



**International  
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Geodesy**  
**Newsletter**

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The *IAG Newsletter* is under the editorial responsibility of the *Communication and Outreach Branch* (COB) of the IAG.

It is an open forum and contributors are welcome to send material (preferably in electronic form) to the IAG COB ([newsletter@iag-aig.org](mailto:newsletter@iag-aig.org)). These contributions should complement information sent by IAG officials or by IAG symposia organizers (reports and announcements). The *IAG Newsletter* is published monthly. It is available in different formats from the IAG new internet site: <http://www.iag-aig.org>

Each *IAG Newsletter* includes several of the following topics:

- I. news from the Bureau Members
- II. general information
- III. reports of IAG symposia
- IV. reports by commissions, special commissions or study groups
- V. symposia announcements
- VI. book reviews
- VII. fast bibliography

Books for review are the responsibility of:

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## Meeting Announcements

### *International workshop on GNSS Remote Sensing for Future Missions and Sciences*

August 7-9, 2011, Shanghai, China

<http://www.shao.ac.cn/gnss>

The Global Navigation Satellite System (GNSS) has been widely used in navigation, positioning and geoscience applications. Recently, the versatile refracted, reflected and scattered signals of GNSS have been successfully demonstrated to sound the atmosphere and ionosphere, ocean, land surfaces (including soil moisture) and the cryosphere as a new remote sensing tool. With the further improvement of the next generation multi-frequency GNSS systems and receivers and new space-based instruments utilizing GNSS reflections and refractions, new scientific applications of GNSS are expected in various environment remote sensing fields in the near future.

The international workshop on *GNSS Remote Sensing for Future Missions and Sciences* will be a forum for assessing current ability and presenting recent results and future developments as well as looking for new collaboration opportunities, joint nanosatellite experiments and missions using GNSS refractometry, reflectometry and scatterometry, e.g., atmospheric and ionospheric sounding using ground and space-borne GPS measurements (CHAMP, GRACE, COSMIC, MetOp, TerraSAR-X, OceanSat-2), GNSS reflectometry (GNSS-R) in ocean altimetry, and soil moisture and ice/snow status as well as geohazards monitoring/warning (e.g., Hurricane, Typhoon, Tsunami and Earthquake).

SANDRA VERHAGEN  
President, IAG Commission 4

### *IAG Sponsored Meetings*

#### *XXV IUGG General Assembly*

June 27 – July 8, 2011, Melbourne, Australia

URL: <http://www.iugg2011.com/>

#### *2011 IAG General Assembly*

at IUGG2011: “*Earth on the Edge: Science for a Sustainable Planet*”

Melbourne Convention and Exhibition Centre, Australia

June 28 – July 7, 2011

The next IAG General Assembly will be held as part of the major IUGG2011 international conference at the new Melbourne Convention and Exhibition Centre from 28<sup>th</sup> June to 7<sup>th</sup> July, 2011. IUGG (or the International Union for Geodesy and Geophysics) is a collaborative grouping of eight scientific learned societies or associations. The conference website is <http://www.iugg2011.com>.

#### *International workshop on GNSS Remote Sensing for Future Missions and Sciences*

August 7-9, 2011, Shanghai, China

URL: <http://www.shao.ac.cn/gnss>

#### *SIRGAS General Meeting 2011*

August 8-10, 2011, Heredia, Costa Rica

URL: <http://www.sirgas.org/>

#### *3rd International Colloquium - Scientific and Fundamental Aspects of the Galileo Programme*

August 31 - September 2, 2011 in Copenhagen, Denmark

More information and online abstract submission is available on the Colloquium web site: <http://www.congrex.nl/11A12/>.

#### *Joint International Symposium on Deformation Monitoring*

November 2-4, 2011, Hong Kong, China

URL: <http://dma.lsgj.polyu.edu.hk/>

## *IAG Related Meetings*

### *ESA International Summer School on GNSS 2011*

*July 20-30, 2011, Berchtesgaden/Bavaria, Germany*

It is the objective of this summerschool to provide the attendees with a comprehensive overview on the design and development of satellite navigation systems as well as its applications. The program is open to graduate students, PhD. candidates, early-stage researchers and young professional willing to broaden their knowledge.

