

Report of the Earth Tide Commission (1999-2000)

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Abstract

The 14th International Symposium on Earth Tides (ETS2000) was successfully held in Mizusawa, Japan, during the period from August 28 to September 1, 2000. 138 participants (including 10 accompanying persons) from 21 countries reported fully on their results of continuing researches on Earth tides and thus contributed to the progress of further research of Earth and Planetary Tides. As the President of the Commission, it is my duty and honor to present a brief report of the Earth Tide Commission for the period 1999-2000.

1. Objective of the Commission

The objective of the Commission is to promote international cooperation and coordination of investigations related to the observation, preprocessing, analysis and interpretation of earth.

By earth tides, we understand all phenomena related to the variation of the Earth's gravity field and to the deformation of the Earth's body induced by the tide generating forces, i.e. the forces acting on the Earth due to differential gravitation of the celestial bodies as the Moon, the Sun and the nearby planets.

The Commission will collaborate with all international and national organizations concerned with the observation, preprocessing,.

The Commission will encourage and promote campaigns to develop, compare and calibrate instrumentation for earth tide observations, techniques of operation, procedures for data preprocessing and data analysis.

The Commission makes standard software for the prediction of earth tide phenomena and for the processing of earth tide observations available to the scientific community by an Electronic Information Service, started in November 1st 1995. Note that the ftp information service is no longer available, because since May 1997, the Electronic Information Service of the Earth Tide Commission is directly accessible from this home page.

The Commission will organize the 14th International Symposium on Earth Tides at Mizusawa/Japan in 2000.

2. Officers of the Commission

The President of the IAG Commission V (Earth Tides) was elected by the Council of IAG at the IUGG/IAG General Assembly held in Birmingham, UK, in July 1999. After discussion and deliberation with some colleagues, the President appointed in autumn 1999 Jacques Hinderer (France) as Vice-President and Olivier Francis (Belgium, now Luxembourg) as Secretary of the Commission until the first regular meeting of the commission, i.e., the 14th International Symposium on Earth Tides (ETS2000). Before the opening session of the ETS2000, the President consulted opinion of the National Representatives of the Commission on proposal

to ask Jacques Hinderer and Olivier Francis to continue their office until the next IUGG/IAG General Assembly to be held in Sapporo, Japan, in July 2003, and obtained their approval. At the opening session of ETS2000, the Commission elected J. Hinderer as Vice-President and Francis as Secretary without a dissenting voice. Congratulation to Jacques Hinderer and Olivier Francis, and the best wishes for their future work.

3. National Representatives to the IAG Commission V: Earth Tides

The National Representatives to the IAG Commission V: Earth Tides were appointed from the National Delegates of IAG in Member Countries of the Union (IUGG). The updated list of the National Representatives is given below.

- * Demitris Arabelos (Greece), ARAB@ENG.AUTH.GR
- * Trevor Baker (UK), tfb@pol.ac.uk
- * John Beavan (New Zealand), J.Beavan@gns.cri.nz
- * Tadeusz Chojnicki (Poland), tch@cbk.waw.pl
- * Ricardo Vieira Diaz (Spain), vieira@iagmat1.mat.ucm.es
- * Bernard Ducarme (Belgium), Bernard.Ducarme@ksb-orb.oma.be
- * D. El-Naggar (Egypt),
- * Jean Flick (Luxembourg), nicolas.doreye@ecgs.lu
- * Casula Giuseppe (Italy), casula@ibpgfs.df.unibo.it
- * Jacques Hinderer (France), jhinderer@eost.u-strasbg.fr
- * Jussi kaariainen (Finland), jussi.kaariainen@fgi.fi
- * Emile Klingele (Switzerland), klingele@geod.ethz.ch
- * Jim Merriam (Canada), jim.merriam@usask.ca
- * Sergey Molodensky (Russia), msm@uipe-ras.scgis.ru
- * Jose Pereira Osorio (Portugal), posorio@oa.fc.up.pt
- * Hans-Peter Plag (Norway), hans.peter.plag@statkart.no
- * Bernd Richter (Germany), richter@ifag.de
- * Tadahiro Sato (Japan), tsato@miz.nao.ac.jp
- * Zdenek Simon (Czech Republic), gope@asu.cas.cz
- * Peter Varga (Hungary), varga@ggki.hu
- * John Wahr (USA), wahr@lemond.colorado.edu
- * R. T. Wonnacott (South Africa), rwonnacott@sls.wcape.gov.za
- * Yaozhong Zhu (P.R.China), zyz@asch.whigg.ac.cn

4. ETC Homepage

The ETC Homepage can be seen through the following address,

<http://www-geod.kugi.kyoto-u.ac.jp/iag-etc/>

5. 2nd ETC Medal

The ETC steering committee (S. Takemoto, J. Hinderer, O. Francis, B. Richter, M.van Ruymbeke, H. Schuh and. G. Jentzsch) decided to award the 2nd ETC Medal (ETC Medal 2000) to the late Prof. Hans-Georg Wenzel for his outstanding contribution to international cooperation in earth tide research.

