

Opportunity Title: A New Description of Ionospheric Variability Driven by Dynamics from the Lower Atmosphere

Opportunity Reference Code: ICPD-2022-28

Organization Office of the Director of National Intelligence (ODNI)

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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.

Additional information about the IC Postdoctoral Research Fellowship Program is available on the program website located at: <https://orise.orau.gov/icpostdoc/index.html>.

If you have questions, send an email to ICPostdoc@orau.org. Please include the reference code for this opportunity in your email.

Application Deadline 2/28/2022 6:00:00 PM Eastern Time Zone

Description **Research Topic Description, including Problem Statement:**

- The Earth's Ionosphere effects radio wave propagation through the atmosphere. Various applications depend on reliable model predictions of ionospheric parameters in order to account for the refracting and retarding effects of the ionosphere on radio waves. Often, the day to day (and even hourly) variability of these parameters are not described by these models, placing a lower limit of ambiguity on the reliability of these model predictions. The variability in these ionospheric parameters is driven by a range of effects such as solar activity, geomagnetic activity, and dynamics from the lower atmosphere (e.g., gravity waves, winds, lightning). Modeling effects of the lower atmosphere on the ionosphere are a topic of growing research interest as new data and observations are continually made available.
- This topic seeks to develop a quantitative description of the ionosphere's variability using input from the lower atmosphere. At a minimum, the description should be derived using a combination of observational data and model predictions. Both the spatial and temporal resolution of the description can be determined based on data availability. The description should be demonstrated

Example Approaches:

There are a number of ways to approach this research problem; versatile approaches are encouraged. Researchers could focus on establishing a relationship between observable parameters that describe large scale thunderstorm activity and those that describe the ionosphere (such as total electron content, F2 layer critical frequency, stroke count or wind speed). The relationship and parameters could then be used to compute an index which describes the variability of one or more ionospheric parameters. Alternatively, researchers can create an empirical model. The model could use a combination of meteorological and geophysical parameters as input

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to then specify the expected variability in Ionospheric parameters for a given region of the atmosphere.

Relevance to the Intelligence Community:

Improved modeling of the Earth's Ionosphere helps to better account for radio frequency propagation effects. These effects are particularly important for improving satellite communications, remote imagery processing, GPS acquisition, and geolocation accuracy. A specification of Ionospheric variability would provide an additional layer of confidence in these model predictions of Ionospheric parameters as well as provide operational situational awareness to users.

Key Words: Ionosphere, Total Electron Content, foF2, Critical Frequency, Peak Density, Peak Density Height, foE, hmF2, hmE, Lightning, Stroke Count, Gravity Waves, Storms, Thunderstorms, Winds, Thermosphere, Troposphere, IRI, IRTAM, Data Assimilation, Empirical Modeling, Atmospheric Science, Indices, Space Weather, Equatorial Ionosphere, Meteorology

Qualifications **Postdoc Eligibility**

- U.S. citizens only
- Ph.D. in a relevant field must be completed before beginning the appointment and within five years of the application deadline
- Proposal must be associated with an accredited U.S. university, college, or U.S. government laboratory
- Eligible candidates may only receive one award from the IC Postdoctoral Research Fellowship Program

Research Advisor Eligibility

- Must be an employee of an accredited U.S. university, college or U.S. government laboratory
- Are not required to be U.S. citizens

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.

- **Discipline(s):**
 - **Chemistry and Materials Sciences** ([12](#))
 - **Communications and Graphics Design** ([2](#))
 - **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** ([2](#))
 - **Physics** ([16](#))
 - **Science & Engineering-related** ([1](#))
 - **Social and Behavioral Sciences** ([27](#))