

International Association of Geodesy Symposia

Chris Rizos, Series Editor
Pascal Willis, Assistant Series Editor

For further volumes:

<http://www.springer.com/series/1345>

International Association of Geodesy Symposia

Chris Rizos, Series Editor
Pascal Willis, Assistant Series Editor

- Symposium 101: Global and Regional Geodynamics
- Symposium 102: Global Positioning System: An Overview
- Symposium 103: Gravity, Gradiometry, and Gravimetry
- Symposium 104: Sea Surface Topography and the Geoid
- Symposium 105: Earth Rotation and Coordinate Reference Frames
- Symposium 106: Determination of the Geoid: Present and Future
- Symposium 107: Kinematic Systems in Geodesy, Surveying, and Remote Sensing
- Symposium 108: Application of Geodesy to Engineering
- Symposium 109: Permanent Satellite Tracking Networks for Geodesy and Geodynamics
- Symposium 110: From Mars to Greenland: Charting Gravity with Space and Airborne Instruments
- Symposium 111: Recent Geodetic and Gravimetric Research in Latin America
- Symposium 112: Geodesy and Physics of the Earth: Geodetic Contributions to Geodynamics
- Symposium 113: Gravity and Geoid
- Symposium 114: Geodetic Theory Today
- Symposium 115: GPS Trends in Precise Terrestrial, Airborne, and Spaceborne Applications
- Symposium 116: Global Gravity Field and Its Temporal Variations
- Symposium 117: Gravity, Geoid and Marine Geodesy
- Symposium 118: Advances in Positioning and Reference Frames
- Symposium 119: Geodesy on the Move
- Symposium 120: Towards an Integrated Global Geodetic Observation System (IGGOS)
- Symposium 121: Geodesy Beyond 2000: The Challenges of the First Decade
- Symposium 122: IV Hotine-Marussi Symposium on Mathematical Geodesy
- Symposium 123: Gravity, Geoid and Geodynamics 2000
- Symposium 124: Vertical Reference Systems
- Symposium 125: Vistas for Geodesy in the New Millennium
- Symposium 126: Satellite Altimetry for Geodesy, Geophysics and Oceanography
- Symposium 127: V Hotine Marussi Symposium on Mathematical Geodesy
- Symposium 128: A Window on the Future of Geodesy
- Symposium 129: Gravity, Geoid and Space Missions
- Symposium 130: Dynamic Planet - Monitoring and Understanding . . .
- Symposium 131: Geodetic Deformation Monitoring: From Geophysical to Engineering Roles
- Symposium 132: VI Hotine-Marussi Symposium on Theoretical and Computational Geodesy
- Symposium 133: Observing our Changing Earth
- Symposium 134: Geodetic Reference Frames
- Symposium 135: Gravity, Geoid and Earth Observation
- Symposium 136: Geodesy for Planet Earth
- Symposium 137: VII Hotine-Marussi Symposium on Mathematical Geodesy
- Symposium 138: Reference Frames for Applications in Geosciences

Earth on the Edge: Science for a Sustainable Planet

Proceedings of the IAG General Assembly, Melbourne,
Australia, June 28 - July 2, 2011

Edited by

Chris Rizos
Pascal Willis

Volume Editors

Chris Rizos
School of Surveying
University of New South Wales
Sydney
Australia

Series Editor

Chris Rizos
School of Surveying
University of New South Wales
Sydney
Australia

Pascal Willis
Institut national de l'Information
Geographique et Forestiere
Direction Technique
Saint-Mande
France

Assistant Series Editor
Pascal Willis
Institut national de l'Information
Geographique et Forestiere
Direction Technique
Saint-Mande
France

ISSN 0939-9585
ISBN 978-3-642-37221-6 ISBN 978-3-642-37222-3 (eBook)
DOI 10.1007/978-3-642-37222-3
Springer Heidelberg New York Dordrecht London

Library of Congress Control Number: 2013956350

© Springer-Verlag Berlin Heidelberg 2014

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

At the XXV General Assembly of the International Union of Geodesy and Geophysics (IUGG), held from June 27 to July 8, 2011 in Melbourne, Australia, the International Association of Geodesy (IAG) also had its quadrennial General Assembly. The IAG co-organised and contributed to several Union Symposia, as well as to Joint Symposia with other Associations. It also organised seven symposia of its own, one dedicated to each of the four commissions and three dedicated to specific scientific issues. This volume contains the proceedings of 13 symposia, which are listed below with the name of their associate editor(s):

