

# International Reference Ionosphere 2019 Workshop:

Improving real-time ionospheric modelling in the  
European and African Sector

**A COSPAR Capacity - Building Workshop**

*Frederick University, Nicosia, Cyprus*



MINISTRY OF EDUCATION,  
YOUTH AND SPORTS



## ***MONDAY, SEPTEMBER 9***

09:30 – 10:20 Registration and Opening Ceremony

10:20 – 10:40 *COFFEE BREAK* -----

### **Real-Time IRI (Chair: B. Reinisch)**

10:40 – 11:00 International Reference Ionosphere 2019: Standard and Real-Time Solutions  
Dieter Bilitza\* and IRI Working Group

11:00 – 11:20 Global and Local Ionosphere as modeled by IRTAM  
Ivan A. Galkin\*, Bodo W. Reinisch, Artem Vesnin, and Dieter Bilitza

11:20 – 11:40 Climate VTEC maps in cooperation of IGS' GNSS and GIRO sensor networks  
performance overview and plans towards VTEC assimilation into IRI  
Adam Froň<sup>SP\*</sup>, Andrzej Krankowski, Manuel Hernández-Pajares, Ivan Galkin, Dieter Bilitza,  
Bodo Reinisch, Kacper Kotulak, Irina Zakharenkova, Iurii Cherniak, Alberto García-Rigo,  
David Roma Dollase

11:40 – 12:00 On the development of a method for updating the IRI model by means of  
assimilated vTEC measurements from a GNSS receiver network  
A. Pignalberi<sup>SP\*</sup>, J.B. Habarulema, and M. Pezzopane

12:00 – 12:20 Using GNSS TEC to improve IRI model performance  
John Bosco Habarulema\*, Nicholas Ssessanga

12:20 – 14:00 *LUNCH BREAK* -----

### **Topside I (Chair: I. Galkin)**

14:00 – 14:20 Evaluation of IRI-2016 electron density in the topside ionosphere at high  
altitudes using topside sounder data

V. Truhlik\*, D. Bilitza, R.F. Benson, L. Třísková, and D. Saxonbergova

14:20 – 14:40 A solar activity correction term for the IRI topside electron density model  
Dieter Bilitza\* and Chao Xiong

14:40 – 15:00 Assessment of the IRI topside-corrected and NeQuick models by using in situ  
electron density measurements from LEO satellites

Chao Xiong\*, and Dieter Bilitza

15:00 – 15:20 Combination of LEO GPS TEC and radio occultation observations for the  
topside ionosphere specification

Iurii Cherniak\* and Irina Zakharenkova

15:20 – 15:40 *COFFEE BREAK* -----

## **Topside II (Chair: S. Radicella)**

15:40 – 16:00 On the NeQuick model topside assessment using RO-derived data  
B. Nava\* and H. Haralambous

16:00 – 16:20 A new NeQuick topside formulation based on Swarm data  
M. Pezzopane\* and A. Pignalberi

16:20 – 16:40 Study of topside scale height based on NeQuick topside formulation and their comparison with ionogram-derived scale height in 2014 at Ascension Island  
Punyawi Jamjareegulgarn\*, Pornchai Supnithi, Takuya Tsugawa, Kornyanat Hozumi

16:40 – 17:00 Modeling ionospheric electron densities based on EOF decomposition of the COSMIC, CHAMP and GRACE Ne profile occultation data  
Man-Lian Zhang, Libo Liu and Qiaoling Li

17:00 – 17:20 Annual Variations of the Critical Frequency foF2 and TEC at the south hemisphere during 20-24 Solar Minima  
L. Biktash

## ***TUESDAY, SEPTEMBER 10***

## **Plasma Irregularities I (Chair: S. Watanabe)**

09:00 – 09:20 Global Plasma Density Irregularity Distributions Observed by Advanced Ionospheric Probe Onboard FORMOSAT-5 Satellite  
Chi-Kuang Chao\* and Yi-Wun Chen

09:20 – 09:40 Altitude identification of ionospheric disturbance detected in TEC data  
Yoshihiro Kakinami\*, Hiroaki Saito, Tetsuo Yamamoto, Chia-Hung Chen, Masa-yuki Yamamoto, Kensuke Nakajima and Jann-Yenq Liu

09:40 – 10:00 Study on the ionospheric plasma blobs associated to the equatorial plasma bubbles observed at low latitude  
J. K. Shi\*, Z. Wang, G. J. Wang, and X. Wang

10:00 – 10:20 Analysis of equinox equatorial ionospheric irregularity events based on various observation techniques  
S. P. Shang\*, J. K. Shi, G. J. Wang, Z. W. Cheng, Z. Wang, X. Wang

