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### Project News

## Successful 2<sup>nd</sup> TechTIDE User Workshop, Prague, Czech Republic, 9<sup>th</sup> October 2019

The 2<sup>nd</sup> TechTIDE User Workshop was held in Prague on 8th - 11th October 2019. Again the workshop brought together users and developers of the TID monitoring and warnings. The TechTIDE developers presented the current release of the TechTIDE system [http://techtide.space.noa.gr/?page\\_id=2811](http://techtide.space.noa.gr/?page_id=2811). Also the users presented their applications and explained the impact of TID effects in their systems. At the end of the User Workshop a detailed discussion between users and developers about the state of the TechTIDE warning system, the current strength and weakness of the services took place. The TechTIDE team prepared and steered a round table discussion, which was complemented by a user questionnaire.



Warning and Mitigation **T**echnologies for **T**ravelling Ionospheric **D**isturbances **E**ffects

#### TechTIDE Project

The overarching objective of TechTIDE is to design and test new viable Travelling Ionospheric Disturbances (TID) impact mitigation strategies for the technologies affected and in close collaboration with operators of these technologies, to demonstrate the added value of the proposed mitigation techniques.

#### TechTIDE Newsletter

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### TechTIDE Consortium Technical Meeting, Prague, Czech Republic, 8<sup>th</sup> - 11<sup>th</sup> October 2019

Attached to the 2<sup>nd</sup> User Workshop, the TechTIDE project consortium organised a Consortium Technical Meeting. There the current status and activities were reviewed and discussed. Each workpackage



status has been presented by the workpackage leads in front of the complete consortium. The discussions were very helpful for the continuation of the developments.



### Many TechTIDE contributions at international conferences

#### TechTIDE @ 27<sup>th</sup> IUGG General Assembly, Montreal, Canada, 8-18 July 2019

Poster presenting the HF interferometry method to detect LSTIDs within the TechTIDE project: "Real Time ionosphere monitoring highlights in the frame of IAG's RTIM-WG", Alberto García-Rigo, David Roma-Dollase, Manuel Hernández-Pajares, Zishen Li, Ningbo Wang, Michael Terkildsen, German Olivares, Reza Ghoddousi-Fard, Eren Erdogan, Denise Dettmering, Haris Haralambous, Yannick Béniguel, Jens Berdermann, Martin Kriegel, Anna Krypiak-Gregorczyk, Tamara Gulyaeva, Attila Komjathy, Panagiotis

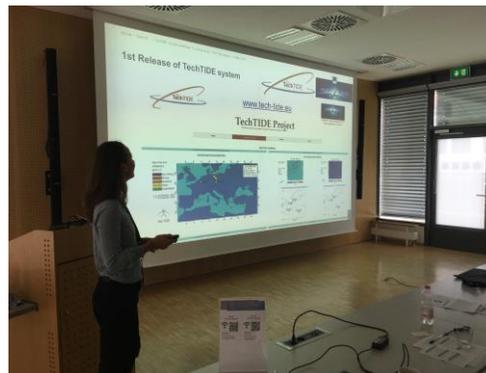
Vergados, Joachim Feltens, René Zandbergen, Tim Fuller-Rowell, David Altadill, Estefania Blanch, Nicolas Bergeot, Jean-Marie Chevalier, Andrzej Krankowski, Loukis Agrotis, Ivan Galkin, Raul Orus-Perez

#### TechTIDE @20<sup>th</sup> International Beacon Satellite Symposium, Olsztyn University, Poland, 19-23 August 2019

Presentation about "Monitoring and analysis of the TIDs triggered by magnetic storms and their impact on EGNOS availability degradation", Dalia Buresova, Anna Belehaki, José Miguel Juan, Jaume Sanz Subirana, Jaroslav Chum, David Altadill, Estefania Blanch, Antoni Segarra, Jurgen Watermann, Daniel Kouba, Ivan Galkin and TechTIDE team

#### TechTIDE @ International Workshop on GNSS Ionosphere 2019, Neustrelitz, Germany, 23-25 September 2019

Scientists and users in the communication and navigation sector gathered in September 2019 in Neustrelitz, Germany, for the 2<sup>nd</sup> International Workshop on GNSS Ionosphere. Upon invitation, the current state of the TechTIDE system has been presented to the workshop participants. The presentation was well accepted and new users could be attracted.



