The ionospheric plasma structures are modulated by solar influences and upward propagating tides of lower atmosphere origins. The modulated global ionospheric effects, including effects from the periodic solar wind, magnetic storm, troposphere excited tides and stratospheric sudden warming, are revealed by electron density profiles derived from GPS radio occultation soundings of FORMOSAT-3/COSMIC during 2006-2011. These results prove that the three-dimensional global observation of the ionosphere is crucial for better understanding the dynamics of Earth’s upper atmosphere. As the result, a continuous satellite constellation capable of performing more GNSS radio occultation soundings is planned and named as FORMOSAT-7/COSMIC-II. In this study, we first review achievements of ionospheric studies obtained from FORMOSAT-3/COSMIC. Following the review, the planned FORMOSAT-7/COSMIC-II mission and its potential application in further exploring the ionosphere effects are introduced.