Opportunity Title: Space Weather Global Ionosphere TEC Accuracy
Opportunity Reference Code: IC-16-26

Organization Office of the Director of National Intelligence (ODNI)

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How to Apply **Create and release your Profile on Zintellect** – Postdoctoral applicants must create an account and complete a profile in the on-line application system. **Please note: your resume/CV may not exceed 2 pages.**

Complete your application – Enter the rest of the information required for the IC Postdoc Program Research Opportunity. The application itself contains detailed instructions for each one of these components: availability, citizenship, transcripts, dissertation abstract, publication and presentation plan, and information about your Research Advisor co-applicant.

Application Deadline 4/15/2016 6:00:00 PM Eastern Time Zone

Description Knowledge of the ionosphere and especially the total electron content is currently a limiting factor in HF (3-30MHz) Communications, Over the Horizon Radar, Signals and Signatures Measurement Intelligence, and Electronic Warfare and Electronic Protection. Objective level requirements have been established to encourage S&T R&D investment in pushing the limit on how accurate we can measure and forecast TEC globally. Radio wave propagation effects in refractive beam bending, attenuation, and polarization rotation are heavily impacted by errors in the knowledge of TEC. If TEC accuracy and resolution were improved significantly (e.g. 1 TECU 2 sigma, with 1 degree latitude/longitude resolution, in 10km 3D altitude bins) it would enable significant improvement in the performance of several types of low frequency RF systems and applications.

Currently terrestrial ionosonde, terrestrial & space based precision navigation & timing receiver occultation measurements, magnetic field, and solar measurements from multiple sensors are fed into the USAF Weather Service (AFWA) space weather forecast models (GAIM). AFWA processes the senor data and utilizes multiple physical models to provide space weather customers. Space weather customers use differing models to predict and correct ionospheric effects on radio wave refractive propagation path/ray trace, attenuation, polarization, and frequency scintillation effects. The accuracy, confidence, and resolution of the current space weather process significantly limit some RF applications. The current methods for predicting TEC have infrequently been measured and performance varies by geographic location, location and frequency and latency of sensor data, models used and latency in updates, and the models used in ray trace/propagation effects prediction and/or correction.

Research is needed to address the proper methodology to verify accuracy/confidence in TEC predictions and wave propagation effects, and how improvements to sensing, modeling, and infrastructure would improve overall global TEC accuracy, confidence, and resolution. Prior independent studies of specific geospatial regions have shown significant error sources in TEC exist routinely (3 to 5 TECU typical).These efforts spot checked

performance and were discontinued. The space weather community has no standard accepted method to routinely measure and understand the accuracy of the current TEC forecast data on a global basis that can serve to guide how best to best utilize and improve global TEC data. The relative value of various types of sensor data, software models, and/or IT infrastructure on overall TEC prediction performance is poorly understood end to end. Developing an understanding of current performance and how each element contributes or hinders performance would be of significant value in identifying the value of potential improvements in any specific end to end element of TEC forecasting. This effort is intended to provide the IC better knowledge and insight into how to improve low frequency RF mission application performance through how to improve TEC forecasting accuracy.

Example Approaches

Proposals may be focused on how to improve knowledge and understanding of:

- The current space weather predictive model TEC accuracy, resolution, and confidence;
- The limits in accuracy/confidence and resolution of existing or postulated space weather sensors or sensing methods (e.g. occultation, ionosonde, UV etc.); and how these may be improved;
- The limits in accuracy/confidence and resolution of complex models that provide forecast of TEC data from sensor input; and how these may be improved;
- How existing communications, networks, data, and compute and storage infrastructure may limit accuracy/confidence and resolution; and how these may be improved;
- Other innovative concepts to understand and improve the accuracy, confidence, and resolution of global TEC.

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Business** (11 👁)
  - **Chemistry and Materials Sciences** (12 👁)
  - **Communications and Graphics Design** (6 👁)
  - **Computer, Information, and Data Sciences** (16 👁)
  - **Earth and Geosciences** (21 👁)
  - **Engineering** (27 👁)
  - **Environmental and Marine Sciences** (14 👁)
  - **Life Health and Medical Sciences** (45 👁)
  - **Mathematics and Statistics** (10 👁)
  - **Other Non-Science & Engineering** (13 👁)
  - **Physics** (16 👁)
  - **Science & Engineering-related** (1 👁)
  - **Social and Behavioral Sciences** (28 👁)