10:20 – 10:40 *COFFEE BREAK* -----

## Plasma Irregularities II (Chair: S.-R. Zhang)

10:40 – 11:00 New IGS ionospheric product - ROTI Fluctuations maps: service, applications and future developments

Andrzej Krankowski, Iurii Cherniak, Irina Zakharenkova, Manuel Hernandez-Pajares, Zishen Li, Ningbo Wang, Yunbin Yuan, Kacper Kotulak, Adam Fron

11:00 – 11:20 Local ionospheric fluctuations climatology study based on ROTI index in comparison to ionosonde measurements

Kacper Kotulak, Adam Fron<sup>SP\*</sup>, Irina Zakharenkova, Iurii Cherniak and Andrzej Krankowski

11:20 – 11:40 Correlation of ROTI and the Range Equatorial Spread-F during Peak of 24th Solar Cycle in 2014 over Equatorial Site in Thailand

P. Thammavongsy\*, P. Supnithi, P. Kenpankho, K. Hozumi and T. Tsugawa

11:40 – 12:00 Comparison of Spread-F probability and the IRI-2016 model during descending solar cycle in 2016 at the equatorial Chumphon station, Thailand

Phimmasone Thammavongsy, Pornchai Supnithi\*, Kornyanat Hozumi, and Takuya Tsugawa

12:00 – 12:20 Studying the ionosphere disturbance with scintillation parameters and its impact on the LEO Satellites within the Geomagnetic storms

Sara R. Aziz<sup>SP\*</sup>, Ayman M. Mahrous and Dalia A.Elfiky

12:20 – 14:00 *LUNCH BREAK* -----

## High Latitudes (Chair: M. Pezzopane)

14:00 – 14:20 Auroral oval and large-scale traveling ionospheric disturbances as derived from GNSS observations

Irina E. Zakharenkova\*, Iurii Cherniak

14:20 – 14:40 Validation of Various Ionospheric Models in the High-Latitudinal Zone  
O. Maltseva, T. Nikitenko

14:40 – 15:00 The asymmetry of mid latitude trough manifestation for north and south hemisphere.

D. Przepórka, B. Matyjasiak\*, H. Rothkaehl, M. Pożoga, Ł. Tomasiak

15:00 – 15:20 Empirical foF2 Model in the Winter High-Latitude Ionosphere Describing the Trough Structure

A. Karpachev\*, M. Klimenko, V. Klimenko, N. Chirik, G. Zhibankov and L. Pustovalova

15:20 – 15:40 *COFFEE BREAK* -----

## Storm Effects (Chair: J.Y. Liu)

15:40 – 16:00 Space weather conditions during the shipwreck of the airship “Dirigibile Italia” in the 1928 polar venture

B. Zolesi\*, M. Pezzopane, C. Bianchi, A. Meloni and Lj.R. Cander

16:00 – 16:20 Investigation of the Travelling Ionospheric Disturbances and their Associated Ionospheric Scintillation During 28th May 2017 Geomagnetic Storm

Ahmed H. Karrar, Hager M. Salah<sup>SP\*</sup>, Nada M. Ellahouny

16:20 – 16:40 Response of low-latitude Hainan ionospheric plasma drifts to geomagnetic activities

Wang Guojun\*, SHI Jiankui, SHANG Sheping

16:40 – 17:00 STORM-3 Option for IRI-Plas Model

Tamara Gulyaeva\*, Haris Haralambous and Ljubov Pustovalova

17:00 – 17:20 Climatology of ionosphere-thermosphere coupling above the Oukaimeden observatory: effects of extreme solar events.

A. Loutfi<sup>SP\*</sup>, A. Bounhir and F. Pitout

19:00 – 21:00 **Social Event**

*Opening Ceremony for ESA Space Weather Exhibition and talk by Dr. Stamatios Krimigis on «Odyssey in Space-1977-2019: The Epic journey of Voyager 1 and 2 from Earth to the Galaxy». Light refreshments and snacks will be served after the talk. IRI workshop participants are invited.*

## WEDNESDAY, SEPTEMBER 11

### GNSS and TEC 1 (Chair: B. Nava)

09:00 – 09:20 Real-Time Ionospheric Monitoring: assessment and combination of IGS Global Ionospheric Maps and multi-TID tsunami signatures

M. Hernández-Pajares\*, D. Roma-Dollase, A. Garcia-Rigo, H. Yang, Z. Li, N. Wang, Y. Yuan, D. Laurichesse, A. Blot and E. Monte

