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Lunar signals in the variations of the daytime equatorial ionisation anomaly from CHAMP

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The temporal variations of the equatorial electrojet (EEJ) amplitude show clear relation to solar and lunar tides and to seasons. Like the EEJ, the formation of the equatorial ionisation anomaly (EIA) is driven by an eastward electric field. This study looks into the response of the EIA strength to the lunar phase. A measure to quantify the strength of the EIA is the crest-to-trough ratio (CTR) of the ionisation anomaly. These data were obtained from CHAMP electron density readings during passes across the equatorial region. The CTR values are sorted by local time (LT), moon phase, solar cycle, and season. On the dayside, between 09h and 18h LT, CTR peaks as expected around noon. This diurnal variation is modulated by the lunar tide, giving largest amplitudes, as expected, around new moon and full moon. The modulation of the CTR strength amounts to about 10%. The lunar semi-diurnal wave exhibits largest CTR amplitudes around December solstice. During June solstice the CTRs are generally weaker. When comparing periods of high solar activity with solar minimum conditions, the overall CTR values are higher around maximum, but the lunar tidal signal is clearer during low solar activity. The phase of the semi-diurnal signal follows the moon age with a delay of 1.7h between moon phase and local time. Compared to the EEJ, the lunar tidal signal of CTR appears 1-2 hours later in local time. Shortly after sunset the determination of the CTR tidal signal is disturbed by equatorial plasma irregularities.