Project Details

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Project Title:
A tool forecasting equatorial plasma bubbles

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Summary:
The equatorial plasma bubbles (EPBs) cause the most severe radio scintillation in the equatorial region at night. Its forecast is urgently needed to the users of satellite communication and navigation systems. Despite the significant progress in modeling and observational techniques in the last 30 years, the variability of the EPB activity is not yet fully understood. Not knowing the precursor of the EPB, EPB forecasting is still a challenging goal to achieve in the near future. The purpose of the proposed study is to support the on-going EPB and scintillation forecasting efforts by providing the database for the EPB properties and developing a forecasting tool. The nighttime FUV observations of the F-region from the TIMED/GUVI provide the global EPB images that show large variability in their depletion depth, longitudinal width, north-south elongation, tilt, and occurrence pattern. Retrieval of the EPB images from the GUVI data will provide a unique data source for the EPB properties that can be used for the study of the EPB distribution, seed perturbation, growth condition, and its forecast. A few techniques have been developed to retrieve the EPB images from the GUVI data but the EPB database has not been created. We propose to apply an image processing technique to retrieve the EPB images and produce the EPB database by processing the GUVI data during 2002-2004. We will also process the ROCSAT-1 data during 1999-2004 to retrieve the EPB characteristics. An EPB forecasting tool will be developed using the EPB database from the GUVI and ROCSAT-1. The EPBs often occur superimposed on large-scale structure that ranges a few to several tens of degrees in longitudes. This phenomenon occurs repeatedly and in all longitude regions. There may be coherence in the occurrence of EPBs. Our forecasting tool will exploit the possible coherent occurrence of EPBs.

Publication References:

Summary: no summary

Reference: Kil, Hyosub; Paxton, Larry J.; Oh, Seung-Jun; (2009), Global bubble distribution seen from ROCSAT-1 and its association with the evening prereversal enhancement, Journal of Geophysical Research, Volume 114, Issue A6, CiteID A06307, doi: 10.1029/2008JA013672

Summary: no summary

Reference: Kil, Hyosub; Heelis, Roderick A.; Paxton, Larry J.; Oh, Seung-Jun; (2009), Formation of a plasma depletion shell in the equatorial ionosphere, Journal of Geophysical Research, Volume 114, Issue A11, CiteID A11302, doi: 10.1029/2009JA014369

Summary: no summary

Reference: Kil, H.; Choi, H.-S.; Heelis, R. A.; Paxton, L. J.; Coley, W. R.; Miller, E. S.; (2011), Onset conditions of bubbles and blobs: A case study on 2 March 2009, Geophysical Research Letters, Volume 38, Issue 6, CiteID L06101, doi: 10.1029/2011GL046885

Summary: no summary

Reference: Oh, S.; Lee, W.; Kil, H.; Kwak, Y.; Paxton, L.; Zhang, Y.; (2013), The Study of the origin of broad plasma depletions in the equatorial F region, American Geophysical Union, Fall Meeting 2013, abstract #SA13A-1947

Summary: no summary

Reference: Kil, Hyosub; Lee, Woo Kyoung; Kwak, Young-Sil; Zhang, Yongliang; Paxton, Larry J.; Milla, Marco; (2014), The zonal motion of equatorial plasma bubbles relative to the background ionosphere, Journal of Geophysical Research: Space Physics, Volume 119, Issue 7, pp. 5943-5950, doi: 10.1002/2014JA019963