Aperture synthesis radar imaging and phase error correction using compressed sensing applied to E region studies

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Different aperture synthesis radar imaging techniques have been applied to the atmospheric/ionospheric radar imaging successfully (Capon, Max. Entropy, CS). All these techniques require that the imaging system is perfectly calibrated and therefore there are not phase errors. Phase errors can appear due to antenna coupling, defects in the antennas, different cable lengths and amplifiers, etc. In addition, it is assumed that the calibrated phases are the same for all observing angles. Such assumption is true when the illuminated beam is narrow. However, for wide beam observations the phase difference between antennas might change for different angles, causing blurring in the image in some angles. In this work, we propose a compressed sensing-based model for image reconstruction and a generalized phase difference correction algorithm. Preliminary results using data set from a new ionospheric radar imager installed in northern Germany to study the E region irregularities (JULIE), will be presented.