Comparison of in-situ electron density measurements with equatorial electron densities obtained by whistler inversion

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The equatorial electron density obtained from whistler inversion has long been regarded as an effective tool for monitoring the plasmasphere from ground based measurements. However, since these inversion methods are based on various models, it is essential to validate them through comparison with in-situ density measurements. To date, no such comparison was made, mostly because of the lack of suitable in-situ data.

The recent Van Allen Probes experiment provides an excellent base for this comparison, the Probes measure not only the electron density and magnetic field, but all the six electromagnetic wave components that is essential for calibration with whistler-based densities.

Whistlers recorded on the ground are propagated in a duct along a magnetic filed line. The ducted propagation was verified first time in the history of whistler research using the six component burst mode measurements on VAP. The wave normal and Poynting vectors were calculated using the Matched Filtering and Parameter Estimation method [Lichtenberger et al., *J. Atmos. Solar-Terr. Phys.* **59**, 1987, p.1075] to check whether the whistler were propagated in a duct. Then a partial-path whistler inversion was applied to the verified whistler to obtain the equatorial electron density.

Our recently developed whistler inversion method [Lichtenberger et al. *J. Geophys. Res.,* 2009, doi: 10.1029/2008JA013799] includes various models, such as wave propagation, magnetic field, field-aligned density distribution and equatorial electron density models. The latter one is a special one used for multiple-path whistler groups. The comparison of the in-situ densities with the ones obtained through whistler inversion provided a complex validation, not only of the field-aligned density distribution model, but the of other ones as well. The validation procedure showed that the average difference between the in-stu and whistler based electron densities is smaller than the uncertainty of the in-situ density measurements itself.