FEATURE EXTRACTION AND MODE IDENTIFICATION IN OBLIQUE INCIDENCE SOUNDINGS

Andrew Heitmann[(1)], **Robert Gardiner-Garden**[(2)]

[(1)]***Intelligence, Surveillance and Reconnaissance Division, DSTO***
PO Box 1500, Edinburgh, SA, 5111, Australia
andrew.heitmann@dsto.defence.gov.au

[(2)]*Intelligence, Surveillance and Reconnaissance Division, DSTO*
PO Box 44, Pyrmont, NSW, 2009, Australia
robert.gardiner-garden@dsto.defence.gov.au

ABSTRACT

Automatic feature extraction and mode identification algorithms have been developed to partition and interpret oblique incidence (OI) ionograms in a robust and reliable fashion. These algorithms perform the preliminary 'rough fit' processing which acts as a precursor to subsequent use of the OI data in ionospheric modelling.

The automatic approach is essentially a three stage process consisting of an image clean-up, extraction of key E_s and F_2 layer features, and synthetic trace fitting to these features (based on a 4-layer parameterised profile of electron density at the path midpoint). Mode identification is achieved by associating image power with the nearest section of the fitted trace. Although the fit does not perfectly represent the entire observed trace (since it is derived from only six image features), it generally gives an accurate interpretation of the OI ionogram, while being quite robust against a wide range of problems encountered in typical soundings.

Testing of the algorithms was carried out on more than 10,000 OI ionograms from the Jindalee Operational Radar Network (JORN). Included among these were cases representing the presence of intense radio frequency interference, ionospheric storms, travelling ionospheric disturbances, spread-F conditions, and multi-hop E_s. For short to medium length paths, it is common for more than 90% of soundings to return the required features and fitted trace; however, this statistic can drop to as low as 30% on longer paths (that is, paths greater than 2000 km where 1-hop E_s is not directly observed). Observations from several different OI paths with closely spaced midpoints show an encouraging level of consistency in the fitted parameters.