URL: <http://www.munich-satellite-navigation-summerschool.org>

### *AOGS 2011 Conference*

*August 8-12, 2011, Taipei, Taiwan*

There will be sessions related to geodesy on topics such as “New technological developments in space geodesy and applications on atmospheric and geodynamical research”, Solid Earth, Natural Hazards, and Atmosphere.

URL: <http://www.asiaoceania.org/aogs2011>

### *XXX URSI General Assembly and Scientific Symposium*

*August 13-20, 2011, Istanbul, Turkey*

URL: <http://www.ursigass2011.org/>

### *ISDE7*

*August 23-25, 2011, Perth, Australia*

The 7th International Symposium on Digital Earth (ISDE7) with the theme of the Knowledge Generation will be held in Perth, Australia from 23-25, August 2011 in conjunction with the Western Australian Land Information System (WALIS) Forum and the State Natural Resources Management (NRM) Conference.

URL: <http://www.isde7.net/>

### *Unified Analysis Workshop*

*September 16-17, 2011, Zurich, Switzerland*

URL: <http://iag.dgfi.badw.de/index.php?id=291>

### *Journées 'Systèmes de référence spatio-temporels' 2011*

*September 19-21, 2011, Vienna, Austria*

URL: <http://info.tuwien.ac.at/hg/meetings/journees11/index.html>

### *SMOS Science Workshop*

*September 27-29, 2011, Arles, France*

URL: <http://www.smos2011.org/>

### *Intergeo 2011*

*September 27-29, 2011, Nürnberg, Germany*

URL: <http://www.intergeo.de/>

### *ISPRS - PIA11 Photogrammetric Images Analysis*

*October 5-7, 2011, Munich, Germany*

URL: <http://www.pia11.tum.de/>

### *IRI Workshop 2011*

*October 10-14, 2011, Hermanus, South Africa*

URL: <http://iri2011.hmo.ac.za/>

### SX5 - Scientific Service Support Based on Galileo E5 Receivers

October 18, 2011, Neubiberg/Munich, Germany

URL: <http://ifen.bauv.unibw.de/sx5/workshop.html>

### OSTST Meeting

October 19-21, 2011, San Diego, USA

URL: <http://www.aviso.oceanobs.com/en/courses/sci-teams/index.html>

### Modern Technologies, Education & Professional Practice in Geodesy and Related Fields

November 10-11, 2011, Sofia, Bulgaria

Contact: [milev@bas.bg](mailto:milev@bas.bg)

### 10th International E-VLBI Workshop

November 13-16, 2011, Broederstroom, South Africa

URL: <http://www.hartrao.ac.za/e-vlbi2011/e-vlbi2011.html>

### UGI 2011 Regional Geographic Conference

November 14-18, 2011, Santiago, Chile

URL: <http://www.ugi2011.cl/>

### AGU Fall Meeting

December 5-9, 2011, San Francisco, USA

URL: <http://www.agu.org/meetings/>

### 2<sup>nd</sup> International School on Least Squares Approach to Modeling the Geoid

February 27- March 2, 2012, Johor Bahru, Malaysia

Theoretical lectures in the mornings are followed by practical computer exercises in the afternoons.

URL: <http://www.infra.kth.se/geo/events/IGS-2012.pdf>

## Reports

### *17<sup>th</sup> ILRS Workshop*

*Bad Koetzing, Germany, 16-20 May, 2011*

The International Laser Ranging Service (ILRS) convened in Bad Koetzing (Germany) for the 17th International Workshop on Laser Ranging between May 16 and May 20, 2011. These workshops are the major communication forum for the observing SLR stations, the data analysts and the data centers. Over 160 attendees from all continents contributed to the discussions. The program dealt with new developments at the various observatories, data quality and quantity related issues, future mission and observation scenarios. The impact of major recent technological developments, such as the operation of ranging systems with a repetition rate of 1 kHz or more, were reviewed as well as one-way ranging transponder applications such as the successful Lunar Reconnaissance Orbiter (LRO).

Apart from the various technical and analysis sessions, which were held at the town hall in Bad Koetzing, a field trip to the nearby Geodetic Observatory Wettzell was also organized. During this field trip all workshop participants had the opportunity to look at the Wettzell Laser Ranging System (WLRS), the new SLR system SOS-W (under construction), the VLBI system, as well as the new TWIN-VLBI2010 system (under construction) and the Large Ring Laser Gyroscope "G". A number of specific working group meetings, an extended poster session and a General Assembly of the ILRS rounded off a very busy week. The 18th International Workshop on Laser Ranging will be held in Tokyo in 2013.