Symposium JG01: Space Geodesy-based Atmospheric Remote Sensing as a Synergistic Link between Geodesy and Meteorology

Editors: Marcelo Santos, Jens Wickert

Symposium JG02: Application of Geodetic Techniques in Cryospheric Studies

Editor: Reinhard Dietrich, Matt King

Symposium JG03: History of Geosciences from Terrestrial to Spaceborne Observations

Editor: Jozsef Adám

Symposium JG04: Structure and Deformation of Plate Interiors

Editor: John Dawson

Symposium JG05: Integrated Earth Observing Systems

Editor: Markus Rothacher

Symposium JG06: Tectonic Geodesy and Earthquakes

Editor: Jeff Freymueller

Symposium G01: Reference Frames from Regional to Global Scales

Editor: Zuheir Altamimi, Athanasios Dermanis, Joao Agria Torres

Symposium G02: Monitoring and Modelling of Mass Distribution and Mass Displacements by Geodetic Methods

Editors: Yoichi Fukuda, Nico Sneeuw, Frank Lemoine, Richard Gross, Herbert Wilmes

Symposium G03: Monitoring and Modelling Earth Rotation

Editors: Richard Gross, Harald Schuh, Oleg Titov

Symposium G04: Multisensor Systems for Engineering Geodesy

Editors: Dorota Grejner-Brzezinska, Hanjörg Kutterer

Symposium G05: Geodetic Imaging Techniques

Editor: Sandra Verhagen, Xiaoli Ding

Symposium G06: Towards a Unified World Height System

Editors: Johannes Ihde, Laura Sanchez

Symposium G07: High Precision GNSS

Editors: Urs Hugentobler, Mikael Lilje, Ruth Neilan

The goal of Modern Geodesy is to monitor changes in a range of physical processes in the solid Earth, the atmosphere and the oceans in order to improve our understanding of this fragile, precious and stressed planet. This is an ambitious goal, but one that all geodesists can have confidence that we are making significant progress in addressing. The range of papers presented at the IAG General Assembly is testament to the ingenuity and hard work of scientists and engineers engaged in geodetic studies and in operational geodesy. Although contributions to the so-called three pillars of geodesy—geometry,

Earth rotation and gravity field—are clearly evident, increasingly the authors of the papers are documenting the contributions of Modern Geodesy to science and society in the context of services and integrated observing systems. One notes that geodesy is applying state-of-the-art technologies (primarily, though not exclusively space-based) and methodologies to what amounts to “Earth Observation”, that is the monitoring in space and time of a variety of Earth process parameters that have geometric, gravimetric or Earth rotation signatures. However, while Modern Geodesy is making enormous contributions to the geosciences as an Earth Observation science, geodesy continues to demonstrate its relevance to society in general, through the provision of fundamental reference frames, Earth observing systems and precise positioning capabilities.

The 2011 General Assembly attracted 370 geodesists from 44 countries. There were 264 oral presentations and 217 posters made at the seven IAG Symposia and six Joint IAG Symposia. Approximately 25 % of those contributions were submitted as full papers for peer review and inclusion in these proceedings. The 80 accepted papers are contained in this volume.

There are several colleagues who contributed to the success of the IAG General Assembly and should be acknowledged here. I am grateful to Hermann Drewes, the Secretary General of the IAG, who coordinated together with the IUGG and IAG Executive Committees and the Local Organising Committee the venue selection, as well as the scheduling and organisation of the symposia which IAG led or contributed to. Michael Sideris, the past President of the IAG, oversaw the planning of the IAG General Assembly. The symposia conveners and co-conveners from the IAG Commissions, Services, GGOS and the Inter-commission Committee on Theory listed on the previous page are gratefully acknowledged for the selection and organisation of the scientific content of the symposia.

Pascal Willis, the IAG Symposium Series Associate Editor, guided the reviews of the submitted papers, communicated with the symposium editors and the paper reviewers, and finally accepted the papers that comprise this volume. I am personally indebted to him, for I could not have put this volume together without his invaluable assistance and tenacity.

