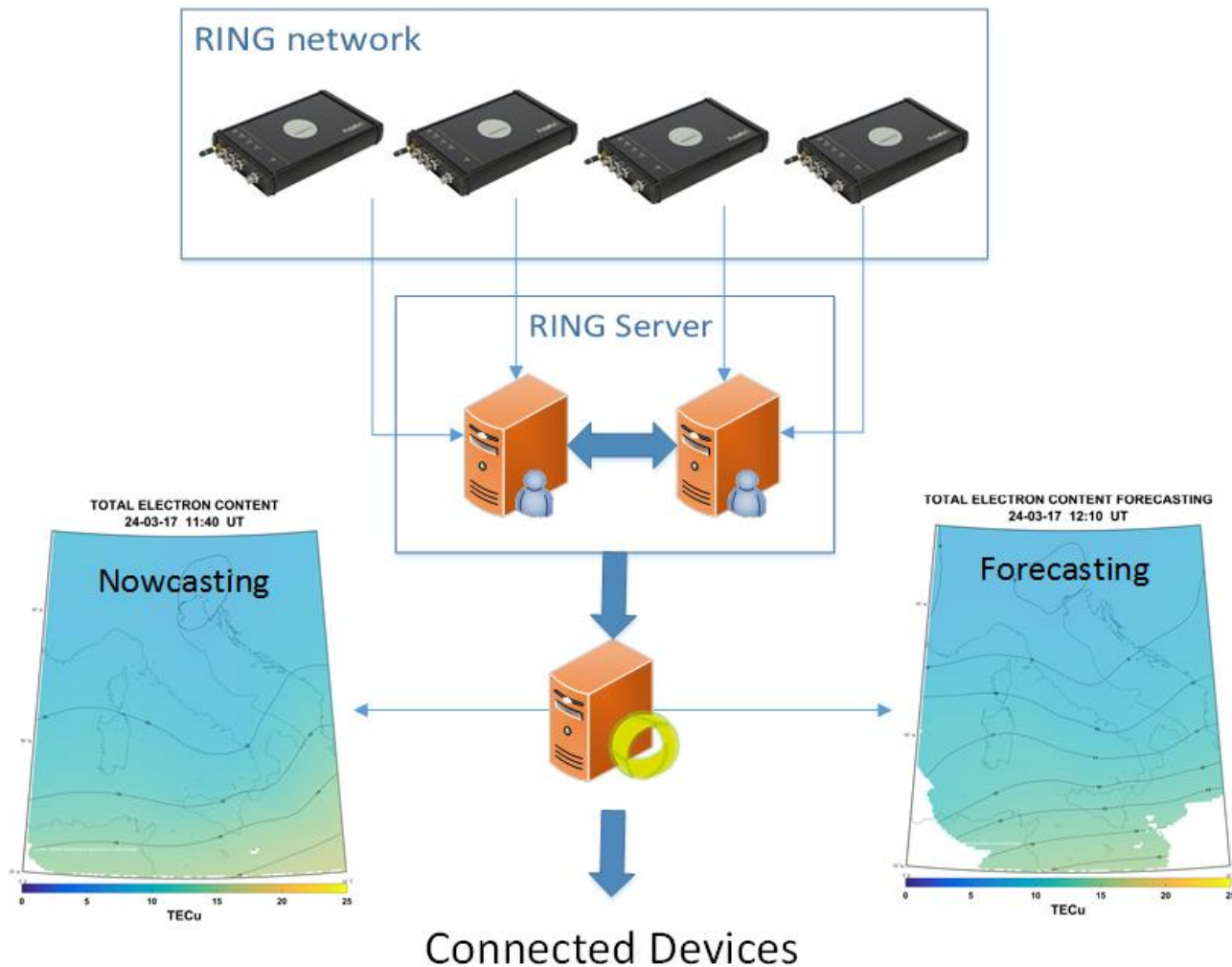
- GNSS service providers
- Route Optimization service providers

Main stakeholders

- Istituto Idrografico della marina
- E-geos SpA
- Vitrociset Belgium
- Finnish Meteorological Institute
- Aerospace & Marine International
- Teseo-Clemessy SpA
- Geo++
- EIT Raw Materials
- University of Nottingham
- Hexagon



PPoT: Precise Positioning of Things



Mitigation on high accuracy positioning

In collaboration with University of Nottingham and Space Research Centre Polish Academy of Science

The short term forecasting model

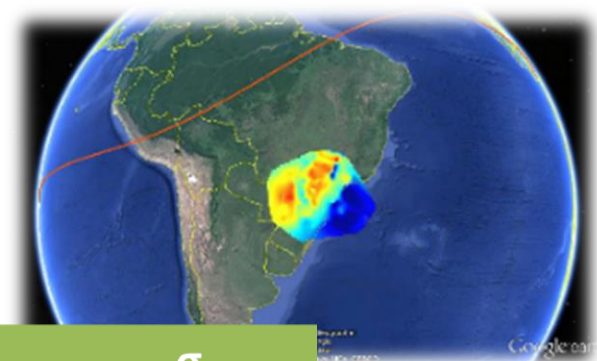
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“Forecasting model for Scintillation and TEC”

