

# **Climate and Geo-Sciences**

**A Challenge for Science and Society  
in the 21st Century**



METEOSAT Image, Copyright ESA/EUMETSAT

edited by

**A. Berger  
S. Schneider  
J. Cl. Duplessy**

Kluwer Academic Publishers

# **Climate and Geo-Sciences**

## **A Challenge for Science and Society in the 21st Century**

edited by

**A. Berger**

Institut d'Astronomie et de Géophysique Georges Lemaître,  
Université Catholique de Louvain-la-Neuve, Belgium

**S. Schneider**

National Center for Atmospheric Research,  
Boulder, Colorado, U.S.A.

and

**J. Cl. Duplessy**

Centre des Faibles Radioactivités,  
Laboratoire Mixte CNRS-CEA,  
Gif-sur-Yvette, France

282/3505  
INSTITUT  
FÜR METEOROLOGIE U. KLIMATOLOGIE  
UNIVERSITÄT HANNOVER  
HERRENHAUSER STR. 2 3000 HANNOVER 21



**Kluwer Academic Publishers**

Dordrecht / Boston / London

Published in cooperation with NATO Scientific Affairs Division

**TABLE OF CONTENTS**

vii

INTRODUCTION	xi
LIST OF PARTICIPANTS	xvii

**SECTION 1 - CLIMATE RECORD / WHAT CAN WE LEARN FROM DATA ?**

BARRON E.J. - Pre-Pleistocene climates : data and models.....	3
HENDERSON-SELLERS A. - Archaean atmosphere-biosphere interactions.....	21
STUIVER M. - Dating proxy data.....	39
BERGER A. - The spectral characteristics of pre-Quaternary climatic records, an example of the relationship between the astronomical theory and Geo-Sciences.....	47
LORIUS Cl.J. - Polar ice cores and climate.....	77
DUPLESSY J.Cl., LABEYRIE L., KALLEL N., JUILLET-LECLERC A. - Intermediate and deep water characteristics during the last glacial maximum.....	105
IMBRIE J., MCINTYRE A., MIX A. - Oceanic response to orbital forcing in the late Quaternary : observational and experimental strategies.....	121
BRADLEY R.S. - Recent developments in Quaternary paleoclimatology.....	165
HOLCOMBE T.L. - Paleoclimate data for studies of global climate change and earth system science.....	173
CROWLEY T.J. - Paleoclimate perspectives on a greenhouse warming.....	179

**SECTION 2 - UNDERSTANDING CLIMATE AND CLIMATIC CHANGES**

GHIL M. - Deceptively-simple models of climatic change.....	211
NICOLIS C. and KEPPENNE C.L. - Climate predictability : a dynamical view.....	241
VAN YPERSELE J.-P. - Coupled ocean and sea-ice models : review and perspectives.....	253
BRASSEUR G. and VERSTRAETE M.M. - Atmospheric chemistry - climate interactions.....	279
OERLEMANS J. - Ice and climate studies.....	303
ROBOCK A. - Volcanoes and climate.....	309
GHAN S.J. - Global climatic effects of a nuclear war : an interdisciplinary problem.....	315
VERSTRAETE M.M. - Land surface processes in climate models : status and prospects.....	321
MYERS N. - Tropical deforestation and climatic change.....	341
DOOGEE J.C.I. - The role of the hydrological cycle in climate...	355
MOREL P. - Changes in ocean temperature and the scientific strategy for international climate research.....	367

**SECTION 3 - SIMULATION OF THE GREENHOUSE WARMING**

SCHLESINGER M.E. - Model projections of the climatic changes induced by increased atmospheric CO <sub>2</sub> .....	375
MITCHELL J.F.B. - Climate sensitivity : model dependence of results.....	417
BRYAN K. - Climate response to greenhouse warming : the role of the ocean.....	435
HARVEY D.L.D. - Unresolved issues and research needs pertaining to the transient climatic response to a CO <sub>2</sub> increase.....	447
WOLLAST R. and MACKENZIE F.T. - Global biogeochemical cycles and climate.....	453
SIEGENTHALER U. - Anthropogenic and natural perturbations of the carbon cycle.....	475
GOUDRIAAN J. - Modelling biospheric control of carbon fluxes between atmosphere, ocean and land in view of climatic change.....	481

**SECTION 4 - TECHNOLOGY FOR CLIMATE STUDIES**

BUZBEE B. - Supercomputing and massive parallelism.....	503
JENNE R.L. - Data management methods; data for Europe.....	513
BARRETT E.C. - Satellites and climate.....	525
RASCHKE E. - Radiation budget and clouds.....	547

**SECTION 5 - CLIMATE ENVIRONMENT AND INTERNATIONAL SECURITY**

EHRLICH P.R. - The global commons and national security.....	553
USHER P. - The global environmental issues - an approach to their solution.....	563
TICKELL C. - Human impact on the environment.....	577
VLACHOS E. - Society and future climate change.....	583
GLEICK P.H. - Global climatic changes and geopolitics : pressures on developed and developing countries.....	603
CHEN R.S. - Climate change in the context of multiple threats..	623
ROBOCK A. - Climate and public policy in the United States Congress.....	633
DA CUNHA L.V. - Climatic changes and water resources development.....	639
BERAN M. - Hydrological impacts - What if we are right ? .....	661
EHRLICH A.H. - Climate change : effects on biological systems..	667
FOSBERG M.A. - Forest productivity and health in a changing atmospheric environment.....	681
FEARNSIDE Ph.M. - Climate environment in international security: the case of deforestation in the brazilian amazon..	689

**SECTION 6 - CONFERENCE OVERVIEW AND RECOMMENDATIONS**

PERRY J. - Where is climate research going ? .....	697
AUTHORS INDEX.....	703
SUBJECTS INDEX.....	715