For the first time the complete review process (paper submission, review and acceptance) was carried out electronically using the new submission web site created by Springer: <http://www.editorialmanager.com/iags>.

Last, but definitively not least, I wish to sincerely thank all the participating scientists of all ages, and those who made oral and poster presentations, who came to Melbourne and made our General Assembly an unqualified success.

Sydney, NSW, Australia
19 January 2013

Chris Rizos

Contents

Part I JG01: Space Geodesy-Based Atmospheric Remote Sensing as a Synergistic Link Between Geodesy and Meteorology

Generation and Assessment of VMF1-Type Grids Using North-American Numerical Weather Models	3
Landon Urquhart, Marcelo C. Santos, Felipe G. Nievinski, and Johannes Böhm	
DORIS Tropospheric Estimation at IGN: Current Strategies, GPS Intercomparisons and Perspectives	11
Pascal Willis, Olivier Bock, and Yoaz E. Bar-Sever	
The Australian Space Research Program Project: Platform Technologies for Space Atmosphere and Climate: Progress and Preliminary Results	19
K. Zhang, J. Sang, C.S. Wang, J.C. Bennett, B. Carter, R. Norman, and S. Wu	
Simulating GPS Radio Occultation Using 3-D Ray Tracing	27
R. Norman, J. Le Marshall, K. Zhang, C.S. Wang, B.A. Carter, Y. Li, and S. Gordon	
Near Real Time Estimation of Integrated Water Vapour from GNSS Observations in Hungary	31
Sz. Rózsa, A. Kenyeres, T. Weidinger, and A.Z. Gyöngyösi	
Determining the 4D Dynamics of Wet Refractivity Using GPS Tomography in the Australian Region	41
Toby Manning, Witold Rohm, Kefei Zhang, Fabian Hurter, and Carl Wang	
Comparing GPS Radio Occultation Observations with Radiosonde Measurements in the Australian Region	51
R. Norman, J. Le Marshall, K. Zhang, C.S. Wang, B.A. Carter, W. Rohm, T. Manning, S. Gordon, and Y. Li	
Zenith Wet Delay Retrieval Using Two Different Techniques for the South American Region and Their Comparison	59
A. Calori, G. Colosimo, M. Crespi, F. Azpilicueta, M. Gende, C. Brunini, and M.V. Mackern	
Uncertainty Considerations for the Comparison of Water Vapour Derived from Radiosondes and GNSS	65
Sz. Rózsa	

Part II JG02: Application of Geodetic Techniques in Cryospheric Studies

- Mean Dynamic Ocean Topography in the Southern Ocean from GRACE and GOCE and Multi-mission Altimeter Data** 81
 Alberta Albertella, Roman Savcenko, Tijana Janjić, Reiner Rummel, Wolfgang Bosch, and Jens Schröter
- A Closed-Loop Simulation on Regional Modelling of Gravity Changes from GRACE** 89
 Katrin Bentel and Christian Gerlach
- Estimation of PGR Induced Absolute Gravity Changes at Greenland GNET Stations** 97
 Emil Nielsen, Gabriel Strykowski, Rene Forsberg, and Finn Bo Madsen

Part III JG04: Structure and Deformation of Plate Interiors

- New Finite-Element Modelling of Subduction Processes in the Andes Using Realistic Geometries** 105
 Stefanie Zeumann, Rekha Sharma, René Gassmöller, Thomas Jahr, and Gerhard Jentzsch
- Pumping Induced Pore Pressure Changes in Tilt Measurements Near a Fault Zone in Mizunami, Japan** 113
 Matthias Queitsch, Gerhard Jentzsch, Adelheid Weise, Hiroshi Ishii, and Yashuiro Asai

Part IV JG05: Integrated Earth Observing Systems

- Future and Development of the European Combined Geodetic Network ECGN** ... 121
 Markku Poutanen, Johannes Ihde, Carine Bruyninx, Olivier Francis, Ulla Kallio, Ambrus Kenyeres, Gunter Liebsch, Jaakko Mäkinen, Steve Shipman, Jaroslav Simek, Simon Williams, and Herbert Wilmes
- Geocenter Coordinates from GNSS and Combined GNSS-SLR Solutions Using Satellite Co-locations** 129
 Daniela Thaller, Krzysztof Sośnica, Rolf Dach, Adrian Jäggi, Gerhard Beutler, Maria Mareyen, and Bernd Richter
- Analysis of the Sea Level Change in New Zealand** 135
 R. Tenzer and V. Gladkikh
- High Precision Deformation Monitoring at the Geodynamic Observatory Moxa/Thuringia, Germany** 141
 Peter Schindler, Thomas Jahr, Gerhard Jentzsch, and Nina Kukowski

