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Revisiting the solar wind electron parameters from Ulysses/Urap quasi-thermal noise measurements using kappa velocity distributions

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Thermal noise spectroscopy is based on a passive measurement of the plasma wave spectrum with a long electric antenna, and yields directly the density and the kinetic temperature of a stable electron velocity distribution. This method is a powerful tool to measure in situ the electron thermodynamic quantities in natural plasmas, and has been used in the solar wind, planetary ionospheres and plasmaspheres or cometary tails. In this work, we will revisit and discuss the electron density and temperature derived from the electrostatic noise measurement made with the URAP dipole electric antenna on Ulysses, as this probe flew by pole-to-pole during the minimum solar activity (1994-95). The electron velocity distribution is modeled by a generalized Lorentzian or kappa distribution. This model is especially adapted in the solar wind, whose electron velocity distribution has a conspicuous suprathermal tail. The three fitted parameters are the electron density, temperature and kappa index of the distribution, and we will discuss their variations with heliocentric distance and latitude. We will especially focus on the total temperature variation with distance during the solar minimum at high latitudes and compare it with the temperature profile predicted by a kinetic collisionless model of the solar wind.