International Reference Ionosphere 2019

A COSPAR Capacity - Building Workshop

Training Week, September 2 – 6, 2019

Frederick University, Nicosia, Cyprus

SUNDAY (1 September):

Arrival

MONDAY (2 September):

08.15-09:00 Registration
09:00-09:30 Opening Ceremony
09:30-10:30 Ionosphere-An introduction (B. Reinisch)

10:30-11:00 Coffee/Tea

11:00-12:00 IRI-Introduction and open problems (D. Bilitza)
12:00-12:30 IRIweb and related services (D. Bilitza)

12:30-14:00 Lunch

14:00-14:15 Forming teams and assigning research tasks
14:15-15:20 Team work with support from advisor and other lecturers

15:20-15:40 Coffee/Tea

15:40-17:00 Team work with support from advisor and other lecturers

TUESDAY (3 September):

09:00-09:45 Ionosondes and the measurements they take (B. Reinisch)
09:45-10:30 GIRO and GAMBIT: access to ionosonde data (I. Galkin)

10:30-11:00 Coffee/Tea

11:00-11:45 ESA Space Weather Activities (A. Glover)
11:45-12:30 Space Weather applications: guidelines for users and developers (F. Da Dalt)

12:30-14:00 Lunch

14:15-15:20 Team work with support from advisor and other lecturers

15:20-15:40 Coffee/Tea

15:40-17:00 Team work with support from advisor and other lecturers

WEDNESDAY (4 September):

09:00-10:00 GNSS data and ionospheric studies (A. Krankowski)
10:00-10:30 Access to GNSS data (A. Krankowski)

10:30-11:00 Coffee/Tea

11:00-11:45 Radio Occultation and access to COSMIC data (H. Haralambous)
11:45-12:30 IRTAM and Real-Time IRI (I. Galkin)

12:30-14:00 Lunch

14:15-15:20 Team work with support from advisor and other lecturers

15:20-15:40 Coffee/Tea

15:40-17:00 Team work with support from advisor and other lecturers

THURSDAY (5 September):

09:00 -10:00 Coupling between ionosphere and thermosphere (S. Watanabe)
10:00 -10:30 Plasmasphere modelling (S. Watanabe)

10:30-11:00 Coffee/Tea

11:00-12:00 Incoherent scatter radar and ionospheric studies (S. R. Zhang)
12:00-12:30 Access to incoherent scatter data (S. R. Zhang)

12:30-14:00 Lunch

14:15-15:20 Team work with support from advisor and other lecturers

15:20-15:40 Coffee/Tea

15:40-17:00 Team work with support from advisor and other lecturers

FRIDAY (6 September):

09:00-09:30 Science Talk: Real-time Modelling of the Vertical Total Electron Content (VTEC) Using B-splines (A. Goss et al.)
09:30-10:30 Representation of plasma temperatures in IRI (V. Truhlik)

10:30-11:00 Coffee/Tea

11:00 – 11:45 Representation of ion composition in IRI (V. Truhlik)

11:45 – 12:00 Dry run of student presentation – Team 1
12:00 – 12:15 Dry run of student presentation – Team 2
12:15 – 12:30 Dry run of student presentation – Team 3

12:30-14:00 Lunch and Group-photo

14:00 – 14:15 Dry run of student presentation – Team 4
14:15 – 14:30 Dry run of student presentation – Team 5
14:30 – 14:45 Dry run of student presentation – Team 6
14:45 – 15:00 Dry run of student presentation – Team 7
15:00 – 15:15 Dry run of student presentation – Team 8

15:20-15:40 Coffee/Tea

15:40-17:00 Team work with support from advisor and other lecturers

List of Student Problems

Problem A: Investigate storm effects on foF2 at a location in the Northern hemisphere and one from a similar latitude region in the Southern hemisphere. What are the differences? Compare with IRI and IRI-Real-Time predictions. Use the 17-18 March 2015 (St. Patrick's Day) storm or select your own storm event. DATA: GIRO-Digisonde; MODEL: CCMC-IRIweb, Gambit-IRTAM; ADVISOR: I. Galkin

Problem B: Study the relationship between electron density (N_e) and electron temperature (T_e) in the middle ionosphere with Swarm and Incoherent Scatter data. Investigate how well IRI represents the relationship that you find between these parameters. IRI includes an option to use the anti-correlation between N_e and T_e to get near real-time T_e values if measured N_e values are available. Assess the reliability of this option based on your study results. DATA: Swarm, Madrigal-IS; MODEL: CCMC-IRIweb; ADVISOR: S. Watanabe

