Properties of Jovian lightning whistlers detected by the Juno Waves Instrument
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We report over seventeen hundred lightning whistlers recorded by the Waves instrument onboard the Juno spacecraft during close approaches to Jupiter between August 2016 and September 2017, mainly at altitudes below 120,000 km, i.e., below radial distances of 2.7 Jovian radii. This data set is much larger than the combined number of lightning events obtained from all previous missions to Jupiter. We detect peak occurrence rates of more than four whistlers per second, with an average rate of one whistler per second at midlatitudes, similar to thunderstorms at Earth. The detected whistlers are systematically observed to propagate from the planet which confirms their sources in the Jovian atmosphere below the spacecraft.

Their short duration can be explained by dispersion calculations based on existing models of ionospheric plasma density and magnetic field.All electron whistlers in our data set have been categorized into two dispersion classes according to the difference of propagation delays at 2 and 5 kHz, whenever this was possible. Class 1 whistlers have this difference lower than 5 ms. Whistlers with larger dispersions fall into class 2. In total, we obtain 32% whistlers in class 1, 25% in class 2, and for the remaining 43% it was impossible to reliably determine the class, mainly in cases when the whistler trace didn't reach both 2 and 5 kHz or in rare cases of proton whistlers.The observed spectral shapes of whistlers provide us with a valuable source of information about the integral properties of the Jovian ionosphere. Low dispersion whistlers indicate that low density ionospheric regions predominantly occur in the northern hemisphere at altitudes between 20° and 70°.