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Plasma waves in Rosetta electric field observations in the plasma environment of comet 67P/Churyumov-Gerasimenko

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We perform a comprehensive statistical study of plasma wave activity observed in the electric field measurements obtained by the Langmuir probe instrument (RPC-LAP) onboard ESA's Rosetta spacecraft, which followed the comet 67P/Churyumov-Gerasimenko in its orbit around the sun for over two years in 2014-2016. We focus on waves in the range 1-30 Hz, roughly corresponding to the lower-hybrid frequency range. Here, electric field oscillations close to the local H_2O^+ lower hybrid frequency are common and collocated with sharp plasma density gradients, suggesting generation by the lower hybrid drift instability. We compare statistically the properties of the waves to the theoretical predictions on lower-hybrid wave generation by the lower hybrid drift instability, regarding e.g. amplitude dependence on plasma density gradients. We also examine the data for waves that can be attributed to other instabilities, such as various velocity-space anisotropies that may occur in the cometary plasma. We correlate the comet-related parameters, (relative spacecraft position, solar distance, plasma and neutral gas density, etc.) with wave-related parameters, such as amplitude/spectral density and frequency. This investigation greatly helps to clarify the importance of the plasma waves in different regions of the cometary plasma environment.