The equatorial ionospheric anomaly (EIA) is characterized in ionospheric density by a trough at geomagnetic equator and north and south crest at about ±15 ° of geomagnetic latitude, which is attributed to the so-called ‘equatorial fountain effect’. This special ionospheric region behaves obvious variability related to solar activity and the dynamics of the mesosphere and lower thermosphere. The correlative analysis about the changes between the ionospheric parameters, solar activity and atmospheric parameters in EIA region is, no doubt, useful for understanding the features and the mechanism of the EIA variation. Based on the total electron content (TEC) derived from GPS data observed at a zonal chain of GPS stations near EIA northern crest, combining with thermospheric temperature from SABER, geomagnetic field strength from ground-based geomagnetic stations, the planetary magnetic activity index, Kp and the daily values of F10.7, the EIA variation and its morphology in China low latitude region are studied. The results show that the EIA manifests different timescale variability: the strength (TEC) of EIA is strong in equinox and high solar activity year. Moreover, the EIA is correlative to the equatorial electrojet (EEJ) strength and is influenced by wave dynamics, solar EUV flux and geomagnetic forcing. This suggests that the ionospheric variability in the China low latitude region is associated with strong coupling processes from regions below (e.g., large-scale atmospheric movements and planetary waves) and above (e.g., solar and geomagnetic activities).