CAREY NOLL  
Secretary, ILRS Central Bureau

## *XXIth EUREF Symposium*

*Chisinau, Moldova, 25-28 May, 2011*

At invitation of the Moldovan Agency for Land Relations and Cadastre as well as the Moldovan State Enterprise "INGEOCAD" and co-sponsored by State Enterprise "IPOT", State Enterprise "Soil Protection and Land Improvement", State Enterprise Cadastru and Leica Geosystems, the IAG Reference Frame Sub-commission for Europe (EUREF) held its 21th Symposium from May 25 – 28, 2011 in Chisinau/Moldova. The EUREF Technical Working Group (TWG) met as usual the day before the beginning of the symposium, i.e. on May 24.

The symposium took place in the at the Conference Hall of Codru Hotel in Chisinau. About 130 geodesists representing 35 countries met for this 2011 annual EUREF symposium.

The symposium was opened by Mr. V. Filat, Prime Minister of the Republic of Moldova and Mr. G. Duca, President of Academy of Sciences of the Republic of Moldova. On behalf of the IAG, Z. Altamimi, President IAG Commission 1 "Reference Frames" and J. Torres, President IAG sub-commission 1.3 "Regional Reference Frames" as well as J. Ihde, Chairman of the EUREF Sub-commission expressed their good wishes for a successful conference.

EUREF is the Reference Frame Sub-commission for Europe of the IAG (International Association of Geodesy), a component of the Regional Reference Frames Sub-commission, integrated in Commission 1-Reference Frames. The long-term objective of EUREF, as defined in its Terms of Reference, "is the definition, realization and maintenance of the European Reference Systems, in close cooperation with the pertinent IAG components (Services, Commissions, and Inter-Commission projects) as well as EuroGeographics and EUMETNET (European Meteorological Services Network)".

The results and recommendations proceeding from EUREF support the use of the European Reference Systems in all scientific and practical activities related to precise geo-referencing and navigation, Earth sciences research and multi-disciplinary applications. EUREF makes use of the most accurate and reliable terrestrial and space-borne techniques available, and develops the necessary scientific background and methodology.

Its activities are focussed on a continuous innovation and on the changing user needs, as well as on the maintenance of an active network of people and organizations, and may be summarized as follows:

- to maintain the ETRS89 (European Terrestrial Reference System) and the EVRS (European Vertical Reference System) and upgrade the respective realizations;
- to refine the EUREF Permanent Network (EPN) in close cooperation with the IGS (International GNSS Service);
- to improve the Unified European Levelling Network (UELN);
- to contribute to the IAG Project GGOS (Global Geodetic Observing System) using the installed infrastructures managed by the EUREF members.

These activities are reported and discussed at the EUREF Symposia, an event that occurs every year since 1990, with an attendance of numerous participants coming from nearly all countries in Europe and other continents, representing universities, research centres and the NMCA (National Mapping and Cadastre Agencies). It's an open forum, and may be attended by any person interested in the work of the Sub-Commission.

The organization of the EUREF Symposia has been and will be supported by EuroGeographics, the consortium of the European NMCA, reflecting the importance of the EUREF work for practical purposes. This involvement is consolidated by a formal liaison between EUREF and EuroGeographics.

The scientific programme covered the following topics:

- Activities of the EUREF Technical Working Group
- New Developments in GNSS Networks
- Modelling the Earth with GNSS
- Mitigation of GNSS Error Sources
- Height, Gravity, Geoid, and Combination of Techniques
- Improvements and Densifications of the ETRS89
- National Reports

In 36 oral presentations and 30 National Reports as well as 17 posters various aspects of EUREF and neighbouring topics were treated. The available texts will be published as usual in the EUREF Proceedings withing the publications series of the German Bundesamt für Kartographie und Geodäsie (BKG). By courtesy of our colleague Carl Calvert, UK, a "Best Student Poster Award" was handed over again to a young scientist. This award was give to Dimitrios Ampatzidis, Department of Geodesy and Surveying Aristotle University of Thessaloniki, for the submission of a poster by him together with Ch. Kotsakis and K. Katsampalos, entitled 'The need of a Local Reference Frame realization in Greece: The deficiency of ETRS89 and a new proposed strategy'.

