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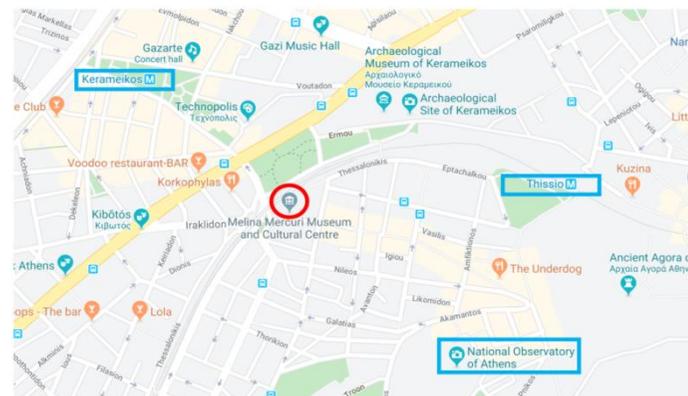
The 3rd and final TechTIDE Users' Workshop will be held in the Cultural Center of the Municipality of Athens "Melina Merkouri" in Athens, Greece, on 2 April 2020.

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 possibilities for long-term collaborations in order to support their mitigation strategies.

In this meeting the consortium will present the key methodologies for the real-time detection of Travelling Ionospheric Disturbances deployed by the TechTIDE system, will demonstrate the final TechTIDE warning system, will discuss the effects of Travelling Ionospheric Disturbances in technological systems and present mitigation use cases.



The Cultural Center of the Municipality of Athens "Melina Merkouri"



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

This Open Access Newsletter contains description of the TechTIDE project activities and it is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

This publication has been produced with the assistance of the European Union under the Horizon 2020 Grant Agreement 776011 of the COMPET-Space Weather 2017 Call. The content of this publication is the sole responsibility of the TechTIDE consortium and can in no way be taken to reflect the views of the European Union.

More details about the programme can be found at [http://tech-tide.eu/](http://tech-tide.eu) and in the TechTIDE Twitter account https://twitter.com/Tech_TIDE.

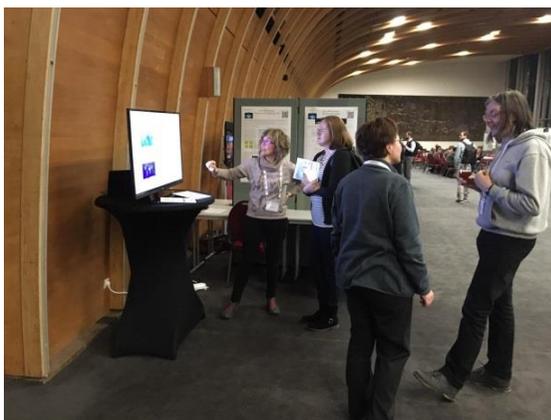
Latest TechTIDE contributions at international conferences

TechTIDE @ AGU Fall Meeting 2019, San Francisco, 9-13 December 2019

Invited talk at AGU Fall Meeting 2019 was 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 Tsagouri, Claudia Borries, Dalia Buresova, Ivan Galkin, J. Miguel Juan, Antoni Segarra and the TechTIDE group

TechTIDE @ 16th European Space Weather Week (ESWW) on 20th November in Liège, Belgium

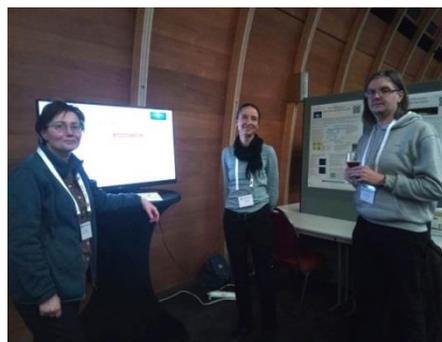
On 20th November TechTIDE was present with a dedicated place on the fair at the European Space Weather Week Fair in Liège, Belgium. The current project achievements were presented by A. Belehaki, T. Verhulst, E. Blanch, C. Borries who represented the TechTIDE group.



In addition, following presentations have been given by members of the TechTIDE team:

Lastovicka, J. "What is happening with

the Sun – and ionospheric response" (oral presentation)



Rusz, J., and J. Chum. "Statistical analysis of medium scale GWs (TIDs) during solar cycle" (p-Poster).