#### TechTIDE Project Members

- National Observatory of Athens (NOA), Greece
- Deutsches Zentrum für Luft- und Raumfahrt (DLR), Germany
- Ustav Fyziky Atmosfery AV CR (IAP), Czech Republic
- Institut Royal Meteorologique de Belgique (RMI), Belgium
- Observatorio del Ebro Fundacion (OE), Spain
- Borealis Global Designs Ltd. (BGD), Bulgaria
- Leibniz Institute of Atmospheric Physics, Rostock University (L-IAP), Germany
- Universitat Politecnica de Catalunya (UPC), Spain
- European Satellite Services Provider (ESSP), France
- South Africa National Space Agency (SANSA), South Africa
- Watermann Juergen Friedrich Wilhelm (JFWCONSULT), France
- Frederick University (FU), Cyprus
- German Federal Police (GFP), Germany

### *TechTIDE @ Space Weather exhibition for pupils and students*

The Frederick University has recently inaugurated a Space Weather exhibition under the support of ESA that is going to operate for two years to promote Space Weather to Secondary education pupils and University students as well. Within the frames of this exhibition they disseminated the TechTIDE project results by means of a poster and also on the video section of a “Space Weather effects” interactive screen.

### *TechTIDE @ the 7th International Colloquium on Scientific and Fundamental Aspects of GNSS, Switzerland, 4-6 September 2019*

Invited talk delivered by the project coordinator, Dr Anna Belehaki, to the 7th International Colloquium on Scientific and Fundamental Aspects of GNSS, organized by ESA and ETH Zürich. The talk summarized the achievements of the TechTIDE project with emphasis on the real-time TID detection capabilities.

#### Latest Achievements

### **TID Algorithms Definition**

WP2 restarted its activity on July 2019 with its last task dedicated to the final TID algorithms. Based on the results of the assessment of the TID impact on aerospace and ground systems (WP5), the effects of TIDs in specific type of operations will be specified. This will allow the developers of the TID identification

codes to adjust the outputs of the ensemble of the codes, in a comprehensive set of parameters that will allow the end user to support the operation of specific systems (such EGNOS, N-RTK, HF communication and geolocation) and the mitigation of the TID effects.

### **TID Activity Metrics Identification**

The TechTIDE consortium generated the TID activity metrics report (under the lead of OE). The TID activity metrics report contains results of the TID detection methods, the additional geophysical information for overall assessment of current conditions, and the classification of the TID activity. Statistical limits will be specified based on which, the TID disturbance will be characterized as unimportant, weak, moderate and intense.

### **Warning System**

The **second release of the TechTIDE system** is online. The new capability is the TID activity report. Here, the current TID activity state can be quickly assessed. Please go to the TechTIDE website and visit the TechTIDE system. The corresponding release note has been submitted in form of a report to the EU portal.

### **Mitigation technologies**

Mitigation procedures of Travelling Ionospheric Disturbances have been developed for each individual operational service: GNSS services (EGNOS in particular), HF communication and N-RTK technologies. The implementation schemes have been recently presented during the 2nd User Workshop

where the improvements have been identified to be implemented for the last, final release of the TechTIDE warning system. First recommendations have been gathered in the first version of the document which will feed the final user requirements document.

### **Dissemination, Exploitation and Communication**

The TechTIDE consortium is actively communicating to the public and scientific community via conference and workshop presentations (as described above) the TechTIDE website, the forum and twitter. In addition, a virtual visit has been prepared, which has been released during the 2<sup>nd</sup> user workshop. Now it is available on the TechTIDE website.

#### Consortium Member Presentation

### **European Satellite Services Provider**

The European Satellite Services Provider (ESSP) is a dynamic company specialized in the operations and service provision of safety-critical navigation satellite systems.



Its ESSP's shareholders are 7 key European Air Navigation Service Providers (ANSPs): ENAIRE, DFS, DSNA, ENAV, NATS, NAV Portugal and Skyguide.

On 2010, the French National Supervisory Authority (NSA) granted to the ESSP a pan-European Certification of Air Navigation Service Provider, according to the Single European Sky Regulation 2096/2005. This Certification delivered by European Aviation Safety Agency (EASA) allows ESSP to provide Navigation Services to all European airspace users.

Our core activity is the operation and service provision of EGNOS (the European Geostationary Navigation Overlay System) Safety of Life (SoL) Service compliant with International Civil Aviation Organization (ICAO) SBAS standards. The EGNOS Service Provision contract is funded by the European Union and managed through the European Global Navigation Satellite Systems (GNSS) Agency (GSA), with a clear mandate to help foster the use of satellite navigation within Europe and particularly in the domain of aviation.

ESSP, as EGNOS operator and services provider, is a GNSS key player in aviation in Europe. It has well-balanced sources of expertise and knowledge in GNSS, SBAS system operations, engineering and management, GNSS performance assessment, navigation services provision, safety issues, and management of diverse GNSS implementation projects in different sectors, among them maritime.

