International Association of Geodesy Symposia

Klaus-Peter Schwarz, Series Editor

*Symposium 101*: Global and Regional Geodynamics
*Symposium 102*: Global Positioning System: An Overview
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*Symposium 118*: Advances in Positioning and Reference Frames
Advances in Positioning and Reference Frames

IAG Scientific Assembly
Rio de Janeiro, Brazil, September 3-9, 1997

Convened and Edited by
Fritz K. Brunner

Springer
The Scientific Assembly of the International Association of Geodesy (IAG) was held from September 3 to 9, 1997 in Rio de Janeiro, Brazil, in conjunction with the 18th Brazilian Congress of Cartography. This was the first time that one of the major IAG meetings took place in Brazil. It provided an opportunity to showcase the progress of geodetic work in South America through campaigns such as SIRGAS. It also provided an opportunity for a large group of international experts to present the state of the art in geodesy and geodynamics and to interact with their hosts on possibilities of future cooperation. For the IAG, it continued a trend, started in Beijing four years ago, to hold major geodetic meetings outside of Europe and North America. The International Geoid School which was held in Sao Paulo following this meeting showed another facet of this growing internationalization of IAG activities and services.

The scientific program of the meeting consisted of three symposia and two special sessions, namely

- Symposium 1: Advances in Positioning and Reference Frames
- Symposium 2: Gravity and Geoid
- Symposium 3: Geodynamics
- Special Session 1: IAG Services
- Special Session 2: Geodesy in Antarctica.

Papers presented at the first symposium are published in volume 1 of these proceedings, while papers of symposia 2 and 3 as well as special session 2 are contained in volume 2. Papers presented at special session 1 will be published separately. More details on the individual volumes are given in the prefaces written by the convenors.

The meeting was jointly organized by the IAG and the Brazilian Society of Cartography, Geodesy, Photogrammetry and Remote Sensing. The two local organizing committees worked closely together to economize on some of the organizational aspects and to guarantee a smooth running of two conferences in the same place. Thanks go to our Brazilian colleagues for their hard work and their warm hospitality. On the geodetic side, special thanks go to Professor D. Blitzkov, the national representative of the IAG who chaired the IAG Local Organizing Committee (LOC), and the dedicated group of individuals working with him. Similarly, Professor W. Torge, past president of the IAG, who provided the liaison between the LOC and the IAG Executive deserves a special vote of thanks. Finally, the symposium and session convenors who not only organized the scientific program but also took care of organizing the review process and editing these proceedings, are thanked for their outstanding efforts.
PREFACE

Over the past few years we have experienced tremendous progress in GPS positioning. Therefore, it seemed appropriate to organise a special symposium for the review of current developments in precise GPS positioning with special emphasis on the work of the related Special Study Groups of IAG.

"Advances in Positioning and Reference Frames“ was one of the symposia held during the Scientific Assembly of IAG in Rio de Janeiro in September 1997. This symposium comprised six sessions: Maintenance and Densification of Reference Frames, GPS Reference Networks, the SIRGAS Project, Current Developments in Precise GPS Positioning, GPS Kinematic Applications, and a very successful Poster Session. During the symposium, 25 invited papers were presented and 70 posters were displayed.

This volume contains the reviewed contributions to the symposium. Its contents reflect the exciting and steadily growing developments of fundamental GPS work as well as novel applications of static and kinematic GPS surveying techniques. The maintenance and the densification of reference frames are treated for the purpose of establishing global and regional GPS networks. The scientific achievements of the South American Geocentric Reference System project (SIRGAS) are discussed. Congratulations to all SIRGAS contributors for their outstanding achievements! Several contributions review the state of the art of GPS analysis techniques, ambiguity resolution methods, as well as GPS antenna and site problems. New applications of kinematic GPS positioning and the quality control issues of real-time GPS positioning are presented.

The individual sessions of the symposium were organised by the conveners Yehuda Bock, Claude Boucher, Luiz Fortes and Chris Rizos, who also carried the main burden of reviewing the manuscripts. Ms. S. Schmuck assisted in the organisation of the papers. I would like to thank everybody who helped with the preparation of the symposium and the proceedings, especially the authors for their excellent contributions.