Part V JG06: Tectonic Geodesy and Earthquakes

- A Geodetic Study of the Otago Fault System of the South Island of New Zealand** 151
 P. Denys, R. Norris, C. Pearson, and M. Denham
- Towards an Integrated Model of the Interseismic Velocity Field Along the Western Margin of North America** 159
 C.F. Pearson, R.S. Snay, and R. McCaffrey

Land Subsidence, Groundwater Extraction, and Flooding in Bandung Basin (Indonesia)	167
Irwan Gumilar, H.Z. Abidin, H. Andreas, T.P. Sidiq, M. Gamal, and Y. Fukuda	
Plate Boundary Deformation Following the December 26, 2004 Andaman–Sumatra Earthquake Revealed by GPS Observations and Seismic Moment Tensors	175
Sanjay K. Prajapati, P.S. Sunil, and C.D. Reddy	
Part VI G01: Reference Frames from Regional to Global Scales	
The Construction of ICRF2 and Its Impact on the Terrestrial Reference Frame ...	185
D. Gordon, K. Le Bail, C. Ma, D. MacMillan, S. Bolotin, and J. Gipson	
EUREF’s Contribution to National, European and Global Geodetic Infrastructures	189
J. Ihde, H. Habrich, M. Sacher, W. Söhne, Z. Altamimi, E. Brockmann, C. Bruyninx, A. Caporali, J. Dousa, R. Fernandes, H. Hornik, A. Kenyeres, M. Lidberg, J. Mäkinen, M. Poutanen, G. Stangl, J.A. Torres, and C. Völksen	
External Evaluation of the Terrestrial Reference Frame: Report of the Task Force of the IAG Sub-commission 1.2	197
X. Collilieux, Z. Altamimi, D.F. Argus, C. Boucher, A. Dermanis, B.J. Haines, T.A. Herring, C.W. Kreemer, F.G. Lemoine, C. Ma, D.S. MacMillan, J. Mäkinen, L. Métivier, J. Ries, F.N. Teferle, and X. Wu	
Atmospheric Effects on VLBI-Derived Terrestrial and Celestial Reference Frames	203
Hana Krásná (née Spicakova), Johannes Böhm, Lucia Plank, Tobias Nilsson, and Harald Schuh	
Modelling Deformation in a Kinematic Datum	209
Chris Crook	
Consistent Adjustment of Combined Terrestrial and Celestial Reference Frames	215
M. Seitz, P. Steigenberger, and T. Artz	
On the Alternative Approaches to ITRF Formulation	223
Athanasios Dermanis	
Spatiotemporal Signal and Noise Analysis of GPS Position Time Series of the Permanent Stations in China	231
Yunzhong Shen and Weiwei Li	
GPS + GLONASS CORS Processing: The Asian-Pacific APREF Case	239
A. Nardo, L. Huisman, and P.J.G. Teunissen	
Direct VLBI Observations of Global Navigation Satellite System Signals	247
V. Tornatore, R. Haas, S. Casey, D. Duev, S. Pogrebenko, and G. Molera Calvés	
First Geodetic Results from the AuScope VLBI Network	253
O. Titov, J.M. Dickey, J.E.J. Lovell, and P.M. McCulloch	
Realisation of a Geodetic Datum Using a Gridded Absolute Deformation Model (ADM)	259
R. Stanaway, C. Roberts, and G. Blick	

Part VII G02: Monitoring and Modelling of Mass Distribution and Mass Displacements by Geodetic Methods