Problem C: Study the upper transition height. This is the height where the O^+ density has dropped to 50% of the total ion density with the other 50% light ions (H^+ and He^+). Use Arecibo Incoherent Scatter (IS) data and compare with the prediction by IRI using the different topside ion density options. This parameter is not currently provided by IRI, so make suggestions how it could and should be included as an output parameter. DATA: Madrigal-IS; MODEL: CCMC-IRIweb; ADVISOR: S.-R. Zhang

Problem D: IRI-2016 includes three options for the height of the F2 peak, hmF2. Evaluate the different options with digisonde hmF2 measurements. Look into using also other data sources, like incoherent scatter radar observations or COSMIC radio occultation data. Determine which IRI option performs best for high and which for low solar activity. DATA: GIRO-Digisonde, COSMIC, Madrigal-IS; MODEL: CCMC-IRIweb; ADVISOR: D. Bilitza

Problem E: The Swarm satellites are measuring electron density and temperature. Help the ongoing assessment and validation of these data by comparing with IRI predictions using the different IRI options for these parameters at the satellite orbit altitudes. Explore existing validation studies and how much your results conform with these earlier results. Of particular interest is the Equatorial Ionization Anomaly region. DATA: Swarm; MODEL: CCMC-IRIweb; ADVISOR: V. Truhlik

Problem F: Study the ion temperature (T_i) climatology in the middle ionosphere with incoherent scatter (IS) data. How does T_i change with altitude, latitude, and local time and how well is this variability represented by IRI. Investigate the availability of additional data sources for this parameter. DATA: Madrigal-IS; MODEL: CCMC-IRIweb; ADVISORS: S.-R. Zhang and V. Truhlik

Problem G: Study the extend of the Equatorial Ionization Anomaly (EIA) in Local Time with GPS TEC data. For what time period are separate cusps observed on both sides of the magnetic equator and when a single maximum at the magnetic equator. Compare with IRI predictions. DATA: IGS-TEC; MODEL: CCMC-IRIweb; ADVISOR: A. Krankowski

Websites for getting data and model values:

IRI model values using IRIweb at
https://ccmc.gsfc.nasa.gov/modelweb/models/iri2016_vitmo.php.
(Questions: D. Bilitza)

Incoherent Scatter data from Madrigal (http://madrigal.haystack.mit.edu/madrigal/)
(Questions: S.-R. Zhang)

IRI real-time foF2 from the site http://giro.uml.edu/IRTAM/ (Questions: I. Galkin)

Digisonde data from DIDBase at the Global Ionosphere Radio observatory (http://giro.uml.edu) (Questions: I. Galkin)

Swarm data from the Swarm data center at ESA at https://earth.esa.int/web/guest/swarm/data-access (Questions: V. Truhlik)

IGS-TEC data from NASA CDDIS archive at https://cddis.nasa.gov/Data_and_Derived_Products/ (Questions: A. Krankowski)

IGS-TEC movie display on NASA CDAWeb at https://cdaweb.gsfc.nasa.gov/ (Questions: D. Bilitza)

COSMIC F-peak and topside electron densities for the COSMIC data center at http://cdaac-www.cosmic.ucar.edu/cdaac/products.html (Questions: H. Haralambous)

A few additional notes:

The first step is to develop a study plan with the different tasks to be accomplished and the assignments for different team members. Consult with the problem advisor on this step. Please contact the data/model source advisor (listed in the section "Websites for getting data and model values") with questions you may have; he may have a faster way to get to the data that you need for your study. Please note that you are encouraged to use additional data sources if you have access to these data sources and if they are beneficial for solving your problem task. Plan on meeting as team every day and review and discuss the different tasks and how far team members have succeeded. Please keep plots and tables that you produce from early on for your final presentation. Towards the end of the first week sit down as team and discuss the layout of your final PowerPoint presentation. Plan on having about 10 slides maximum that include slides to cover the following important items: (1) state the problem, (2) explain your methodology to solve the problem, (3) explain the data and model used, and (4) your results and interpretation. Discuss with your problem advisor and benefit from the feedback that you receive during the dry runs on Friday of the first week.

Lecturers:

Dieter Bilitza (George Mason University and NASA Goddard Space Flight Center, USA)

Bodo Reinisch (University of Massachusetts Lowell and Digisonde International Inc., USA)

Ivan Galkin (University of Massachusetts Lowell, USA)

Vladimir Truhlik (Institute of Atmospheric Physics, Prague, Czech Republic)

Shigeto Watanabe (Hokkaido University, Sapporo, Japan)

Shunrong Zhang (MIT, Millstone Hill, USA)

Andrzej Krankowski (University of Warmia and Mazury, Olsztyn, Poland)

Alexi Glover (ESA, ESOC, Darmstadt, Germany)

Federico Da Dalt (Rhea for ESA, Darmstadt, Germany)

Haris Haralambous (Fredrick University, Nicosia, Cyprus)