LONG-TERM CHANGES IN IONOSPHERIC PARAMETERS OVER AHMEDABAD

H. Chandra, G. D. Vyas and S. Sharma

Physical Research Laboratory, Ahmedabad 380009, India

ABSTRACT

Ionospheric data over Ahmedabad obtained from regular radio soundings made during past four decades are analyzed to study long term changes. Midday values of the critical frequencies of E, F₁ and F₂ layers show a small positive trend with changes of less than 0.1 MHz for E and F₁ layers and about 0.2 MHz for F₂ layer in of 40 years. Increase in the peak altitude of F₂ layer is also noticed. However the increases are within the limits of accuracies involved in estimation.

INTRODUCTION

Increase of trace gases and consequences in global climate is a subject of great concern. Several studies have dealt with the warming in troposphere and stratosphere due to the increase of trace gases. Roble and Dickinson (1989) were the first to examine the effects in mesosphere and thermosphere and showed that a cooling of 10°K in mesosphere and 50°K in thermosphere will occur by doubling of CO₂ and CH₄ at 60 km level resulting in the associated changes in the composition and in the ionosphere. Rishbeth (1990) estimated the ionospheric changes at a mid latitude station for geomagnetically quiet and sunspot minimum period as a consequence of this cooling. He showed that E and F₁ layer peaks will be lowered by 2 and 20 km respectively with no significant changes in peak electron densities as the increase in production will be compensated by increase in loss coefficients. Factors like dynamics and chemistry were not considered in the estimates. Rishbeth pointed, however, the need to continue global monitoring. With an aim to determine long term changes in the ionosphere over Ahmedabad, a low latitude station in the anomaly crest region, we have examined 40 years of ionospheric data.

RESULTS

Regular ionospheric soundings are made over Ahmedabad, since 1953 when an automatic ionosonde (British, Mk. II) was installed. This ionosonde was replaced in 1976 by a C₄ model and currently a digital KEL ionosonde is operational from 1993. Hourly data are scaled and published regularly. To study the long term changes in the critical frequencies of different layers monthly median values for midday (11-13 hr 75° EMT) were examined. The solar cycle variation is removed by taking a 5 point running mean (5 years) of the 40 years of data sequence and the deviations from the running mean for each season were obtained. The deviations for fₑE for the three seasons are plotted as a function of year in Figure 1 while similar plots for fₑF₁ and fₑF₂ are shown in Figure 2 and Figure 3 respectively.