

Investigation of fine structures in the ionosphere by interferometry with the EISCAT Svalbard Radar

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We have operated the EISCAT Svalbard Radar (ESR) in interferometry mode with two antennas (32 m steerable and 42 m fixed) during the combined radar and optical observations from January 10th to 19th, 2002. It is known that the scale size of the auroral fine structure is often much smaller than the beam width of the ESR (about a kilometer at the E region height). By operating the ESR in interferometry mode, we look for small scale structures, within a scattering volume. Both of the two antennas were pointed in a field-aligned direction. Transmission was done by the 42 m antenna and echoes were received both at the 42m and the 32 m antennas simultaneously. Simple long pulses were used in our experiment, while the alternating-code was used in the similar campaign in 2001. Signals were sampled by our own PC at an intermediate frequency, and normal ESR raw data were also recorded as usual. The temporal resolution could be in principle down to the inter pulse period (6.7 msec) without restriction of cycle time of the alternating-code (640 msec in the standard ESR experiment).

From 06:46:00 to 06:47:30 UT on January 17th, 2002, the ESR detected strong echoes which are often referred to as Naturally Enhanced Ion-Acoustic Lines (NEIALs) or Anomalous Ion Spectra (AIS) when auroral fine structures were observed in the field of view of the ESR by a high resolution video camera. Time variation of the spectra of the echoes were obtained with very high time resolution less than 0.1 sec. The complex coherence functions of the signals from the two antennas are also calculated. But the coherence of the two signals were not high, which we think because of the fast motion of the auroral fine structures across the interferometry fringe pattern.

At the meeting, the high time resolution observation of the AIS will be discussed in connection with the theories which have been suggested. Some results of the interferometry will be also presented and discussed with the auroral fine structures detected with the optical instruments.