

COSPAR Session C4.1 Report

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The session C4.1 entitled 'Improved Description of the Ionosphere Through Data Assimilation' was organized by the COSPAR/URSI Working Group on the International Reference Ionosphere. The 2-day event was divided into sessions on Real-Time IRI and Data assimilation, Assessment of Model Performance, Plasmasphere and Topside in IRI, New Inputs and Improvements, and Posters. The meeting was well attended with 45-65 people throughout. Of the 24 oral papers and 5 posters originally submitted for the session 20 orals and 3 posters were presented at the meeting.

Good progress is made in developing and improving the Real-Time IRI with emphasis on the F-region and assimilation of ionosonde data (IRTAM, I. Galkin, UML/USA). Use of the model to support International Space Station (ISS) Program Safety was reported by W. Hartman (Boing Comp., USA). The next challenge now is the assimilation of GNSS data into the Real-Time IRI and different approaches were discussed in presentations by A. Fron (UWM/Poland), T. Gulyaeva (IZMIRAN/Russia), and B. Nava (ICTP/Italy). The IRI team is working closely with the International GNSS (IGS) Iono Group which publishes the IGS standard $vTEC$ maps. The goal is to use relative TEC changes to update IRI topside parameters to real-time conditions. Another approach is the use of effective ionospheric and solar indices to update the IRI model based on foF2 and M(3000)F2 data from ionosondes (M. Pezzopane, INGV/Italy).

Performance evaluation of the IRI model with different data sources was the topic of presentations by I. Cherniak (UCAR/COSMIC, USA) using Radio Occultation and topside GPS TEC measurements, by I. Zakharenkova (UWM, Poland) based on Jason-2/Jason-3 altimeter data, by Feza Arikan (Hacettepe U, Turkey) based on ionosonde data, by Joseph Minow (MSFC, USA) using in situ measurements from the Floating Potential Measurement Unit (FPMU) on the International Space Station and COSMIC radio occultation measurements, and by H. Haralambous (Frederick U, Cyprus) focusing on the E- and F1-layer with measurements of the Cyprus Digisonde. These presentations provided valuable results for future improvements of the IRI model. Particularly, in the topside ionosphere IRI shows some shortcomings in describing the solar cycle variations. First improvements were presented by D. Bilitza (GMU/USA) for the topside electron density based on Alouette/ISIS topside sounder data and CHAMP, Grace and Swarm in situ data and by V. Truhlik (IAP, Czech Republic) for the electron and ion temperatures.

Several presentations reported on new inputs for IRI including a modelling approach using B-splines for high-resolution global and regional $vTEC$ representation (A. Goss, DGFI/Germany), a model for the electron density in the plasmasphere based on Akebono data (S. Watanabe, Hokkaido U, Japan), and a high-latitude electron density model based on over 28 million ionosonde and radio occultation observations (D. Themens, U New Brunswick, Canada).

The session was followed by the IRI Working Group meeting on Wednesday evening that was attended by 22 members. Regarding the next release of the IRI model it was decided to include the new FIRI model for the electron density in the D-region (M. Friedrich, TU Graz, Austria), the storm-time model for hmF2 of D. Altadill (Ebro Observatory, Spain), an improvement of the topside electron density model (D. Bilitza, UML/USA) and Vary-Chap (M. Osman, UML) and/or Gulyaeva (IZMIRAN, Russia) as additional topside options, and the new ion temperature model presented by V. Truhlik (IAP/Czech Republic). It was also decided to provide IRI users with the option to extrapolate the IRI topside profile to plasmaspheric heights for comparison of IRI-TEC with GNSS TEC data.

New officers were elected for the next 4-year service period: D. Altadill (Ebro Observatory, Spain; Chair) (re-elected), I. Galkin (UML, USA; Vice-Chair COSPAR), A. Krankowski (UWM, Poland; Vice-Chair URSI). COSPAR officers are elected for 4-year time periods and can serve for 8 years. The Working Group thanked V. Truhlik (IAP, Czech Republic) and S. Watanabe (Hokkaido U, Japan), who had reached the 2-term limit, for their 8 years of excellent support for the IRI project. Two new members were elected to join the IRI Working Group: D. Themens (U New Brunswick, Canada) and I. Cherniak (UCAR/COSMIC, USA). Both are involved in modelling and model assessment efforts of great value for the IRI project. A presentation was given by H. Haralambous (Frederick U, Cyprus) with general and logistics information about his university which will be the site of the IRI COSPAR Capacity Building Workshop in September 2019.