In parallel, ESSP accrues wide know-how and background in certification and standardization activities as well as in GNSS stakeholders' and users' management and interfacing and GNSS services

adoption in the different user domains (mainly aviation).

In TechTIDE project, ESSP leads work package 6 which aim is to establish mitigation procedures for TID effects in operational systems (EGNOS, HF communications and N-RTK users). In addition, ESSP contribute to work package 1 and 5.

### South Africa National Space Agency

SANSA was established to promote the use of space and cooperation in space-related



activities while fostering research in space science, advancing scientific engineering through the development of human capital and provide support to industrial development in space technologies. The Space Science Programme (one of 6 core programmes within SANSA) leads multi-disciplinary space science research and applications. Key functions include fundamental and applied space science research, the support of space facilitated science through data acquisition, the coordination and administration of scientific data, and the provision of space weather and magnetic technology products and services on a commercial and private basis. Through the Space Science Programme, SANSA contributes to the worldwide network of magnetic observatories responsible for monitoring the Earth's magnetic field, and participates in global scientific projects. The programme also provides leadership in post-graduate

student training as well as providing science advancement, public engagement, and learner and educator support with STEM subjects.

SANSA's research activities are focused in the areas of ionospheric characterisation and modelling, plasma physics, geomagnetism, middle and upper atmosphere, space weather research and radiation belt studies. Through SANSA's space weather centre (a regional warning centre of the International Space Environment Service (ISES)) space weather services such as frequency predictions and space weather indices for radio communication and electric power industry are provided.

SANSA's main contribution to TechTIDE has mainly been in the work of compiling a TID activity report that will provide a compilation of the results of all TID detection algorithms and of additional parameters from the geospace and the Earth's atmosphere, to provide the metrics for the assessment of TID impact probability in users operations. For this report they have provided total electron content (TEC) results (including TEC background, TEC perturbations and rate of change of TEC) over Africa for several disturbed periods between 2012 and 2018. SANSA is also providing ionosonde measurements from South Africa.



### Upcoming Events

#### Planned conference contributions

##### *24th Science Week at the Observatori de l'Ebre, Spain, in November 2019*

The 24th Science Week will be held at the Observatori de l'Ebre in November 2019. The Ebro Observatory will give a conference about ionospheric disturbances and the TechTIDE project objectives.

##### *Contribution to 16th European Space Weather Week (ESWW)*

The ESWW is the main annual event in the European Space Weather calendar. It will be held on Liège, Belgium on 18-22 November 2019. It is the European forum for Space Weather.

The Ebro Observatory has submitted an abstract to the session 17 "Satellite and ground-based observations for space weather and space climate monitoring and modelling". This session aims to provide the possibility to present and discuss contributions on the use of data from satellite and ground-based observations, in order to enhance the understanding of space weather and space climate, and their impact on critical infrastructure. A true global picture of space weather and space climate, in which regional effects can be put into a global context, can be obtained from the combination of space and ground measurements. Being able to predict extreme events and develop strategies for mitigation is very important for space assets (including future satellite

mission concepts) and critical infrastructures on the ground.

##### *AGU Fall Meeting 2019, San Francisco, 9-13 December 2019*

Invited talk at AGU Fall Meeting 2019 that will be held in San Francisco from 9-13 December. Session SA018 - Resolving the Generation Mechanisms of Traveling Ionospheric Disturbances (TIDs). Title: Real-Time identification of Travelling Ionospheric Disturbances- The TechTIDE project. Authors: Anna Belehaki, Estefania Blanch, David Altadill, Ioanna Tzagouri, Claudia Borries, Dalia Buresova, Ivan Galkin, J. Miguel Juan, Antoni Segarra and the TechTIDE group

##### *TechTIDE and ISWAT*

TechTIDE joined the COSPAR ISWAT initiative <http://iswat-cospar.org>. We contribute in the discussion panel organized in the AGU Fall meeting in San Francisco on 10 December 2019, presenting our conclusions on the detection of TIDs in real-time and future plans in the framework of ISWAT.

##### *The 3rd Users Workshop and Final consortium meeting, 1 to 3 April 2020, Athens, Greece*

The 3rd Users Workshop and Final consortium meeting will be held in Athens, Greece from 1 to 3 April 2020. TechTIDE users are invited to actively participate and assess the functionality and the efficiency of the final TechTIDE release and discuss with the consortium the possibility for long-term collaborations in order to support their mitigation strategies.

### Imprint

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