For the last several years we have been actively developing and using on various science projects the ionospheric data assimilation algorithm IDA4D and the estimating model parameters algorithm EMPIRE. Most of the science studies undertaken with these two algorithms have focused on geomagnetic storms and the responses at mid and high latitudes. While the validation studies have focused on electron density and TEC for IDA4D and winds and electric fields for EMPIRE, again at mid latitudes and through simulations.

Recently we have begun to focus on the equatorial ionosphere and the influence of equatorial electric fields on the global low latitude electron density distribution. Or, to reverse the question, to what degree can the equatorial electric field distribution be estimated from the 3D time-evolving electron density distribution, supplemented with some (sparse) direct measurements? IDA4D is first run for a full day as a global electron density assimilation algorithm, ingesting, in addition to the regular data ingested, in-situ densities from C/NOFS and radio occultations from C/NOFS. Then the EMPIRE algorithm ingests the 4D distribution of electron densities and error covariances from IDA4D along with direct measurements of ion drifts from C/NOFS. These direct measurements, and derived observations from IDA4D are used to estimate the 2D (geomagnetic longitude and altitude) equatorial electric potential as a function of time. In order to accomplish this, improvements have been made to EMPIRE to include a Gauss-Markov Kalman Filter for the forward propagation in time.

This presentation presents some initial results of the IDA4D and EMPIRE algorithms at equatorial latitudes, and discusses some of the issues involved in estimating low latitude electric fields from a combination of electron density observations and direct observations of ion drifts.