Chum, J., J. Lastovicka, and J. Rusz. "Investigation of ionospheric disturbances

by continuous HF Doppler sounding" (p-Poster)

Curto, J.J., Juan, J.M., Altadill, D., Timoté, C., Blanch, E., Segarra, A. "Detector of Solar flare effects on geomagnetism and ionosphere based on GNSS and ionosonde data".

TechTIDE @ 24th Science Week at the Observatori de l'Ebre, 10 November 2019, Roquetes, Spain

The TechTIDE Ebro Observatory team organized the traditional Open Day at their Research Institute with a conference and a guided tour. The conference was dedicated to disseminate the TechTIDE project. It was titled "The ionosphere: a tool and, at the same time, an obstacle for radio-telecommunications".

This is an activity dedicated to the general public that is performed every year. About 100 people participated in this activity.



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

Publications of journal papers

The following scientific journal papers have been recently published by the TechTIDE team.

Vadym Paznukhov, David Altadill, Miguel Juan, Estefania Blanch (2019): Ionospheric tilt measurements: application to TID climatology study, Radio Science, <https://doi.org/10.1029/2019RS007012>

David Altadill, Antoni Segarra, Estefania Blanch, J. Miguel Juan, Vadym V. Paznukhov, Dalia Buresova, Ivan Galkin, Bodo W. Reinisch and Anna Belehaki (2020): A method for real-time identification and tracking of traveling ionospheric disturbances using ionosonde data: First results, J. Space Weather Space Clim., <https://doi.org/10.1051/swsc/2019042>

Recent collaboration activities

In October 2019 -January 2020, Dr. Buresova from IAP visited the TechTIDE colleagues at SANSa Space Sciences in Hermanus, South Africa. During her visit, she worked on the inter-hemispheric comparison of the ionosphere-plasmasphere system together with the scientists from the SANSa Space Sciences (Dr. J. B. Habarulema, Dr. T. Matamba, Dr. P. J. Cilliers) and scientists from the Belgium Royal Institute Meteorological (Dr. N. Bergeot, Dr. J.-M. Chevalier, Dr. E. Pinat) during visit Joint paper has been prepared and submitted to the EGU 2020 (Session ST3.1) based on the work results.

Latest Achievements

Requirements Analysis

End of 2019, the set of feedback from the two TechTIDE user workshops has been reviewed for additional user requirements. These have been integrated into the TechTIDE final user requirements document. Based on the latest requirements document, the TechTIDE project decides on necessary updates of the TechTIDE warning system.

TID Algorithms Definition

The TechTIDE task was to release algorithms for the TID identification and to implement the resulting products in the TechTIDE warning system. The last remaining task of this work was dedicated to define and implement final TID algorithms. The TID identification codes in TechTIDE have been adjusted since its first release driven by the assessment of the TID impact on aerospace and ground systems to efficiently support specific systems operations (such EGNOS, N-RTK, HF communication and geolocation) and the mitigation of the TID effects. The new products and improvements were encouraged partly by users' recommendations. A large number of analyses have been performed concerning the occurrence of TIDs as detected by the TechTIDE methods that might serve to users to be warned about the largest occurrence of LSTIDs and MSTIDs. The methods products feed the TechTIDE warning system

and establish a pre-operational system whose reliability of detection and to issue warnings of the occurrence of TIDs over the region extended from Europe to South Africa have been demonstrated.

TID Activity Metrics Identification

Even though the activities of the related workpackages finished officially, the TechTIDE analyses of the seasonal dependence of the LSTID parameters still continue. These are intended to be used for scientific publications.

Warning System

The final release of the TechTIDE warning system is under implementation. The database is rebuilt to support APIs which is critical for the mitigation technologies. In addition, the user interface will provide additional functionalities, including users' dashboards, and the easy navigation to the real-time and past activity reports. The final release will be announced through the Twitter within February 2020.

Dissemination, Exploitation and Communication

The TechTIDE team is continuously active in the dissemination of the project results, as is visible in project news. Currently, the team is revising the TechTIDE strategy for dissemination, exploitation and communication, which is going to be submitted end of January.