Hans-Georg Wenzel was born on February 3, 1945 at Hahnenklee, country of Goslar/Germany. After graduated the Technical University of Hannover in 1972, Hans-Georg Wenzel worked in Institut für Erdmessung, University of Hannover as scientific assistant, chief engineer and senior scientist. He received the Doktor-Ingenieur degree with a thesis on the accuracy of gravimetric earth tides observations (1976), and his Dr.-Ing. habil. thesis dealt with high resolution spherical harmonic models for the gravitational potential of the earth (1985). In 1988, he became Professor at the Geodetic Institute, University of Karlsruhe, and Director of the Schiltach Geodynamical Observatory (Black Forest Observatory). In March 1999, he

accepted a call from the University of Hannover to become Professor for physical geodesy at the Institut für Erdmessung, and suddenly passed away on November 11, 1999 at Hannover without any recognizable warning. His contribution to gravity and Earth tides researches is so well known through the papers more than 150. He is famous by development of a new tidal potential catalogue, a worldwide synthetic gravity tides model, and the Earth tides data processing package so called ETERNA.

In the world wide geodetic community, he chaired the IAG special study group "Global Gravity Field Approximation" (1987 - 1991) and the International Gravity Commission working group "Computation of Mean Gravity Anomalies" (1989 - 1991). He served as Secretary (1987 - 1991) and President (1991 - 1995) of IAG Section 3 "Gravity Field Determination" and as President of the Earth Tides Commission (1995 - 1999). His management abilities were acknowledged in the Directing Board of the Bureau Gravimétrique International (1987 - 1995), and as Secretary of the Federation of the Astronomical and Geophysical Data and Analysis Services FAGS, since 1996.

With grateful appreciation for the numerous services rendered by Prof. Hans-Georg Wenzel during his lifetime, all participants of ETS2000 paid one-minute's tribute to him with deepest sympathy.

The Commission awarded the 2nd ETC Medal (ETC Medal2000) to Ms Marion Wenzel at the Opening Session of ETS2000 on August 28 2000 at Mizusawa, Japan.

6. ETC Working Groups

At the opening session of ETS2000, chairpersons of following Working Groups reported their activities,

Working Group 4 "Calibration of Gravimeters", (M.van Ruymbeke),

Working Group 5 "Global Gravity Monitoring", (B. Richter),

Working Group 6 "Earth Tides in Geodetic Space Techniques, (H. Schuh),

Working Group 7 "Analysis of Environmental data for the interpretation of gravity measurements", (G. Jentzsch).

The Commission thanks all members and chairpersons of WGs which have been active during the last period, for their fruitful work. ETC accepted the conclusions of the reports of the Working Groups and decided according to their wishes:

*To close Working Groups 4 and 5.

*To extend for another 4 year term the activities of the Working Group 6 (Earth Tides in Geodetic Space Techniques) under the new chairperson-ship.

*To extend for another 4 year term the activities of the Working Group 7 (Analysis of Environmental data for the interpretation of gravity measurements) under the new chairperson-ship.

*To create Working Group 8 on "Gravitational Physics" under the chairperson-ship of Prof. Lalu Mansinha to tackle among others the following scientific problems:

The Problem of Aberration:

Modern tidal position catalogs assume that the true position of the tide causing body is responsible for the tidal forces, rather than the apparent position, as in optical astronomy. The problem may have consequences, as it may imply relative velocities between the gravity and optical signals. This is a case for experts in Celestial Mechanics and in Earth Tides.

The Gravitational Shielding:

There is currently no accepted theory of gravity that incorporates or predicts gravitational shielding. The problem is possibly different from the absorption of gravitational radiation by matter. The Earth Tide community should think about, and search for, the consequences of shielding.

7. Directing Board of the International Center for Earth Tides (ICET)

The ICET Directing Board (S.Takemoto (Chair), B.Ducarme, T.F.Baker, D.Crossley, H.T.Hsu and O. Francis (Non-voting member)) met together on August 29, 2000 at the Z-hall in Mizusawa. The main subject for discussion was "Future activity of ICET and re-organization of the IAG services". ICET-DB discussed on the GFFS (Gravity Field and Figure of the Earth Service) proposed by Prof. F. Sanso, which is a new Service including activities of BGI, IGeS and ICET. Because of a restriction of time, ICET-DB could not draw a conclusion at Mizusawa and decided to continue our discussion by E-mail. ICET-DB will draw a conclusion not later than the end of October 2000.

8. Resolution Committee

The Resolution Committee (J. Hinderer(Chair), O. Francis, B. Ducarme, B.Richter, M.van Ruymbeke, H. Schuh and G. Jentzsch, H. Hsu, L. Mansinha, M.Ooe and S. Takemoto,) was held on August 31, 2000. The Earth Tide Commission has adopted the 11 resolutions at the closing session of the 14th International Symposium on Earth Tides, August 28 - September 1, 2000, Mizusawa, Japan.

