An overview of CAWSES-India program with emphasis to equatorial atmospheric coupling processes

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Abstract
This paper presents an overview of CAWSES—India program, highlighting some of the Indian coordinated efforts to understand the Sun–Earth system as a whole, with special emphasis to the equatorial and low latitude phenomena. Two multi-institutional, multi-instrument campaigns, one under ‘Space Weather: Science and Applications’ and the other emphasizing tides under ‘Atmospheric Coupling Processes’ were conducted during February–April 2006. The highlights of the campaigns include improved prediction of equatorial spread-F (ESF) based on a ‘new factor’ combining the strength and asymmetry of the equatorial ionization anomaly (EIA); simultaneous detection of quasi-2-day wave at both E and F region heights; tomographic image showing a Traveling Ionospheric Disturbance (TID) in association with a counter electrojet (CEJ) event—all highlighting the neutral and electrodynamical coupling of the equatorial ionosphere–thermosphere regions; an unusual lowering of mesospheric temperature during a moderate geomagnetic storm—highlighting a new space weather effect; diurnal tide showing a peak amplitude of 35 m/s at 45 km in zonal wind and a significantly lower amplitude (~15 m/s) in the meridional wind and also evidence of convective activity in the lower atmosphere influencing the tidal variability in the Mesosphere–Lower Thermosphere (MLT) region highlighting the vertical coupling of the atmospheric regions. The development of models for equatorial and low latitude ionosphere has been among the prime activities taken up under ‘Space Climate’. Two models have been developed towards this end: one based on Second Degree (SD) relationships of F region parameters to the mean sun spot number and the other a Multiple Regression Analysis (MRA) based model involving expressions relating F region parameters to that representing solar and geomagnetic activities. The two models, intended for long and short term predictions, have been found to represent the equatorial and low latitude ionosphere over Indian longitudes better than the commonly used International Reference Ionosphere (IRI). Under the theme of ‘Solar Influence on Atmospheric Climate’, a study has been made on the effects of solar variability on middle atmosphere using satellite data and model simulations, highlighting the significant differences between them.

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1. Introduction

The Climate and Weather of the Sun–Earth System (CAWSES) is an international program initiated by the International Scientific Committee on Solar Terrestrial Physics (SCOSTEP). The program, initially drawn up for a period of 4 years (2004–2008) to start with, has been formulated under four themes viz., 1. Solar Influence on Climate, 2. Space Weather: Science and Applications, 3. Atmospheric Coupling Processes and 4. Space Climate (for more details refer SCOSTEP website http://www.yorku.ca/scostep and also http://www.bu.edu/cawses; Basu and Pallamraju, 2006). Looking into the significant outcome from the international coordinated activity and keeping its relevance in mind, SCOSTEP had extended the duration

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