Consortium Member Presentation

Jürgen Friedrich Wilhelm Watermann (JFWCONSULT)



jfwConsult is a micro-enterprise specialising in scientific and technical consulting to European national and international agencies, institutions and enterprises active in the space research and engineering sector. It provides consulting services in basic and applied space physics with emphasis on the transition of scientific and technical research results to pre-operational and operational space weather services and products. jfwConsult was founded in April 2010 by Dr Jürgen Watermann, a physicist with more than 25 years of experience in basic and applied space research acquired at various first-class laboratories in Europe and North America. As of today Dr Watermann is owner and general manager of jfwConsult.

He contributed to the collection and systematic organisation of the initial user requirements and participated in the compilation of the Deliverable D1.1 "Initial Users' Requirements report", taking advantage of his involvement in several of the ESA SSA SWE projects and his familiarity with the ESA SSA User Requirements Document. jfwConsults' main TechTIDE task is however the study of geomagnetic storm driven large scale TIDs (LS-TIDs) observed simultaneously in the same longitude sector in both hemispheres (more specifically, in the European and

African sectors between about 0 deg and 40 deg eastern longitude). Analysis of 36 storm time intervals (ssc, main phase, recovery) revealed that (i) during the main phases of moderate and strong geomagnetic storms LS-TIDs were almost always observed in both hemispheres, and (ii) LS-TIDs launched in one hemisphere and crossing the (magnetic) equator were found to occur but only rarely. The study is accessible on the TechTIDE website as Deliverable D3.4.



Frederick University (FU)

Frederick University is an energetic and vibrant private university operating in the Republic of Cyprus. FU has a long history of more than 50 years in higher education. The research activity of the Cyprus Ionospheric Research group (established in 2004) lies in the context of the study and mitigation of ionospheric effects on radio systems. The ultimate goal of the group is to conduct studies on ionospheric variability and explore various techniques on monitoring and modeling of ionospheric characteristics in support of systems such as HF communication networks and GNSS. Over the last 14 years, the team has completed 7 nationally funded research projects and has participated in various COST actions. Within the frames of the TechTIDE project FU has developed a near-real time technique to monitor TID activity registered on virtual height variations from ionograms provided by European Digisondes.

Upcoming Events

Planned conference contributions

EGU General Assembly, 3-8 May 2020, Vienna, Austria

ST3.1 session: "Open Session on the Ionosphere and Thermosphere"

"EU HORIZON 2020 project TechTIDE TID identification and monitoring techniques" by David Altadill, Antoni Segarra, Estefania Blanch, José Miguel Juan, Dalia Buresova, Ivan Galkin, Anna Belehaki, Haris Haralambous, Claudia Borries and TechTIDE consortium.

"Large Scale TIDs climatology over Europe using HF Interferometry method" by Estefania Blanch, Antoni Segarra, David Altadill, Vadym Paznukhov, J. Miguel Juan.

"CIR/HSSS-related TID activity and their interhemispheric circulation" (p-Poster) by Buresova, D., J. B. Habarulema, J. Watermann, I. Edemskiy, J. Urbar, D. Altadill, E. Blanch, S. Segara, and Z. Katamzi.

"Interhemispheric comparison of the ionospheric electron density response during geomagnetic storm conditions" by Habarulema, J.B., N. Bergeot, J-M. Chevalier, E. Pinat, D. Buresova, T. Matamba and Z. Katamzi-Joseph.

"Properties and Generation of Large Scale Travelling Ionospheric Disturbances during 8 September 2017"



by Claudia Borries, Arthur Amaral Ferreira, Chao Xiong, Renato Alves Borges, Jens Mielich and Daniel Kouba

The 3rd Users Workshop and Consortium Meeting, 2 to 3 April 2020, Athens, Greece

The 3rd Users Workshop and Consortium Meeting will be held in Athens, Greece from 2 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

Overall coordinator:

Anna Belehaki

National Observatory of Athens (NOA)
Institute for Astronomy, Astrophysics, Space Applications
& Remote Sensing
Vas. Pavlou & I. Metaxa, GR-15 236 Penteli, Greece

Email: techtide.project@gmail.com

Telephone: +30 210 8109192

TechTIDE Homepage: <http://www.tech-tide.eu>

Twitter: @Tech_TIDE https://twitter.com/Tech_TIDE

ResearchGate: <https://www.researchgate.net/project/TechTIDE-2>

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