NIMO
Next generation Ionosphere Model for Operations

AT A GLANCE

What is it?

NIMO is an ionospheric data assimilation system and physics-based forecast model that provides global 3D specifications of electron density at a 15-minute cadence and regularly updated 24-hour climatological forecasts. The model will transition to operations at Fleet Numerical Meteorology and Oceanography Center (FNMOC) in FY23.

How does it work?

Using the Ionosphere Data Assimilation 4D (IDA4D), NIMO assimilates a wide variety of ionospheric datasets including slant TEC from ground-based GPS receivers, ionosonde electron density profiles, and radio occultation data from COSMIC-2. NIMO is also capable of ingesting ultraviolet (UV) measurements of airglow. The SAMI3 (SAMI3 is Also a Model of the Ionosphere) is used as the background model for IDA4D and also serves as the short-term forecast model.

What will it accomplish?

NIMO provides ionospheric specification and forecasts that support performance predictions and mission planning efforts relevant to Navy/DoD systems, including over-the-horizon radar (OTHR), communications.

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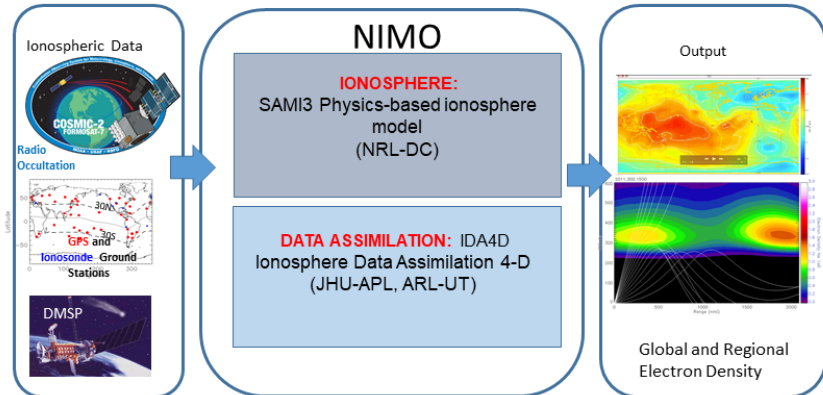
NIMO consists of a data assimilation system, IDA4D, developed by JHU-APL and ARL:UT and a physics-based ionosphere model, SAMI3. NIMO ingests a number of different datasets that can be represented as an electron density. The output is a 3D represetation of the ionospheric electron density over the full globe or a high-resolution region.

Objective

- Characterize and forecast the ionosphere, with specific emphasis on the bottomside ionosphere (below the F-region peak density) on a global and regional scale.

Approach

- NIMO consists of NRL's state-of-the-art physics-based ionosphere model (SAMI3) coupled to a ionospheric data assimilation system (IDA4D) that has been developed by the Johns Hopkins University Applied Physics Laboratory (JHU/APL) and the Applied Research Laboratories at the University of Texas at Austin (ARL:UT) to provide specifications and short-term forecasts of the ionosphere.

- The model employs a flexible framework that has important advantages:
  - New datasets can be easily ingested; specifically any data type that can be represented as an electron density.
  - The SAMI3 ionosphere forecast model, while currently coupled to a climatological thermosphere (MSIS 2.0), can be coupled in the future to a thermosphere forecast model that includes lower atmospheric weather, which can be an important driver of ionospheric structure and variability.

Payoffs

- NIMO provides an important capability that delivers situational awareness of the environment that is of paramount importance to medium- and long-range high frequency (HF) communications and Over-The-Horizon Radar (OTHR) systems.
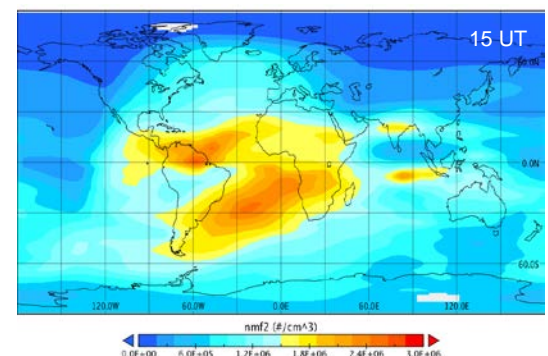
NIMO output consists of 3D electron density profiles that are updated every 15 minut