

Can the Weddell Sea anomaly and related phenomena be explained by conjugate effects?

Alan Burns

The Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) GPS occultation data have been analyzed in this study to provide a better understanding of the Weddell Sea Anomaly (WSA) and to place it in the wider context of a general phenomenon that occurs near dusk in summer. The terminator and the magnetically conjugate points for the terminator in the other hemisphere have been plotted on top of global maps of COSMIC NmF_2 and hmF_2 for several months around the December and June solstices for 2006 to 2008. These plots show that, in the late afternoon when the terminator and conjugate terminator are sufficiently separated, there are distinct enhancements of NmF_2 and increases in hmF_2 as soon as the conjugate footprint of the field line on the winter terminator is seen at middle latitudes in the summer hemisphere. This effect is most pronounced where the WSA is formed, but it also occurs across the South Pacific Ocean in the southern summer, and across much of the North Atlantic Ocean, Siberia and Kamchatka during the northern summer. An hmF_2 increase occurs between the two terminators even at locations where there is no increase in NmF_2 . The NmF_2 enhancement starts at the poleward boundary of the equatorial anomaly and occurs further from it as local times get later. This behavior is not consistent with neutral wind or downward precipitation explanations of the phenomenon, but is consistent with the behavior expected if a poleward (and hence upward as well) electric field is occurring in the evening. A similar, but reversed, effect occurs in hmF_2 near dawn.