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Modelling the effects of changes in the Earth's magnetic field from 1957 to 1997 on the ionospheric hmF2 and foF2 parameters

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We have modelled the effects of changes in the Earth's magnetic field on the ionosphere as have occurred from 1957 to 1997 using the NCAR Thermosphere-Ionosphere-Electrodynamics General Circulation Model (TIE-GCM). Previous studies that attempted to quantify these effects used a constant wind field, so that any electro-dynamical coupling processes could not be accounted for. Using TIE-GCM we can account for these processes. We find substantial changes in the F2 layer peak height hmF2 (up to $\pm$20 km) and critical frequency foF2 (up to $\pm$0.5 MHz) over South and Central America and the eastern portion of North America. This would make up a significant contribution to observed long-term trends in these areas and therefore must be taken into account in their interpretation. Modelled trends exhibit a strong seasonal and diurnal variation, highlighting the importance of separating data with respect to season and local time. Most of the changes in hmF2 and foF2 can be related to changes in the component of the neutral wind that blows charged particles up or down magnetic field lines, changes which are in turn mostly caused by changes in the inclination of the field, though changes in declination and neutral wind also play a role. Changes in the vertical component of the **E**x**B** drift seem to have had little effect on hmF2 and foF2.