

A study on the characteristic features of the V1 layer of the Venus ionosphere using Akatsuki measurements.

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Abstract: The source of V1 layer of the Venus ionosphere is as enigmatic as its very existence itself. Discovered, for the first time by the radio occultation experiment (VeRA) onboard Venus Express, it is known to exist at about 125 km altitude and has been surmised to be caused by soft X-ray emissions [1]. A characteristic feature of this ionospheric layer as well as consensus on its source, however, is yet to emerge mostly because of the lack of observation opportunities. In this context, radio occultation measurements of the Venus ionosphere using Akatsuki measurements assume significance as these not only add to the data base but also give measurements from the low latitude regions which have remained less explored during previous missions due to satellite trajectory [2].

In this paper, we study the characteristics of V1 layer using some thirty radio occultation measurements done since 2016 both at UDSC in Japan, and IDSN in India [2]. Only those measurements were considered where the ionosphere was in the sunlit side and solar zenith angle was less than 85 degree. In all we got sixteen profiles satisfying these conditions. We get several profiles from the low latitude regions of the Venus ionosphere giving some interesting features of the V1 layer. Interestingly, distinct V1 layers were not visible in many cases. While in some profiles it appeared as a ledge, there were a few examples too when a very distinct peak was also visible. The origin for such features has been explored using an in-house developed one dimensional photochemical model for the Venusian ionosphere (1DPCM) [3]. Though both the peak V1 layer height and density get neatly reproduced in the model, in most of the cases we note the model V1 layer appears only as a shoulder. A detailed comparison of the model and Akatsuki derived altitude profiles of the Venus ionosphere under varying solar conditions would be provided and reasons for the occurrence of V1 layers of varying characteristics would be discussed.

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