9. IAG Travel Awards

The following 5 persons are winners of IAG Travel Award for the ETS2000.

Alexander Kopaev, (Moscow, Russia), Janusz Bogusz, (Warsaw, Poland), Carla Braitenberg, (Trieste, Italy), Sun He-Ping (Wuhan, P.R. China), Zhigen Yang (Shanghai, P.R. Chin)

10. Publication of the ETS2000

Proceedings of scientific papers will be published as a special issue of the Jour. Geod. Soc. Japan. Other Report on the ETS2000 including the list of participants will be appeared in the next issue of BIM (BULLETIN D'INFORMATIONS MAREES TERRESTRES).

11. Next Symposium

During the ETS2000, Canadian Colleagues (Profs. D. Smylie, L. Mansinha and S. Pagiatakis) kindly offered to have the next (15th) International Symposium on Earth Tides in Canada in 2004. The Earth Tide Commission acknowledges the receipt of this invitation.

September 1, 2000

ETS2000 RESOLUTIONS

1/ Recognizing the importance of the observation of tidal effects and of the determination of tidal parameters by space geodetic techniques,
the ETC recommends
to continue this observational effort;
to compare the results obtained by different space geodetic techniques between each other and with the results of ground based tidal measurements.

2/ Recognizing the importance of the new international services on space geodetic techniques,
the ETC recommends
that WG6 establishes or intensifies the cooperation with the analysis coordinators of these international services concerning the tidal modelling.

3/ Considering the new fields of tidal research in lunar and planetary geodesy,
the ETC recommends
that the tidal community should take an active part in space missions related to lunar and planetary geodesy ;
requests a proper archiving of the data and metadata acquired during those missions and normal access to the world-wide geodetic community.

4/ Considering the increasing interest of the tidal community to lunar and planetary researches,
the ETC recommends
that a session on tides on the planets should be included in the future earth tides symposia.

5/ Recognizing the importance of a global Earth coverage with superconducting gravimeters
for the study of weak geophysical signals,
for the determination of the liquid core resonance parameters,
for the study of the polar motion effects on gravity,
for the intercomparison of the load vectors derived from recent ocean tides models,
for the study of global and regional gravity changes to validate the results of the dedicated satellite missions,
the ETC recommends
to extend the GGP observation period for an additional 6 year period starting July 2003, to maintain the existing sites and to encourage the installation of new GGP stations especially in the Southern hemisphere and in polar regions.

6/ Recognizing the fact that presently the calibration of the superconducting gravimeters participating to the world-wide GGP project is not homogeneous,
the ETC recommends
that systematic calibration campaigns with absolute gravimeters should be planned and realised before the end of the current GGP observation period,
through an international cooperative effort.

7/ Recognizing the importance to keep in operation several calibration techniques for gravimeters to allow a mutual accuracy control,
the ETC recommends
that inertial calibration platforms and moving mass calibration devices should continue to be developed or maintained besides more usual calibration methods such as intercomparison with absolute or well-calibrated relative instruments.

8/ Recognizing the importance of environmental data for the interpretation of tidal measurements, the ETC recommends:

a/ to record the following parameters:

- The barometric pressure, temperature, precipitation, and ground water level. The sampling rate for the recording of environmental parameters should correspond to the sampling rate of the geodynamic data observed. A sufficient resolution and accuracy of the measurements of the environmental parameters should be granted.
- Although the difficulties of monitoring soil moisture are recognized, its is recommended to undertake efforts to realize a continuous monitoring of this parameter.
- The monitoring of wind is also recommended because wind might produce short-period noise as well as long-period modulations.

b/ to correct gravity data in long term studies for local (diameter 100km), regional (diameter 2000 km), and global atmospheric pressure signals as all three produce significant effects.

c/ to develop correction models for gravity, tilt, and strain related to:

- ground water table variations
- snow, rain and soil moisture
- stress resulting from temperature variations

9/ Noting the importance for tidal measurements of accurate error estimates and appreciating that such estimates can be made only if the power spectral density of the noise is known, the ETC recommends to show noise spectra as Power Spectral Density expressed in unit $2/\text{frequency}$.

10/ On behalf of all participants of the 14th International Symposium on Earth Tides, the ETC thanks the Japanese National Committee for Geodesy, the Science Council of Japan, the Geodetic Society of Japan, the National Astronomical Observatory of Japan, the City of Mizusawa and the Iwate Prefecture for their generous support to the Symposium.

11/ ETC thanks the Local Organising Committee : Masatsugu Ooe (Chairman), Tadehiro Sato (Secretary) , Jiro Segawa (President of Geodetic Society of Japan) and the staff, for their wonderful welcome and their many efforts in making the 14th International Symposium on Earth Tides a great scientific success.