

# Preface

Building on its heritage in planetary science, remote sensing of the Earth's atmosphere and ionosphere with occultation methods has undergone remarkable developments since the first GPS/Met 'proof of concept' mission in 1995. Signals of Global Navigation Satellite Systems (GNSS) satellites are exploited by radio occultation while natural signal sources are used in solar, lunar, and stellar occultations. A range of atmospheric variables is provided reaching from fundamental atmospheric parameters such as density, pressure, and temperature to water vapor, ozone, and other trace gas species. The utility for atmosphere and climate arises from the unique properties of self-calibration, high accuracy and vertical resolution, global coverage, and (if using radio signals) all-weather capability. Occultations have become a valuable data source for atmospheric physics and chemistry, operational meteorology, climate research as well as for space weather and planetary science.

The 3rd International Workshop on Occultations for Probing Atmosphere and Climate (OPAC-3) was held September 17–21, 2007, in Graz, Austria. OPAC-3 aimed at providing a casual forum and stimulating atmosphere for scientific discussion, co-operation initiatives, and mutual learning and support amongst members of all different occultation communities. The workshop was attended by 40 participants from 14 different countries who actively contributed to a scientific programme of high quality and to an excellent workshop atmosphere.

The programme included 6 invited keynote presentations and 16 invited presentations, complemented by about 20 contributed ones including 8 posters. It covered occultation science from occultation methodology and analysis via results of recent occultation missions and application of occultation data in atmospheric and climate science to the presentation of future occultation missions. The detailed programme and all further workshop information will continue to be available online at the OPAC-3 website at <http://www.uni-graz.at/opac3>.

Key challenges, as defined by the workshop participants, are to establish occultation as a future climate monitoring system demanding the demonstration of traceability to the International System of Units (SI), which is a fundamental property of a climate benchmark data type. Enhancement and validation of processing chains for the quantification of uncertainty between different retrieval methods and processing systems are further important requirements. Of high importance in this respect is the continuation of GNSS radio occultation missions with a sufficient number of

satellites as well as the conveyance of new mission concepts towards new horizons in occultation research.

This book was compiled based on selected papers presented at OPAC-3 and well represents in its five chapters the broad scope of the workshop. Occultation methodology and analysis with an overview on applications is given in chapter 1. The use of solar, lunar, and stellar occultations from SCIAMACHY and GOMOS onboard ENVISAT for atmospheric studies is described in chapter 2. Chapter 3 and chapter 4 present applications of GNSS occultation from the current missions CHAMP and Formosat-3/COSMIC for atmospheric and climate studies. The topics comprise the use of occultation data in numerical weather prediction and atmospheric wave analysis as well as in climate monitoring and change research. Upcoming occultation missions and new concepts are presented in Chapter 5.

We cordially thank all OPAC-3 colleagues, who contributed as authors and co-authors to the book, for their effort and work. All papers were subject to a peer review process, involving two independent expert reviewers per paper from the community of OPAC-3 participants and beyond. We very much thank these reviewers for their important service to ensure scientific correctness and high quality of the book. The reviewers, in alphabetical order, were S. P. Alexander, L. K. Amekudzi, C. O. Ao, G. Beyerle, C. Boone, K. Bramstedt, S. Cho, L. B. Cornman, M. Dominique, A. von Engeln, U. Foelsche, J. M. Fritzer, S. Healy, S.-P. Ho, K. Hocke, N. Jakowski, Y.-H. Kuo, B. C. Lackner, F. Ladstädter, K. B. Lauritsen, S. S. Leroy, A. Löscher, J.-P. Luntama, A. G. Pavelyev, M. Petitta, D. Pingel, B. Pirscher, P. Poli, T. M. Schröder, S. Schweitzer, V. F. Sofieva, S. V. Sokolovskiy, A. K. Steiner, M. Stendel, S. Syndergaard, A. de la Torre, F. Vespe, J. Wickert, and J. J. W. Wilson.

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We hope that, in the spirit of the OPAC-3 aims, the book will become a useful reference for the members of the occultation-related community but also for members of the science community at large interested in the present status and future promise of the field of occultations for probing atmosphere and climate.

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