

Radio Sounding of the Venus Ionosphere: From Mariner V to Venus Express

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Propagation of radio waves through a planetary atmosphere/ionosphere allows the derivation of vertical profiles of temperature, pressure, number density in the neutral atmosphere and vertical profiles of electron density in the ionosphere. This is feasible in the Venus atmosphere from the ionopause (between 300 km to 600 km altitude) down to altitudes of 35 km – 40 km. This presentation reviews the radio sounding observations of the Venus ionosphere from Mariner V in the 1960s to the current observations from Venus Express.

The radio science experiment VeRa on Venus Express sounds the Venus ionosphere at radio wavelengths on a routine basis. It collected so far the largest data base on ionospheric electron density profiles over a time of four years. The structure of the dayside ionosphere shows a sharp base at 115 km altitude and two pronounced electron density peaks at 125 km and 140 km, designated V1 and V2, respectively. The peak densities and the peak altitudes of the V1 and V2 layers show the expected behaviour in dependence with the solar zenith angle. The diffusive equilibrium region is highly varying with plasma scale heights between 15 km and 60 km. A bulge in the topside in all dayside electron density profiles between 155 km and 175 km may be caused by a change in the loss rate. In comparison, the VIRA model does not show the base, the V1 layer and the bulge which are so well pronounced in the VeRa electron density profiles. Quite a number of low altitude layers below the V1 layer have been observed and are interpreted as being caused by the infall of meteorites in the atmosphere creating an ionized layer either by charge exchange with the background ion density or by photoionisation. These layers have been observed in particular when Venus was crossing the orbit planes of comets.