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# Temporal behavior of the ionospheric electron density over the Arecibo radar

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What is the temporal behavior of the electron density in the mid-latitude ionosphere? Answering this simple and fundamental question is complicated by the fact that single satellite measurements cannot distinguish between spatial and temporal variations hence leading to the common dubious assumption that a measured parameter is static. Ground based ISR's suffer the same fundamental complication since the Earth is rotating and thus measurements are separated in both time and space. As a consequence we currently know virtually nothing about the dynamics of for example the ionospheric electron density. We address the question by measuring the electron density in a small volume using a new innovative fixed volume scan technique. We use the Arecibo radar to measure the electron density continuously for 6 minutes in a very small volume (altitude/longitude/latitude of 1.0 km / 4.4 km / 0.3 km) fixed in an inertial frame. Nearly 100 fixed volume scans were performed separated in local time. We find changes in the electron density amounting to $\sim$10% of the total electron density over the 6 min scanning period without any obvious external (solar wind) or internal magnetospheric causes. Our results emphasize the limitations of models, which assume that average distributions are representative and that dynamics can be ignored.