According to the Sub-commission's Terms of Reference, the term in office of the EUREF Officers has ended with this Symposium. The EUREF TWG submitted proposals to the symposium plenary, all proposals were unanimous accepted. The EUREF Officers for the term 2011 – 2015 are

- Chair: Dr. Johannes Ihde, Germany (re-elected)
- TWG Chair: Dr. Carine Bruyninx, Belgium (re-elected)
- Secretary: Dr. Alessandro Caporali, Italy (replacing Helmut Hornik, Germany)

The scientific sessions were accompanied by a social programme with impressive arrangements of Moldovan hospitality and culture.

A detailed overview on this symposium (programme, participants, ppt-files of presentations, photo gallery etc.) will be put into the EUREF homepage – see symposia. There also the previous symposia are documented.

The EUREF Sub-commission acknowledges the financial support given by EuroGeographics for the enabling the participation of delegates from economical weak countries.

By courtesy of the colleagues of France, the EUREF Sub-commission is invited to hold its 2012 Symposium in Paris – St- Mandé. Details will be published in the EUREF homepage in time.

JOHANNES IHDE  
EUREF Chair

HELMUT HORNIK  
EUREF Secretary till May 2011

ALESSANDRO CAPORALI  
EUREF Secretary since May 2011

Enclosure: Resolutions of the XIXth EUREF Symposium in Chisinau, May 25 – 28, 2011

### *Resolutions of the XIX<sup>th</sup> EUREF Symposium in Chisinau, May 25 – 28, 2011*



#### **Resolution no. 1**

The IAG Reference Frame Sub-commission for Europe (EUREF)

*recognising that* GNSS campaigns and subsequent computations were completed and presented to the Technical Working Group (TWG) as

1. EUREF Serbia 2010;
2. EUREF MAKPOS 2010; and
3. EUREF Faroe Islands 2007;

were accepted as Class B standard by the TWG

*endorses* the set of points for 1) Serbia, 2) Former Yugoslav Republic of Macedonia, and 3) Faroe Islands as an improvement and extension of ETRS89 in those countries.



#### **Resolution no. 2**

The IAG Reference Frame Sub-commission for Europe (EUREF)

*considering* the ongoing evolution of GNSS and the availability of new GNSS signals such as GPS L5 for example

*encourages* EPN station managers to configure their stations to, where possible, submit observations of all the new signals in addition to current submissions.



#### **Resolution no. 3**

The IAG Reference Frame Sub-commission for Europe (EUREF)

*noting* the success of the latest questionnaire on the national adoption of ETRS89 and the use EUREF products *and recognising* the success of the ETRS89 coordinate monitoring activity

*and considering* the importance of full coverage of this type of information across the EUREF region

*encourages* the member countries of EUREF, who have not already done so, to submit their national ETRS89 coordinates of their EPN stations if possible.



#### Resolution no. 4

The IAG Reference Frame Sub-commission for Europe (EUREF)  
*recognising* the significant practical and scientific value of the EVRS and the advantages of improving its subsequent realisation  
*encourages* national UELN/EUVN levelling data providers to submit new or repeated levelling measurements to the UELN data centre especially connections between countries  
*and requests* that national authorities inform the Technical Working Group of their decision to make the descriptions of the national vertical reference systems and transformations parameters available on the CRS-EU facility.



#### Resolution no. 5

The IAG Reference Frame Sub-commission for Europe (EUREF)  
*recognising* the recent availability of corrections in the RTCM standard for satellite orbits, clocks and biases, that enable the testing of real-time precise point positioning (PPP) in the ETRS89  
*invites* the EUREF community to trial these new corrections and provide feedback to the TWG on their performance.



#### Resolution no. 6

The IAG Reference Frame Sub-commission for Europe (EUREF)  
*recognising* the efforts of Helmut Hornik as, at first, RETrig and then EUREF Secretary 1981 – 2011  
*expresses* its heartfelt thanks for his contribution to the development of geodetic reference frames in Europe for the last 3 decades.



