Secular Solar and Geomagnetic Variations in the Last 10,000 Years

edited by

F.R. Stephenson

and

A. W. Wolfendale

Physics Department, University of Durham, Durham, England

> UNIVERSITÄTSBIELIOTHEK HANNOVER

TECHNISCHE INFORMATIONSBIBLIOTHEK



Kluwer Academic Publishers

Dordrecht / Boston / London

Published in cooperation with NATO Scientific Affairs Division

TABLE OF CONTENTS

Preface	ix
List of Participants	xiii
Section I. The Sun	
Variability of the Present and Ancient Sun: a test of Solar Uniformitarianism J.A. Eddy	1
The Sun among the Stars: What Stars Indicate about Solar Variability D.R. Soderblom and S.L. Baliunas	25
Long and Short Cycles in Solar Activity during the last Millennia M.R. Attolini, M. Galli and T. Nanni	49
Is the Solar Cycle an Example of Deterministic Chaos? N.O. Weiss	69
Fast Dynamos with Flux Expulsion A.M. Soward	79
The Pattern of Large-scale Convection in the Sun C.A. Jones and D.J. Galloway	97
Section II. The Sun from Historical Records	
Solar Variability from Historical Records F.R. Stephenson	109
The Behaviour of Solar Activity as Inferred from Sunspot Observations 165 B.C. to 1986 A.D. Wittmann and Z.T. Xu	131
Solar, Geomagnetic and Auroral Variations Observed in Historical data J. Feynman	141
UNIVERSITÄTSBIBLIOTHEK HANNOVER	

TECHNISCHE

Analysis of Pre-telescopic and Telescopic Sunspot Observations K.K.C. Yau	161
Seasonal and Secular Variations of the Oriental Sunspot Sightings D.H. Willis, C.M. Doidge, M.A. Hapgood, K.K.C. Yau and F.R. Stephenson	187
The Solar Diameter since 1715 J.H. Parkinson, F.R. Stephenson and L.V. Morrison	203
Section III. The Sun and Climate	
The Climate of the Past 10,000 Years and the Role of the Sun T.M.L. Wigley	209
The Climatic Impact of Secular Variations in Solar Irradiance G.C. Reid and K.S. Gage	225
<u>Section IV.</u> Solar and Geomagnetic Signals in Cosmogenic Nuclides and Sea Sediments	
The Solar Component of the Atmospheric ¹⁴ C Record M. Stuiver and T.F. Braziunas	245
Production and Decay of Radiocarbon and its Modulation by Geomagnetic Field-Solar Activity changes with Possible Implications for Global Environment P.E. Damon	267
¹⁰ Be as a Proxy Indicator of Variations in Solar Activity and Geomagnetic Field Intensity during the last 10,000 Years G.M. Raisbeck and F. Yiou	287
Temporal ¹⁰ Be Variations in Ice: Information on Solar Activity and Geomagnetic Field Intensity J. Beer, U. Siegenthaler and A. Blinov	297
Model Comparison of 14 C and 10 Be Isotope Records U. Siegenthaler and J. Beer	315

vi

The Dependence of Cosmogenic Isotope Production Rate on Solar Activity and Geomagnetic Field Variations A. Blinov	329
Solar Imprint in Sea Sediments: the Thermoluminescence Profile as a New Proxy Record G. Cini Castagnoli and G. Bonino	341
Section V. The Earth's Magnetic Field	
Secular Variations of the Geomagnetic Field - the Archaeomagnetic Record D.H. Tarling	349
The Geomagnetic Field over the Last 200 Years F.J. Lowes	367
Geomagnetic Field and Radiocarbon Activity through Holocene Time K.M. Creer	381
Geomagnetic Secular Variation as Determined from Paleomagnetic Studies of Lake Sediments and its Relation to the Study of the Cosmic Ray Flux K.L. Verosub	399
Archeomagnetic Results from United States, 10,000 BC to Present, and with some Data from MesoAmerica R.L. DuBois	419
Geomagnetic Intensity Measurements from Northern Greece and their Comparison with other Data from Central and N. Eastern Europe for the Period 0-2000 yr AD	
S.P. Papamarinopoulos	437
Section VI. Cosmic Rays, the Earth and Cosmology	
The Sun and Cosmic Rays A.W. Wolfendale	443
Terrestrial Variations within given Energy, Mass and Momentum Budgets; Paleoclimate, Sea Level, Paleo- magnetism, Differential Rotation and Geodynamics	
NA. Mörner	455

.

.

Geophysical Observations over the Last Few Millennia and their Implications S.K. Runcorn	479
Astronomy: Evolution of Evolution Sir William McCrea	489
Index	499