Computing Scheme of Co-seismic Change of Deflection of the Vertical and Applied in the 2010 Chile Earthquake	269
Wenke Sun and Xin Zhou	
Satellite Gravity Models and Their Use for Estimating Mean Ocean Circulation ...	275
Roland Pail, Alberta Albertella, Daniel Rieser, Jan Martin Brockmann, Wolf-Dieter Schuh, and Roman Savcenko	
The Integral-Equation-Based Approaches for Modelling the Local Gravity Field in the Remove–Restore Scheme	283
A. Abdalla and R. Tenzer	
Validation of Second-Generation GOCE Gravity Field Models by Astrogeodetic Vertical Deflections in Germany	291
C. Voigt and H. Denker	
On the Estimate of Accuracy and Reliability of the A10 Absolute Gravimeter	297
Jan Krynski, Przemysław Dykowski, Marcin Sękowski, and Jaakko Mäkinen	
Modelling and Observing the Mw 8.8 Chile 2010 and Mw 9.0 Japan 2011 Earthquakes Using GOCE	303
J. Bouman, M. Fuchs, T. Broerse, B. Vermeersen, P. Visser, E. Schrama, and M. Schmidt	
Multi-sensor Space Observation of Heavy Flood and Drought Conditions in the Amazon Region	311
Florian Seitz, Karin Hedman, Franz J. Meyer, and Hyongki Lee	
Accurate Determination of the Earth Tidal Parameters at the BIPM to Support the Watt Balance Project	319
O. Francis, Ch. Rothleitner, and Z. Jiang	
Towards Constraining Glacial Isostatic Adjustment in Greenland Using ICESat and GPS Observations	325
Karina Nielsen, Louise S. Sørensen, Shfaqat Abbas Khan, Giorgio Spada, Sebastian B. Simonsen, and René Forsberg	
Determination of High Precision Underground Equipotential Profiles for the Alignment of a Future Linear Collider	333
Sébastien Guillaume, Mark Jones, Beat Bürki, and Alain Geiger	
Reducing the Measurement Time of the Torsion Balance	341
Gy. Tóth, L. Völgyesi, and S. Laky	
Topographic–Isostatic Reduction of GOCE Gravity Gradients	349
Thomas Grombein, Kurt Seitz, and Bernhard Heck	
Measurement of Underground Variations in the Deflection of the Vertical with a High Precision Interferometric Deflectometer	357
Sébastien Guillaume, Mark Jones, Beat Bürki, and Alain Geiger	
Analysis of Time Variations of the Gravity Field Over Europe Obtained from GRACE Data in Terms of Geoid Height and Mass Variation	365
Jan Krynski, Grazyna Kloch-Glowka, and Malgorzata Szelachowska	

Accurate Gravimetry at the BIPM Watt Balance Site	371
Z. Jiang, V. Pálinkáš, O. Francis, S. Merlet, H. Baumann, M. Becker, P. Jousset, J. Mäkinen, H.R. Schulz, K.U. Kessler-Schulz, S. Svitlov, A. Coulomb, L. Tisserand, H. Hu, and Ch. Rothleitner	
Study of the Time Stability of Tides Using a Long Term (1973–2011) Gravity Record at Strasbourg, France	377
M. Calvo, S. Rosat, J. Hinderer, H. Legros, J.-P. Boy, and U. Riccardi	
Submonthly GRACE Solutions from Localizing Integral Equations and Kalman Filtering	383
Christian Gruber, Yongjin Moon, Frank Flechtner, Christoph Dahle, Pavel Novák, Rolf König, and Hans Neumayer	
The GOCE Estimated Moho Beneath the Tibetan Plateau and Himalaya	391
Daniele Sampietro, Mirko Reguzzoni, and Carla Braitenberg	
Validation of GOCE Gravitational Gradients in Satellite Track Cross-Overs	399
Phillip Brieden and Jürgen Müller	
Reducing Non-tidal Aliasing Effects by Future Gravity Satellite Formations	407
Michael Murböck and Roland Pail	
Preliminary Results from the Superconducting Gravimeter SG-060 Installed in West Africa (Djougou, Benin)	413
J. Hinderer, S. Rosat, M. Calvo, J.-P. Boy, B. Hector, U. Riccardi, and L. Séguis	
Atmospheric Corrections for Superconducting Gravimeters Using Operational Weather Models	421
Maria Karbon, Johannes Böhm, Bruno Meurers, and Harald Schuh	
Micro-Gravity Measurements in Northern Victoria-Land, Antarctica: A Feasibility Study	429
G. Jentzsch, R. Ricker, A. Weise, A. Capra, M. Dubbini, and A. Zanutta	
High-Resolution Measurements of Non-Linear Spatial Distribution of Gravity Gradients in Hungary	435
L. Völgyesi and Z. Ulmann	
Part VIII G03: Monitoring and Modelling Earth Rotation	
Lunar Laser Ranging: Recent Results Based on Refined Modelling	447
Jürgen Müller, Franz Hofmann, Xing Fang, and Liliane Biskupek	
Recursive Adjustment Approach for the Estimation of Physical Earth Parameters from Polar Motion	453
S. Kirschner and F. Seitz	
Atmospheric and Oceanic Excitation of the Free Core Nutation Estimated from Recent Geophysical Models	461
Aleksander Brzeziński, Henryk Dobslaw, and Maik Thomas	
Regional Multi-Fluid-Based Geophysical Excitation of Polar Motion	467
Jolanta Nastula, David A. Salstein, and Richard Gross	
Quantifying the Correlation Between the MEI and LOD Variations by Decomposing LOD with Singular Spectrum Analysis	473
Karine Le Bail, John M. Gipson, and Daniel S. MacMillan	