#### Resolution no. 7

The IAG Reference Frame Sub-commission for Europe (EUREF) which held its twenty first symposium in Chisinau from May 25 – 28, 2011  
*expresses* its heartfelt thanks to the Local Organising Committee: Anatolie Ghilas, Maria Ovdii, Alexandru Cebanu, Tamara Rudenco, Ion Eremia, Lucia Cuşnir, Ion Danii, Vladimir Mihov, Viorica Olaru, Ion Bolohan, Natalia Spilevaia and Serghei Nagorneac for organising the symposium and for the excellent arrangements resulting in a very successful meeting and for the support given by:

- Agency for Land Relations and Cadastre
- State Enterprise “INGEOCAD“
- State Enterprise “ CADASTRU”
- State Enterprise “IPOT”
- State Enterprise “Soil Protection and Land Improvement”
- Leica Geosystems.



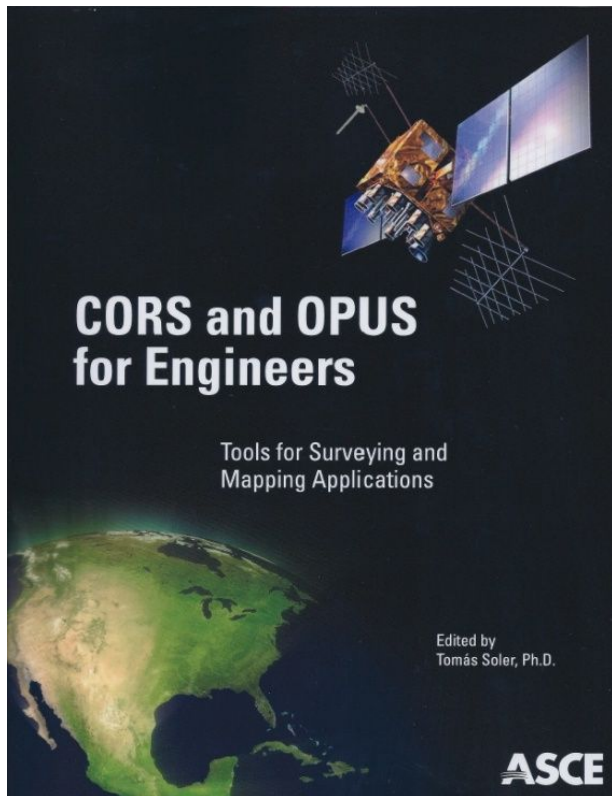
- when it has to be right





## Book Review

*Tomás Soler (Editor): CORS and OPUS for Engineers: Tools for Surveying and Mapping Applications*



Title:	CORS and OPUS for Engineers: Tools for Surveying and Mapping Applications
Editor:	Tomás Soler
Publisher:	American Society of Civil Engineers (ASCE)
ISBN	978-0-7844-1164-3
Year:	2011
Price:	\$90.00List / \$67.50 ASCE Member
Pages:	VI, 186 p., 21.50 x 28 cm, Illus., Including references and index
Size:	21.5 × 28 cm
Details:	Paperback, Sponsored by ASCE Geomatics Division and the National Geodetic Survey

The major GNSS utilities in the U.S.A. and its territories are the CORS (Continuously Operating Reference Station) network of GNSS of permanent stations and OPUS (Online Positioning User Service). CORS is operated and coordinated by NGS as is the free OPUS service. The monograph “CORS and OPUS for Engineers” contains 22 contributions, of which about half are previously published papers and the other half is a collection of contributions mainly by NGS researchers and a private engineering firm GPS Survey Manager. The purpose of the monograph is to provide academic researchers and engineers working in the area of surveying, GIS, and mapping applications, a better and deeper understanding of CORS and OPUS. The contributions comprehensively describe CORS and OPUS, providing insight in the theory and addressing topics that are of particular interest to users.

The CORS network, which by design is a dynamic network that to date has grown to more than 1500 stations, is introduced at the beginning of the monograph. This includes a complete exposure of the history of this high-accuracy GNSS network and identification of principle applications to science and engineering. In line with the intended dynamic nature of the network, the second paper provides details for establishing and operating CORS stations for users wishing to add a station to the network.

Like the CORS network, and anything else in GNSS these days, the OPUS services are a work in progress. At this time there are two services available and addressed in detail in the monograph, OPUS-S and OPUS-RS.

The OPUS-S service applies to static applications when observing sessions are greater than two hours. The automated processing selects the nearest three CORS stations with good quality data and carries out three independent vector determinations. The vectors are added to the known coordinates of the CORS stations. The resulting three sets of coordinate estimates for the new station are averaged to constitute the final position solution. The peak-to-peak (range) of the three determined coordinates is provided as a measure of accuracy for each component.