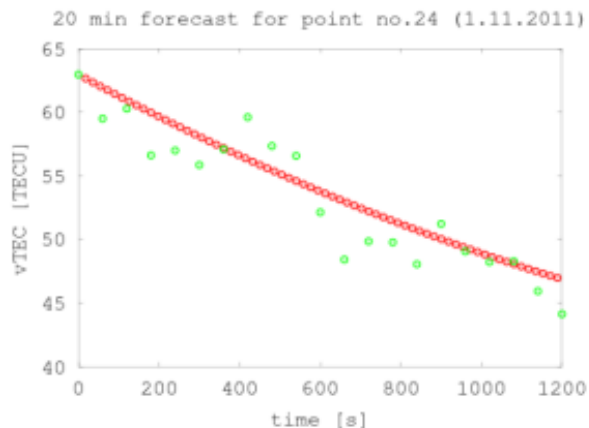
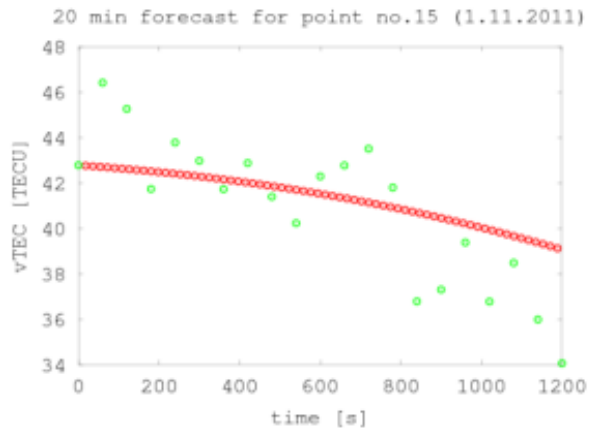


UNITED KINGDOM · CHINA · MALAYSIA

*Field test in Hanoi
performed last
October
thanks to BELS!*



TEC map



0 to 20 min forecasting horizon

P	σ_{S4}	$\sigma_{\sigma\phi}(\text{rads})$	$\sigma_{\text{TEC}}(\text{TECU})$
68%	0.02	0.01	0.05
80%	0.03	0.02	0.09
90%	0.04	0.03	0.19
95%	0.06	0.04	0.38
99%	0.12	0.13	1.06

Model forecasting resolution

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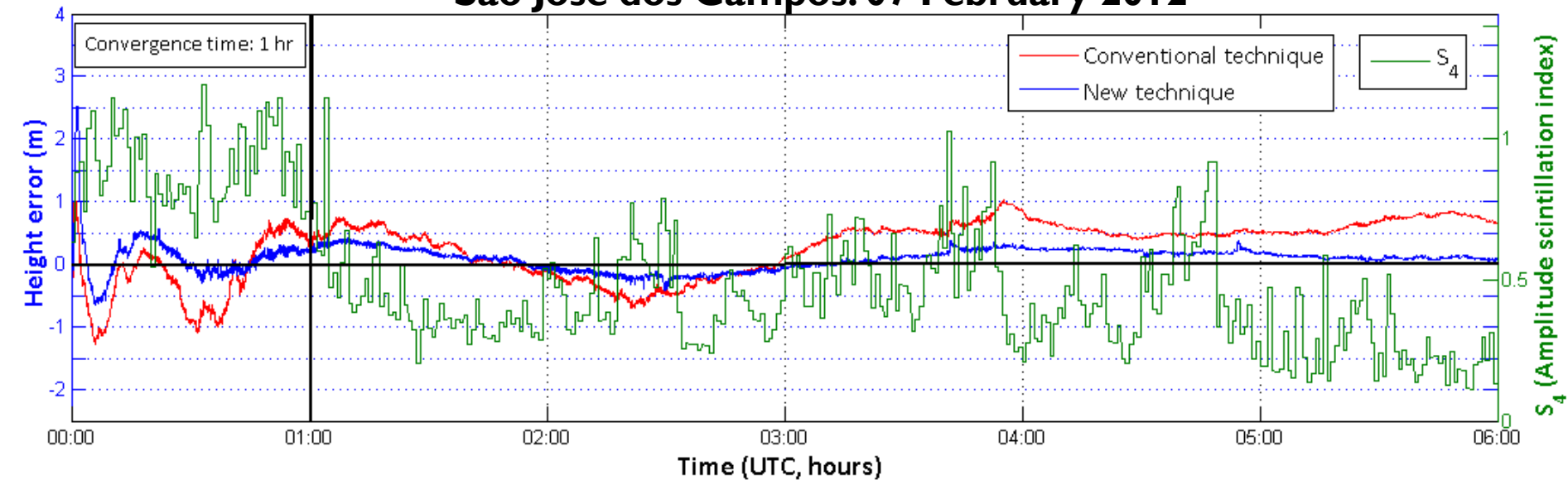


