

CHAPTER I

INTRODUCTION



Purpose

This thesis presents the analytical portion of a project related to measurement and analysis of the natural low-frequency magneto-telluric field, which comprises geomagnetic and geoelectric oscillations. The discussion focusses on the mathematical aspects in application to digital computer programming, and data processing.

Background

The magneto-telluric field is assumed to be a stationary process characterized by random variables changing with time. Each magneto-telluric record is unique, so it can not be described by an explicit mathematical relationship. The properties of a stationary process are usually described by

1. Mean square values
2. Auto-correlation function
3. Power spectral density function

The future of magneto-telluric field, a random process, can partly be determined by past values of the variable, and the idea of definite extrapolation is replaced by that of a conditional distribution: a probability distribution of future values, conditioned by the knowledge of past values.

The joint properties, cross-correlation and cross-power spectra, of any two random data are also studied.

Approach

The calculation procedures are developed and written in digital computer format, namely FORTRAN IV for IBM 1800.

The magnetic field is recorded in a complete vectorial description which is composed of three orthogonal components H_x , H_y and H_z of the magnetic field in north-south, east-west and vertical directions. For the electric field, only the plane components E_x and E_y of the electric field in north-south and east-west directions are recorded. These records are digitized at regular sampling time intervals. The digitized data are then fed into the computer on punched cards.