

EARTH GRAVITY FIELD FROM SPACE – FROM SENSORS TO EARTH SCIENCES

Cover illustration: Since the time of Newton the falling apple is regarded as a symbol of gravitation. Nowadays it symbolizes the free fall of satellites guided by the Earth's gravity field in their orbit around the Earth. The highly exaggerated undulations of the geoid surface demonstrate the variations of the Earth's gravity field. They are caused by density contrasts inside the Earth and at its surface.

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**EARTH GRAVITY FIELD FROM SPACE –
FROM SENSORS TO EARTH SCIENCES**

*Proceedings of an ISSI Workshop
11–15 March 2002, Bern, Switzerland*

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FOREWORD

This volume in the *Space Sciences Series of ISSI* is dedicated to the determination of the Earth's gravity field, which was the topic of a workshop organized by ISSI from 11 to 15 March 2002 in Bern. The aim of the meeting was to gather active researchers from various fields (satellite geodesy, gravity field modelling, solid Earth physics, oceanography, etc.) to assess the exciting new developments that are made possible by space missions currently in orbit or about to be launched.

Following some general enquiries with the scientific community concerning the desirability of organising a workshop on the proposed topic, a group of four convenors (Gerhard Beutler, Univ. of Bern; Mark Drinkwater, ESA-ESTEC, Noordwijk; Reiner Rummel, Techn. Univ. München; Rudolf von Steiger, ISSI, Bern) formulated the aims and goals of the workshop, structured the workshop into six sections, nominated a list of session chairs (Georges Balmino, GRGS-CNES, Toulouse; Roberto Sabadini, Univ. of Milano, Christian Le Provost, Obs. Midi-Pyrenees, Toulouse; Philip Woodworth, Bidston Observatory, Birkenhead; Miguel Aguirre, ESA-ESTEC, Noordwijk), who in turn set up a programme of introductory talks. The workshop was organized such as to have only plenary sessions with typically half-hour presentations and ample time for discussions. The last day was devoted to conclusions and future objectives.

The ESA Earth science explorer core mission GOCE, to be launched in 2006, will enhance our knowledge of the global static gravity field and of the geoid by orders of magnitude. The U.S. satellite gravity mission GRACE (2002-2006) is currently measuring, in addition, the temporal variations of the gravity field. With these new data a whole range of fascinating new possibilities will be opened for solid Earth physics, oceanography, geodesy and sea level research. The new generation of gravity missions employs sensor concepts for gravity field measurement, orbit and attitude control and orbit determination that show interesting similarities with space experiments planned in the field of fundamental physics. This workshop brought together some 50 acknowledged experts in their field to discuss (1) strategies for ultra precision orbit determination and gravity field modelling with the data of the upcoming gravity field missions, (2) the use of accurate and high resolution gravity models in Earth sciences whereby, in particular, synergy is expected between the various science fields in their use of this type of new information, and (3) gravity field requirements and possible sensor and mission concepts for the time after GRACE and GOCE.

This volume is the collection of the papers that resulted from the talks given at the workshop, so we think it gives a good overview of the topics and their interrelations. All papers were peer reviewed by referees.

It is a pleasure to thank all those who have contributed to this volume and to the workshop in general. We thank the authors for writing up their contributions and the reviewers for their critical reports. We also thank the directorate and staff of ISSI for selecting this topic for a workshop and for their support in making it happen, in particular Johannes Geiss, Brigitte Fasler, Gabriela Indermühle, Vittorio Manno, Xavier Schneider, and Silvia Wenger. Last but not least we owe particular thanks to Ursula Pfander for her invaluable and skillful assistance in editing this volume.

March 2003

G. Beutler, M.R. Drinkwater, R. Rummel, R. von Steiger



Group Photograph



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Picture taken by R. von Steiger at the Roman amphitheater in Avenches.