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ESTIMATION OF SAMPLING REQUIREMENTS FOR TRACK-TYPE REMOTE SENSING SURVEYS

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Many types of remote sensing measurements are made along lines or tracks over the earth's surface which are spaced at distances governed primarily by assumptions about the nature of the phenomena being measured and cost considerations. In geophysical surveys, aircraft-borne magnetic, gravity, gamma ray, electromagnetic and other sensors are flown at low altitude with approximately parallel line spacings ranging from ¼-mile to several miles. These measurements are commonly sampled and digitized at an arbitrarily high rate along the flight path generating an adequately sampled record with respect to the Nyquist rate which is governed by the bandwidth of the physical phenomenon being observed. The sampling interval in the across track direction is the track spacing and closely spaced samples there would be extremely costly to obtain because of the increased number of flight lines required. The research discussed in this paper addresses the problem of determining the sampling requirements for proper representation of the geophysical fields and is based on study of the power spectral density of the measured quantities.

The primary object of the measurement of various geophysical phenomena in exploration for minerals and petroleum deposits is to locate anomalies in these variables which may relate to "targets" of economic value. The spacing of survey lines has an important impact on the ability to reconstruct the measured surface and subsequent detection of anomalies. A method of selecting line spacing is discussed, in which the along track spectrum is used to predict the across tract frequency content of the "scene" using certain assumptions on the isotropy of the fields of interest. Comparisons will be shown of spectral estimation using classical windowed periodogram and autoregressive methods. Analysis results using data from analytical models and real data from U.S. Energy Research and Development Administration airborne geophysical surveys will be presented.

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