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First electron density and temperature estimates from the Swarm Langmuir probes and a comparison with IS measurements

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The Langmuir Probes (LP) on the Swarm satellites are part of the Electric Field Instruments (EFI), which are featuring thermal ion imagers (TII) and so are measuring 3-d ion distributions. The main task of the Langmuir probes is to provide measurements of spacecraft potentials influencing the ions before they enter the TIIs. In addition also electron density (Ne) and temperature (Te) are estimated from EFI LP data. The design of the Swarm LP includes a standard current sampling under sweeps of the bias voltage, and also a novel ripple technique yielding derivatives of the current-voltage characteristics at three points in a rapid cycle. In normal mode the time resolution of the Ne and Te measurements so becomes only 0.5 s.

We show first Ne and Te estimates from the EFI LPs obtained in the commissioning phase in December 2013, when all three satellites were following each other at about 500 km altitude at mutual distances of a few tens of kilometers. The LP data are compared with observations by incoherent scatter radars, namely EISCAT UHF, VHF, the ESR, and also Arecibo.

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