09:20 – 09:40 Performance evaluation of IRI-2016 with GPS-derived TEC at the meridian 110° E in China in 2014

Q. Wan\*, J. Li, G. Ma, X. Wang, W. Lu, T. Maruyama, J. Fan, J. Zhang

09:40 – 10:00 Ionospheric Monitoring over Africa from Space-based GNSS radio occultation

M. Moses<sup>SP\*</sup>, J. D. Dodo, L. M. Ojigi, K. Lawal

10:00 – 10:20 Real-time GPS TEC Bias Estimation  
Prasert Kenpankho\* and Pornchai Supnithi

10:20 – 10:40 *COFFEE BREAK* -----

## GNSS and TEC II (Chair: M. Hernández-Pajares)

10:40 – 11:00 GNSS and Ionospheric studies  
Christine Amory-Mazaudier

11:00 – 11:20 Ionospheric Total Electron Content at low latitude  
Hammou Ali O<sup>SP\*</sup>, N. Zaourar, R. Fleury, C. Amory-Mazaudier

11:20 – 11:40 Ionospheric total electron content (TEC) daily variability prediction model with Bayesian inference  
Geletaw B. <sup>SP\*</sup>, Melessew N., Abdu M.

11:40 – 12:00 Assimilate the ionospheric electron density over the American Sector by using the ISRs and Swarm Satellites data: comparing with IRI model results during the 7th of September 2017 Geomagnetic storm  
O. A. AbuElezz<sup>SP\*</sup>, A.M. Mahrous, P. Cilliers, R. Fleury and A. M. Yassen

12:00 – 12:20 Regional ionospheric total electron content over Africa from ground-based GNSS observations  
M. Moses<sup>SP\*</sup>, J. D. Dodo, L. M. Ojigi, K. Lawal

12:20 – 14:00 *LUNCH BREAK* -----

14:00 – 22:00 *Excursion to Historic Site at Limassol and Cultural Evening/Dinner*

## ***THURSDAY, SEPTEMBER 12***

### F-peak Mapping (Chair: J.B. Habarulema)

09:00 – 09:20 Description of the Behaviour of Minimum and Maximum Daily Values of foF2 and Comparison Against IRI predictions.  
Eduardo Araujo-Pradere\*, Patrick Dandenault

09:20 – 09:40 Daytime mid-latitude F2-layer Q-disturbances: A formation mechanism  
L.Perrone\* and A. Mikhailov

09:40 – 10:00 Factors Affecting Ionospheric Delayed Response to Solar EUV Variability  
Rajesh Vaishnav<sup>SP\*</sup>, Christoph Jacobi, Jens Berdermann, Mihail Codrescu, and  
Erik Schmölder

10:00 – 10:20 Data mining on F2 peak over South Africa  
Erika Gularte\*, Gustavo Baume and Daniel D. Carpintero

10:20 – 10:40 *COFFEE BREAK* -----

## Equatorial Ionization Anomaly (Chair: P. Coïsson)

10:40 – 11:00 Equatorial Anomaly Structure under High Solar Activity  
A. Karpachev

11:00 – 11:20 The Merging Height of Equatorial Ionization Anomaly from COSMIC  
Observations: its seasonal, longitudinal, and local time variations  
He Huang<sup>SP\*</sup>, Xian Lu, Libo Liu, Haonan Wu, and Qiaoling Li

11:20 – 11:40 Estimating the daytime vertical  $E \times B$  drift velocities in the F-region of the  
equatorial ionosphere using the IEEY and AMBER magnetic data in West Africa  
A. A. Diaby<sup>SP\*</sup>, V. Doumbia, O. K. Obrou, F. O. Grodji, Z. Tuo, K. N'guessan and E.  
Yizengaw

11:40 – 12:00 Ionospheric empirical modeling based on empirical orthogonal function (EOF)  
analysis  
Shunrong Zhang

12:00 – 12:20 Modelling of ionospheric profile parameters using EEJ current and comparison  
with IRI-2016  
S. A. Bello\*, M. Abdullah, N. S. A. Hamid, B.W. Reinisch, A. Yoshikawa

12:20 – 14:00 *LUNCH BREAK* -----

## E-Region and Bottomside (Chair: J. K. Shi)

14:00 – 14:20 The role of the thickness parameters in near real time empirical modeling of  
ionospheric electron density  
S. M. Radicella\*, K. Alazo-Cuartas, Y. Migoya Oruè and A. Kashcheyev

14:20 – 14:40 An improved ionosonde-based parameter to assess Sporadic *E* layer intensities. A  
simple fact overlooked.  
Christos Haldoupis (presented by Haris Haralambous)



