

# Dependence of observations of VHF broadcasting waves from overseas on positions of equatorial plasma bubbles

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In this study, we examined the relation between VHF broadcasting waves from overseas observed at Tateyama (35.0N, 139.9E) in Japan and plasma bubbles observed at Sata (31.0N, 130.7E) in Japan and Darwin (12.4S, 131.0E) in Australia.

We have made continuous observations of VHF electromagnetic waves at Tateyama observatory in Chiba prefecture, Japan. It is found that TV broadcasting waves can propagate from eastern and south-eastern Asia to Tateyama. The broadcasting waves from Taiwan and Philippines (USA channel assignment) are usually observed when plasma bubbles were simultaneously observed by All-sky imager at Sata. In this study, we examined the relation between these broadcasting waves and plasma bubbles observed at Darwin, which is the conjugate point of Sata. It is found that the broadcasting waves of USA channel assignment are always detected at Tateyama when plasma bubbles grow to higher than 19 degrees of magnetic latitude. This fact implies that the suitable scatter points for observing the broadcasting waves transmitted from Philippines are located higher than 19 degrees of magnetic latitude.

In order to confirm this observational fact, the propagation path of these broadcasting waves are determined by the ray-tracing calculation with the effect of scattering by plasma bubbles. In this calculation, it is assumed that the VHF waves are scattered by plasma bubbles (or field-aligned irregularity) and the scattered ray path is on the surface of cone with the angle at which the incident ray path and the main magnetic field intersect. The results of the calculation show that the suitable scatter points for observing the VHF waves at Tateyama are located above East China Sea and that the positions of these points are higher than 20 degrees of magnetic latitude. Thus, the observational results are confirmed by the ray-tracing calculation.