

PREFACE

Working Group 1—3 of the International Association of Geomagnetism and Aeronomy has held a biennial series of Workshops on Electromagnetic Induction in the Earth and Moon since their initial meeting in Edinburgh, 1972. In 1986 the 8th such IAGA Workshop was held at the Observatoire Cantonal and the Université de Neuchâtel, Switzerland, 24—31 August. The meeting was sponsored by Le Canton de Neuchâtel, L'Observatoire Cantonal de Neuchâtel, L'Université de Neuchâtel, La Société Helvétique des Sciences Naturelles, Le Fonds National Suisse pour la Recherche Scientifique, IAGA and the International Union of Geodesy and Geophysics.

Workshop meetings generally consist of a number of selected topics some of which commence with the delivery of an invited review. Topics for the 8th Workshop included global and regional conductivity studies, the distortion of electromagnetic fields, instrumentation, data processing and inversion including theoretical developments and presentations concerning EMSLAB. For some of these topics review papers were invited and six are presented in this special issue of *Surveys in Geophysics*. The Workshop regards publication of the collected review papers with some importance as a means of presentation of current knowledge and as a useful reference for further work. We are indebted to *Surveys in Geophysics* for their association with us since 1980.

Electromagnetic induction studies span a range of topics from source field considerations in the magnetosphere and ionosphere, to detailed regional studies of the crust and asthenosphere and investigations of the Earth's deep interior through global parameters.

The review papers this year look downwards to concentrate on exploring the Earth through its electrical conductivity and begin with Parkinson's review of global investigations. Using recent marine magnetotelluric results he shows that, whilst conductivity estimates are very variable, average conductivity profiles for both continental and marine mantle depths are quite similar. Even so, it is argued that conductivity variability precludes a generally acceptable world average depth profile that could be used as a standard. Such lateral conductivity changes must indeed be expected as a consequence of the recent view of the Earth's interior seen through seismic tomography and may thus yield alternative information. The other five reviews concern measurements, processing and regional applications. Pedersen shows that field procedures must be reappraised in order to take full advantage of the more accurate and sophisticated instruments that are being produced, and it is clear that in-field processing will continue its rapid development and contribute to this reappraisal. Measured data have to be processed to determine response functions which may then be modelled by a suitably parameterised earth. The production of the response function however involves making assumptions including the

nature of the induction phenomena, the source of induction and the dimensionality of the region under investigation. Svetov and Shimelevich suggest instabilities experienced in some processing applications may invalidate these assumptions and they use theoretical developments to establish stable processing criteria. This paper is a useful presentation of the latest methods used in the U.S.S.R. with applications.

Electromagnetic fields impinging upon the Earth's surface are distorted in many ways, some by extraneous man-made noise-generating features, some by crustal inhomogeneities the very essence of which we seek to determine. Two papers show our current understanding of distortion. Szarka examines man-made contributions including passive sources (e.g. pipelines, fences) and active sources (e.g. power transmission lines, railways) and presents a body of observational examples. Active sources interact with geological structures and care must be taken in identifying and eliminating these sources, that is in general improving signal to noise ratios for valid EM signals. In some circumstances the extraneous fields themselves can be used and modelled effectively. In the second paper Menvielle examines the case of distortion by crustal inhomogeneities including static distortion and the effects of 2- and 3-dimensional structures. A characteristic dimension scaling the problem can be used to judge when 2-D modelling may misrepresent 3-D effects and adjustment lengths are given for a number of situations.

The review by Hjelt attests to the value of and interest in electromagnetic induction studies. Techniques that have been developed over the years and presented at Workshop meetings continue to be employed world-wide in regional studies of conducting structures and in multi-disciplinary work. Hjelt has compiled results published since 1980 and has separated these into distinct areas of the world, passing comment on the major observed regional features. This bibliography is essential reading for all researchers into a specific area and exemplifies the contribution electromagnetic induction studies make to our understanding of the Earth and some of its processes.

The Neuchatel Workshop was attended by 175 participants from 31 countries. In addition to the review papers published here, 155 contributed papers were presented. About 35 of these form a special issue of *Physics of the Earth and Planetary Interiors*. The induction community are indebted to the Swiss organisers and sponsors for an excellent meeting, managed in the efficient style with which their country is justifiably associated. The 9th Workshop is to be held in Dagomys (U.S.S.R.), 24–31 October, 1988.

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