14:40 – 15:00 Collocated bottomside electron density profiles from radio occultation missions and Digisondes and their comparison with IRI  
Haris Haralambous\* and Theodoros Leontiou

15:00 – 15:20 Assessing 0+ whistlers in ELF domain to constrain the ionosphere along the propagation path: initial results  
P. Coisson\*, G. Hulot, R. Madelon, P. Vigneron, O. Bonnot, V. Truhlik, D. Buresova, J. Chum, J. Mlynarczyk, A. Kulak and P. Rzonca

15:20 – 15:40 *COFFEE BREAK* -----

## Plasmasphere Modelling (Chair: D. Bilitza)

15:40 – 16:00 Plasmasphere Modeling  
Shigeto Watanabe\*, Yoshiya Kasahara, Atsushi Kumamoto, Ayako Matsuoka, Yoshizumi Miyoshi, Iku Shinohara, Fuminori Tsuchiya

16:00 – 16:20 Coupled modelling of the atmosphere/ionosphere system with the whole atmosphere model EAGLE  
Timofei Sukhodolov\*, Fedor Bessarab, Berndt Funke, Maxim V. Klimenko, Vladimir V. Klimenko, Dmitry V. Kulyamin, Katharina Meraner, Eugene Rozanov

Student Team Presentations:

16:20 – 16:30 Team 1  
16:30 – 16:40 Team 2  
16:40 – 16:50 Team 3  
16:50 – 17:00 Team 4  
17:00 – 17:10 Team 5  
17:10 – 17:20 Team 6  
17:20 – 17:30 Team 7

19:00 – 21:00 **Social Event:** *An evening getting to know Nicosia - sponsored by the Cyprus Space Exploration Organisation*

***FRIDAY, SEPTEMBER 13***

## Temperatures, Ion composition and Ion Drift (Chair: E. Araujo-Pradere)

09:00 – 09:20 Global empirical modeling of ion temperature for the International Reference Ionosphere  
V. Truhlik\*, D. Bilitza, P.G.Richards, D. Kotov, L. Třísková, and M. Shulha



09:20 – 09:40 East-West Difference of Electron Temperature in the Mid-latitudes Topside Ionosphere

Han Ma<sup>SP\*</sup>, Libo Liu

09:40 – 10:00 Propositions on improvement of the topside ion composition model in IRI for low solar activity conditions

Maryna Shulha<sup>SP\*</sup>, Dmytro Kotov, Vladimir Truhlik, Phil Richards, Oleksandr Bogomaz

10:00 – 10:20 Progress towards data improvisation for low latitude vertical drifts modeling

John Bosco Habarulema\*, Makhosonke B. Dubazane, Zama T. Katamzi-Joseph, and Jean

10:20 – 10:40 *COFFEE BREAK* -----

## New Inputs for IRI I (Chair: Haris Haralambous)

10:40 – 11:00 Ionospheric observations of FORMOSAT-3/COSMIC and FORMOSAT-7/COSMIC-2

J.Y. (Tiger) Liu

11:00 – 11:20 The ionospheric effects and impact on GNSS navigation system positioning of the September 2017 solar flare

I.Shagimuratov\*, A. Krankowski, I. Zakharenkova, N. Tepenitzina, G.Yakimova

11:20 – 11:40 Equatorial ionospheric electrodynamics during solar flares

Ruilong Zhang\* and Libo Liu

11:40 – 12:00 Lofar as new tool for ionospheric model validation

Mariusz Pozoga\*, Barbara Matyjasiak, Katarzyna Budzińska, Hanna Rothkaehl and Lukasz Tomasik

12:00 – 12:20 Seasonal variation of plasma bubbles during solar cycle 23 - 24 over the Brazilian equatorial region

Ebenezer Agyei-Yeboah\*, Igo Paulino, Amauri Fragaso de Medeiros, Ricardo Arlen Burit, Ana Roberta Paulino, Patrick Essien, Hisao Takashi, Cristiano Max Wrasse

12:20 – 14:00 *LUNCH BREAK* -----

## New Inputs for IRI II (Chair: V. Truhlik)

14:00 – 14:20 Space Weather Research in Egypt

O.A.AbueElezz<sup>SP\*</sup>, A.M.Mahrous

14:20 – 14:40 Longitudinal variations of ionospheric and thermospheric parameters for summer noontime conditions: Dependence on solar activity

A. Mikhailov\* and L. Perrone

14:40 – 15:00 AI algorithms in ionospheric prediction and forecasting  
Ljiljana R. Cander\* and Bruno Zolesi

