An additional layer in the equatorial ionosphere

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The physical mechanism, climatology and weather of an additional layer, called the F3 layer, that has been predicted to exist during daytime at altitudes above the F2 peak in the equatorial ionosphere are studied through ionosonde observations and theoretical modeling. The ionograms recorded in 1995 at the equatorial station Fortaleza (4S, 38W; dip angle 9S) in Brazil show an F3 layer on 49% of the days, with the occurrence being most frequent 75% and distinct in summer as predicted. Magnetic activity has no statistical significance on the occurrence of the F3 layer. On a day-to-day basis, the F3 layer occurs from 0800 LT to 1630 LT, with the duration of occurrence ranging from 15 min to 6 hours; the virtual height of the layer varies from about 380 km to 770 km and the critical frequency of the layer exceeds that of the F2 layer by 0.2-2.3 MHz. There are also days when the layer reoccurs. The model results show that an F3 layer occurs when the time-cumulative vertical plasma velocity (resultant of the upward ExB drift and neutral wind) displaces the daytime F2 peak to high altitudes, to form the F3 layer, while the normal F2 layer develops at low altitudes through the usual photochemical and dynamical effects of the equatorial region. Sudden displacements result in more distinct F3 layers than gradual displacements.