May 1998

Fritz K. Brunner
Session 1: Maintenance and Densification of Reference Frames
Convener: Claude Boucher

WGS 84 - Past, Present and Future
_J.A. Slater and S. Malys (invited)_

ITRF Densification and Continuous Realization by the IGS
_G. Blewitt, C. Boucher, P.B.H. Davies, M.B. Heflin, T.A. Herring and J. Kouba (invited)_

The Use of the EUREF Permanent GPS Network for the Maintenance of the European Terrestrial Reference Frame

The European Vertical GPS Reference Network Campaign 1997 - Concept and Status
_J. Ihde, J. Adam, W. Gurtner, B.G. Harsson, W. Schlüter and G. Woeppelmann (invited)_

From UELN-95 to EVS 2000 - European Activities for a Continental Vertical Datum
_W. Augath, F. Brouwer, H. Lang, J. van Mierlo and M. Sacher_

Global GPS Networks and the Determination of Earth Rotation Parameters
_V. Ashkenazi, T. Moore, L.J. Symons, W. Chen and M.H.O. Aquino_

Realization of the ITRF-94 in Thailand and Malaysia by Use of a Combined Network for Geodynamics and National Survey
_M. Becker, E. Reinhart, H. Seeger, S. Mingsamong, C. Boonphakdee and S. Abu_
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The New Swiss National Height System LHN95
U. Marti and D. Schneider

The Non-Fiducial Approach Applied to GPS Networks
J.F.G. Monico and E.S. da Fonseca Junior

The Statefix West Australian GPS Network
M.P. Stewart, H. Houghton and X. Ding

POLREF-96 - The New Geodetic Reference Frame for Poland
J.B. Zielinski, A. Lyszkowicz, L. Jaworski, A. Swiatek, R. Zdunek and S. Gelo

Session 3: SIRGAS Project
Convener: Luiz Paulo S. Fortes

An Overview of the SIRGAS Project (Abstract)
L.P.S. Fortes (invited)

The Definition and Realization of the Reference System in the SIRGAS Project
M. Hoyer, S. Arciniegas, K. Pereira, H. Fagard, R. Maturana, R. Torchetti,
H. Drewes, M. Kumar and G. Seeber (invited)

Time Evolution of the SIRGAS Reference Frame
H. Drewes (invited)

Results of the SIRGAS 95 GPS Network Processing at DGFI/I

The Integration of Brazilian Geodetic Network into SIRGAS
S.M.A. Costa, K.D. Pereira and D. Beattie

Adjustment of the New Venezuelan National GPS Network within the SIRGAS
Reference Frame
H. Drewes, H. Tremel and J.N. Hernández

Realization of a Geocentric Reference System in Argentina in Connection
with SIRGAS
J. Moirano, C. Brunini, H. Drewes and K. Kaniuth
Some Considerations Related to the New Realization of SAD-69 in Brazil

L.C. Oliveira, J.F.G. Monico, M.C. Santos and D. Blitzkow

The IGS Regional Network Associate Analysis Center for South America at DGFI/I

W. Seemüller and H. Drewes

The Redefinition of the Geodetic Reference System of Uruguay into SIRGAS Frame


Session 4: Current Developments in Precise GPS Positioning
Convener: Yehuda Bock

GPS Ambiguity Resolution for Navigation, Rapid Static Surveying, and Regional Networks

P.J. de Jonge (invited)

GPS Antenna and Site Effects

J.M. Johansson (invited)

Precise GPS Positioning Improvements by Reducing Antenna and Site Dependent Effects

G. Seeber, F. Menge, C. Völksen, G. Wübbena and M. Schmitz (invited)

IGS Orbit, Clock and EOP Combined Products: An Update

J. Kouba and Y. Mireault (invited)

The Use of GPS for Monitoring of the Ionospheric Disturbances

L.W. Baran and I.I. Shagimuratov

An Integrated GPS Monitoring System for Site Investigation of Nuclear Waste Disposal

R. Chen and J. Kakkuri

Determination of Stochastic Models of GPS Baselines in GPS Network Adjustment

X. Ding, M. Stewart and J. Chao

The Assisi Landslide GPS Network

D. Dominici, F. Radicioni, S. Selli and A. Stoppini

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Static and Kinematic Positioning with GPS for the Construction and Maintenance of High Speed Railway Lines
H. Kahmen

Kinematic GPS for Ice Sheet Surveys in Greenland
K. Keller, R. Forsberg and C.S. Nielsen

A Reweighted Filtering Algorithm and its Application to Open Pit Deformation Monitoring
M. Jia, M. Tsakiri and M. Stewart

C. Roberts and C. Rizos

Modified GPS-OTF Algorithms for Bridge Monitoring: Application to the Pierre-Laporte Suspension Brigde in Quebec City
R. Santerre and L. Lamoureux

The GPS Component of the Project for Digital Mapping of the KARST Aquifer System Near Curitiba, Brazil (Abstract)
M.C. Santos, A.J.B. Vieira and H. Firkowski

Kinematic GPS Positioning with Adaptive Kalman Filtering Techniques
J. Wang, M. Stewart and M. Tsakiri