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The electron density trough and the mapped plasmapause in the nighttime mid-latitude ionosphere probed by DEMETER

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This paper for the first time concurrently investigates the mid-latitude trough and the plasmapause positions in the ionosphere by co-located measurements of the electron density, electron temperature, and whistler count observed by DEMETER (Detection of Electro-Magnetic Emissions Transmitted from Earthquake Regions) satellite in the nighttime at 2230 LT (local time) during the 4-year period of 2006-2009. More than 14000 DEMETER orbits of the electron density and the electron temperature are used to search the trough position, while the same amount of the whistler is employed to determine the mapped plasmapause position in the mid-latitude ionosphere. In general, the mid-latitude trough appears in the poleward side of the plasmapause. The plasmapause moves equatorward during the higher solar activity of the 4-year study period, while the mid-latitude trough shifts poleward in the Summer month (hemisphere). Both of the mid-latitude trough and the plasmapause move equatorward during the magnetic disturbed condition. However, for the magnetic disturbed kp$\geq$6-, the mid-latitude trough could overtake and appear in the equatorward side of the plasmapause.