2015 Workshop: Distributed observatories

Long title
Distributed observatories of small instruments: Science and assimilation
Conveners
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Description

This workshop will present the latest results on measurements of the ionosphere and/or thermosphere obtained using distributed, conjugate, multiple instruments, arrays and/or networks. One of these distributed networks is the low-latitude ionosphere sensor network (LISN) consisting of 45 GPS receivers, 5 magnetometers distributed in 2 baselines and 3 VIPIR ionosondes that were installed along the magnetic field line that intersects the magnetic equator at 68º W longitude. In addition, there exits several networks of small instruments such as chains of magnetometers, Fabry-Perot interferometers, small radars, all-sky imagers, GPS receivers, and multiple RF receivers. Investigators and/or students are welcome to introduce their existing instrumentation, plans for future installations, and present their recent results. Conjugate observations using the C/NOFS and/or SWARM satellites and ground-based instruments are also part of this workshop as well as assimilation and modeling investigations employing data from distributed observatories.

We propose to organize a 2-hour session to discuss the importance of multiple-sensor measurements, regional coverage, and continuous (24/7) operations. The session will start with short presentations that will outline recent instrument deployments. We will continue with science presentations and discussions that will address the following topics.

I. Statistics of TIDs in South and Central America, and their relationship with tropospheric triggering phenomena. II. On the role of TIDs seeding mid-latitude depletions. III. Ionosphere-thermosphere coupling during disturbed conditions

(assimilation results). IV. Ionospheric/thermospheric spatial variability in the American sector and other sectors around the World.

We plan to conclude with a round-table discussion to elucidate the measurements, processing techniques, and observation campaigns that are required to advance our knowledge on the topics mentioned above.

Agenda

1:30- 1:45 Bob Schunk: Ionospheric Reconstructions with the Multimodel Ensemble Prediction System (MEPS).

1:45 – 1:55 Vince Eccles: Determining ionospheric drivers using data-model Inversion techniques with a couple ionosphere-electrodynamics model.

1:55 – 2:05 Valladares: LISN science during 2014-2015.

2:05 – 2:15 Bullett: VIPIR measurements over South America

2:15 – 2:25 Urbina: Recent VHF Radar Observations of low-latitude from Huancayo, Peru.

2:25 – 2:35 Rodrigues: AMISR-14 observations of equatorial spread F

2:35 – 2:45 Martinis: Imager observations in the American sector

2:45 – 2:55 Yizengaw: Post-midnight bubbles and scintillations longitudinal variability: possible forcing from lower atmosphere

2:55 – 3:05 LaBelle: Spaced extremely simple AM radio receivers to detect MSTIDs.

3:05 – 3:30 Discussions

Justification

The regional and continuous observations obtained with the distributed observatories indicate a high degree of spatial and temporal variability of the ionosphere over South and Central America and the Caribbean region. These regional observations have provided maps (also in real-time) of MSTIDs, mid-latitude depletions and plasma bubbles in a regional context. The advantage over other techniques is that it is possible to follow the temporal evolution of the structures across a Continent. In addition to the measurements of medium-scale (and large-

scale) structures, distributed GPS receivers are also able to measure the conditions of the background ionosphere. This workshop aims to answer two fundamental questions: Is the present instrumentation in South and Central America (and other parts of the Globe) able to assess the temporal and spatial variability that exists at all local times, and during all ionospheric conditions? And, can a first-principle physics-based assimilation model of the low latitude ionosphere duplicate this variability?

a. Identify the relevant CEDAR Science Challenge that the workshop addresses and describe:

i. How the associated questions will be addressed,
ii. What resources exist, are planned, and/or are needed,
iii. How progress should be measured

b. Describe the relevance to the 2011 CEDAR Strategic Plan

This workshop will address several points described on the Strategic Thrust # 6 on Manage, Mine and Manipulate Geoscience Data and Methods. Specifically, we will mine the large resources provided by distributed observatories and conduct:

• Continued evolution of data assimilation schemes to integrate data with physics-based models for improved predictive capability. • Develop advanced analysis techniques needed for effective fusion of observations into sophisticated inference models.

This workshop is also related to the study of the ionosphere-thermosphere system in an integrated fashion and the effective space weather and climatology capabilities emphasized in the 2013-2022 Decadal.

Before the session we will coordinate the oral presentations to address several, but closely similar points. During the session, we will formulate a plan to work on the issues that are controversial such as the idea of conjugate vs. non-conjugate MSTIDs and mid-latitude depletions and any other issue that will come out during the session. One member of the audience will be dedicated to write and summarize the issues addressed during the discussions.

We will use the resources provided by distributed observatories and new radars and ionosondes that have been recently installed, and new satellite missions that are

planned in the near-future (e.g. GOLD, ICON). Observations include TEC values, neutral winds, airglow images, density profiles from ionosondes, regional maps of scintillations, and 3 components of magnetic field. Computational resources include identification of TIDs, depletions and different physics-based assimilation programs.

Progress will be measured writing a full report that will include data presented, ideas exposed and discussions that will be undertaken. Progress will be also measured in the number of publications and presentations in other meetings (AGU, URSI) that will be derived from the talks and discussions during the session workshop. We plan to convene a distributed observatory workshop during the CEDAR 2016 meeting.

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