Mitigation on high accuracy positioning

In collaboration with University of Nottingham and Space Research Centre Polish Academy of Science

Precise Point Positioning results

São José dos Campos: 07 February 2012



	RMS of height error (m)		
	Mitigated	Conventional	Improvements
During convergence	0.21	0.51	60%
After convergence	0.16	0.54	69%

Measurement campaign for model testing in Hanoi

In collaboration with Hanoi University of Science and Technology

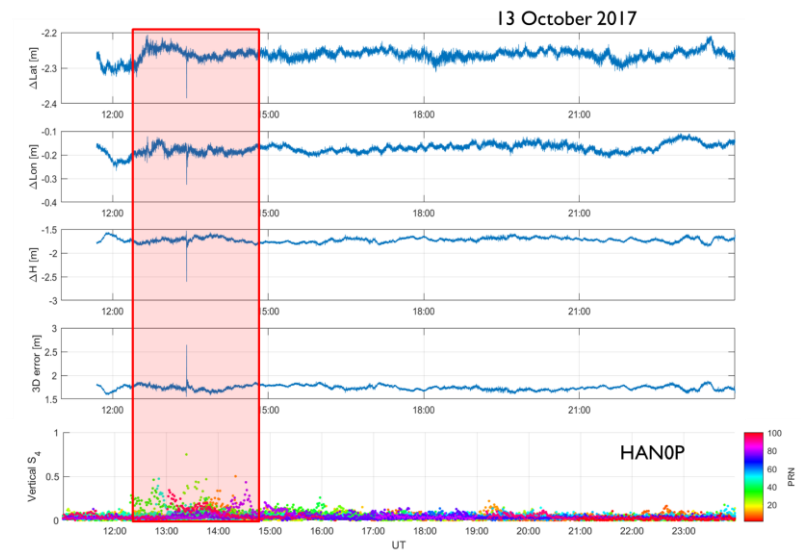


Rover test site 2



Rover test site 1

Positioning on a fixed point to be processed in kinematic mode



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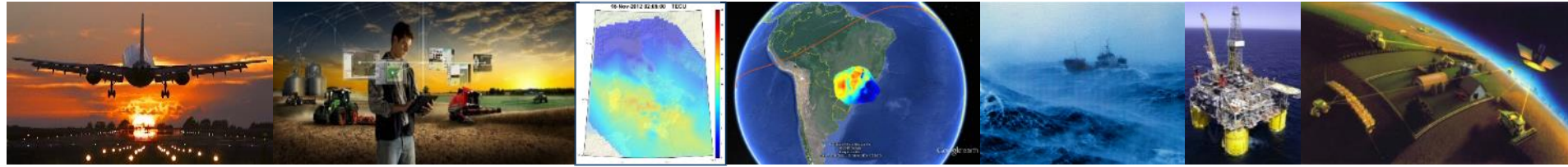


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Potential customers



GNSS service providers

- Agriculture
- Aviation
- Maritime
- Mining
- Dredging
- Constructions
- Offshore operations
- Land management
- Geodesy/land surveying

Industrial partnership is welcome

SPACE WEATHER Centres



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9th Multi-GNSS Asia Conference - Jakarta, 9/11 Oct. 2017



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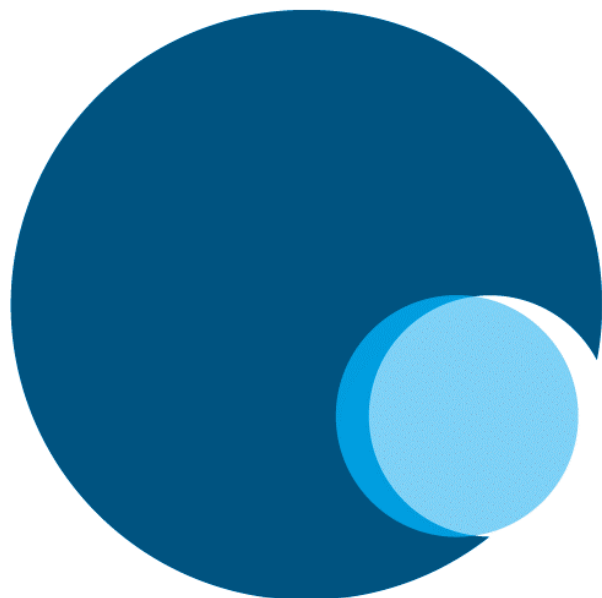


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Vincenzo Romano

General Manager

Email:

vincenzo.romano@spaceearth.net



Thank you!



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