15:00 – 15:20 Ionosondes input data quality - description of algorithm prepared for the  
PECASUS project.  
Lukasz Tomasik\*, Mariusz Pozoga, Anna Świątek, Leszek Jaworski, and Barbara Matyjasiak

15:20 – 15:40 *COFFEE BREAK* -----

15:40 – 16:40 FINAL DISCUSSION – IRI next version -

16:40 – 16:50 Students Receive their Certificates

16:50 – 17:10 Awarding Prize for Best Teams

17:10 Workshop concludes

## Poster Session (Chair: C. Oikonomou)

P01 - Preliminary Performance Evaluation of IRI-2016 Model Using IRNSS Data over Low  
Latitude Stations  
D.Kavitha, Perumalla Naveen Kumar\*, N.Santhosh

P02 - Improvements and validation of the IRI UP method under moderate, strong, and severe  
geomagnetic storms  
M. Pietrella\*, A. Pignalberi and M. Pezzopane

P03 - Developing an artificial neural network model for NmF2 and hmF2 forecast over Jeju  
station (126.30°E, 33.43°N)  
SuIn Moon<sup>SP\*</sup>, YongHa Kim, JeongHeon Kim, Se-Heon Jeong, YongSil Kwak, JongYeon  
Yun, and WooYeon Park

P04 - Low-latitude Ionosphere Response to Severe Geomagnetic Storms – the Comparison of  
Topside Sounding Data and IRI Simulations  
Victor H. Depuev\*, Anna H. Depueva

P05 - Comparison of vTEC retrieve from FORMOSAT-3/COSMIC RO profiles with Jason-1  
measurements  
Ayelén E. Volk<sup>SP\*</sup>, Claudio A. Brunini

P06 - Study of ionospheric disturbance associated to Geomagnetic variation at low latitudes during the storm of December 20, 2015

A.M. Mahrous, I.Fathy and Yara Ahmed<sup>SP\*</sup>

P07 - Validation of a new NeQuick topside formulation based on Swarm data

I. Cherniak\*, A. Pignalberi, M. Pezzopane, H. Haralambous, I. Zakharenkova

P08 - The Correlative Variation of Ionospheric EIA and EEJ in East-Asia and American Sectors

D. Zhang\*, J. Liu, Y. Hao, Z. Xiao

P09 - Manually scaling one year ionograms measured by Jeju ionosonde in 2012

Se-Heon Jeong<sup>SP\*</sup>, Yong Ha Kim

P10 - Database solutions to handle data for ionospheric model verification

Mariusz Pozoga\*, Lukasz Tomasik and Barbara Matyjasiak

P11 - Morphology of the responses of GPS TEC within the African equatorial ionization anomaly (EIA) region to intense geomagnetic storms during the Ascending phase of solar cycle 24

Oyedokun O. J, Akala A. O., Oyeyemi E.O.

P12 - Observed Discrepancies in International Reference Ionosphere Model Predictions at a Low-Latitude Nigerian Station

Ayomide O. Olabode\* and Emmanuel A. Ariyibi

P13 - Latitudinal variations of GPS TEC with IRI-2012 and IRI 2016 model during a high solar activity period

R. Atulkar\* and P.K. Purohit

P14 - The type III Solar Radio bursts of September 2017 and their associated Ionospheric impact

T. Ndacyayisenga\*, J. Uwamahoro and P. Mungufeni

P15 - Estimation of ionospheric critical plasma frequencies from GNSS-TEC measurements using artificial neural networks

V. Otugo

P16 - Characterization of GPS-TEC over the transition region from low to midlatitude regions during the years 2014 – 2018

Patrick Sibanda

P17 - Latitudinal Dependence of Occurrence of Ionospheric Irregularities for Different Seasons

L. Biktash

P18 - Study of the variability of the total electronic content (TEC) in the intertropical

African zone according to the solar and geomagnetic parameters  
R. J. Nsonga Oumba\*, J. B. Dinga and C. B. Biona

P19 - Correlation between temperature and rainfall over the Democratic Republic of the Congo  
from 1961 to 2015  
Balue Kumona Yannick

P20 - Denoising of Scintillated GNSS signal based on CEEMD-MFDFA Method  
Wasiu A. Ahmed\*, Ganiy I. Agbaje, Lukman A. Isiaka and Hamed O. Jimoh

P21 - Performance evaluation of IRI and IRI-Plas models over the African low-latitude region  
S. J. Adebisi\*, I. A. Adimula, O. A. Oladipo, and B. W. Joshua

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\* presenting author  
<sup>SP</sup> Student Participant