Part IX G04: Multisensor Systems for Engineering Geodesy

- Advances of Engineering Geodesy and Artificial Intelligence in Monitoring of Movements and Deformations of Natural and Man-Made Structures** 481
G. Retscher, G. Montes, and A. Reiterer
- Precise Antenna Calibration for Ground-Based Pseudolite** 487
Mingkui Wu, Jingsong Huang, Yaming Xu, Yaodong Qiu, Chao Li, Renlan Cai, and Yunhe Yuan
- Collaborative Positioning in GPS-Challenged Environments** 493
Allison Kealy, Nima Alam, Mahmoud Efatmaneshnik, Charles Toth, Andrew Dempster, and Dorota Brzezinska

Part X G05: Geodetic Imaging Techniques

- GNSS Attitude Determination for Remote Sensing: On the Bounding of the Multivariate Ambiguity Objective Function** 503
Nandakumaran Nadarajah, Peter J.G. Teunissen, and Gabriele Giorgi
- Monitoring Ground Subsidence Using PALSAR and ASAR in Shanghai Downtown Area** 511
Jicang Wu, Lina Zhang, Tao Li, and Jie Chen

Part XI G06: Towards a Unified World Height System

- Geoid of Nepal from Airborne Gravity Survey** 521
Rene Forsberg, Arne Vestergaard Olesen, Indridi Einarsson, Niraj Manandhar, and Kalyan Shreshta
- GOCE and the Geoid in South America** 529
A.C.O.C. de Matos, D. Blitzkow, G.N. Guimarães, and M.C.B. Lobianco
- Derivation of the Topographic Potential from Global DEM Models** 535
Christian Gruber, Pavel Novák, Frank Flechtner, and Franz Barthelmes
- Strategies for Connecting Imbituba and Santana Brazilian Datums Based on Satellite Gravimetry and Residual Terrain Model** 543
Henry D. Montecino and Silvio R.C. de Freitas
- Realization of WHS Based on Gravity Field Models Free of Dependencies on Local Vertical Datums** 551
Róbert Čunderlík, Robert Tenzer, and Karol Mikula
- Study of Alternatives for Combining Satellite and Terrestrial Gravity Data in Regions with Poor Gravity Information** 561
K.P. Jamur, S.R.C. de Freitas, and H.D. Montecino

Part XII G07: High Precision GNSS

- Single-Frequency PPP-RTK: Theory and Experimental Results** 571
Dennis Odijk, Peter J.G. Teunissen, and Amir Khodabandeh
- Single Frequency PPP Using Real-Time Regional Broadcast Corrections via NTRIP for the Australian GDA94 Datum** 579
Lennard Huisman, Peter J.G. Teunissen, and Congwei Hu

Global Assessment of UNB's Online Precise Point Positioning Software	585
Landon Urquhart, Marcelo C. Santos, Carlos A. Garcia, Richard B. Langley, and Rodrigo F. Leandro	
Reliable Integer Ambiguity Resolution	591
Patrick Henkel and Patryk Jurkowski	
Array-Aided CORS Network Ambiguity Resolution	599
Bofeng Li and Peter J.G. Teunissen	
A New Newton-Type Iterative Formula for Over-Determined Distance Equations	607
Yamin Dang and Shuqiang Xue	
List of Reviewers	615