The OPUS-RS (rapid static) service applies to cases where the observation session length is between 15 minutes and 2 hours. The internal processing occurs in two steps. In the first step, the network mode, the software selects up to 9 CORS stations within a radius of 250 km of the new station. Holding the published CORS station coordinates fixed, it then estimates the double difference integers, tropospheric refraction parameters, and double difference ionospheric delays relative to the selected CORS stations. The second step, called the rover mode, uses the computed atmospheric corrections to predict the respective atmospheric phase advances and phase delays at the rover station. The latter corrections are then held as constraints in the solution for the coordinates of one rover location.

As mentioned above, the OPUS-S designers prefer to use the peak-to-peak statistic computed from the coordinates of three independent solutions as a measure of accuracy for the rover perhaps to avoid the archetypical too optimistic formal standard deviations obtained from the GPS least squares adjustment. In addition, the individual comparisons of solutions also reveal more readily information about the quality of the adopted CORS coordinates. One of the contributions in the monograph addresses the theoretical relationship between such a range measure and the more commonly used standard deviation. In the case of OPUS-RS, the interpolation, and possibly even extrapolation, makes the solution dependent on the spatial distribution of the selected CORS stations. The influence of this geometry is parameterized by a newly introduced Interpolative Dilution Of Precision (IDOP) factor which is one of two arguments of a function that predicts the standard deviation of the position solution. The other argument is the Root Mean Squared Distance (RMSD) between the rover and the individual CORS stations involved. Several papers are included on the derivation of IDOP and the graphic display of the estimated functional accuracy.

Since the goal of CORS and OPUS is to achieve the highest accuracy in geospatial positioning, essential elements are geodetic datum definition and transformation. Several papers address the issues. A complete summary of the transformations equations and the explicit way in which these are applied is given on page 155. Initially, the CORS coordinates (ITRF00, epoch 1997.00) are extracted from the NGSIDB (NGS Integrated Data Base) and then epoch-transformed to the midpoint epoch of the observation interval for processing in OPUS (ITRF00, epoch  $t$ ). The adjustment using the GPS observations and PAGES software fixes the CORS stations on this frame and epoch and obtains the resulting coordinates of the rover on the same frame ITRF00 and epoch  $t$ . All ITRF00 coordinates are finally transformed to the NAD83 (CORS96), epoch 2002.0, both in OPUS-S and OPUS-RS, using program HTDP (Horizontal Time Dependent Positioning).

The monograph contains a complete listing and discussion of all relevant transformation equations, including a paper on HTDP. The HTDP program takes crustal motions within the United States into consideration. Conceptually, the transformations outlined above will remain valid even after the expected new reference frame and epoch will be introduced at about the middle of 2011. Operationally, users will then only have to replace (ITRF00, epoch 1997.00) by (IGS08, epoch 2005.00) and (NAD83 (CORS96), epoch 2002.00) by (NAD83(2011), epoch 2010.00). In essence, old outdated reference frames will be replaced by new more accurately determined counterparts.

Since this monograph also addresses the needs of users, there are several contributions on the TEQC (Translate, Edit, and Quality Control) utility to quality-check the input data files and possibly edit the data before submitting to OPUS. Other contributions provide a detailed interpretation of the OPUS output. Yet, another contribution deals with vector adjustments and using the CORS coordinates and their respective stochastic information as a priority input.

The monograph does not contain any report on comparing OPUS with other available online GNSS processing services. It does, however, contain an empirical detailed testing that led to the recommendation that OPUS-RS be used for observation spans of 15 minutes to 2 hours, and OPUS-S for a longer observation series.

The contributions that had previously not been published in peer-reviewed journals are all of high quality and very much enhance and complete the monograph. On page 22 a paragraph appears mistakenly twice and in the last contribution ITRF2000 or ITRF00 is inadvertently given as ITRF200 a couple of times. It can be concluded that the monograph "CORS and OPUS for Engineers" provides a complete, very informative, and very convenient compilation of articles about these two important GNSS utilities. It is highly recommended for researchers and engineers. Whereas OPUS-RS is applicable only to projects within the area of the United States, the free services of OPUS-S are useful to international users as well.

Orono, ME, June 2011

ALFRED LEICK