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The structure of the Venus ionosphere

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The Venus Express Radio Science Experiment VeRa sounds the atmosphere and ionosphere of Venus with radio signals in order to retrieve vertical profiles of temperature, pressure, neutral number density and electron density. Dual-frequency one-way radio signals at X-band and S-band stabilized by an onboard Ultrastable Oscillator can be used for the first time. Opportunities for atmospheric/ionospheric sounding occur in so-called occultation seasons when the radio signals propagate through the atmosphere/ionosphere prior and after the spacecraft enters and leaves the geometrical occultation by the planetary disk as seen from the Earth.

More than 80 electron density profiles from the Venus ionosphere could be retrieved during the first and second occultation season in summer 2006 from equatorial to high southern latitudes for occultation entry and high polar latitudes in the North for occultation exit for an altitude range from 120 km to 300 km. The base of the daytime ionosphere appears to be definite and stable at 120 km altitude. The main layer and the lower secondary layer, V2 and V1, respectively, are strong and stable and change their peak densities and peak altitudes only according to the changes in solar zenith angle. The ionopause is found at surprisingly low altitudes between 225 to 275 km and clearly changes their electron density gradient and altitude with the changes in solar wind pressure. The topside ionosphere is highly dynamic and a third layer, V3, seems to be present.