



**International Association  
of Geodesy**

# Newsletter

## December 2023

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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. 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

## General Announcements



### **Call for Nominations: Director of the Bureau of Networks and Observations**

Dear Colleagues,

GGOS is seeking nominations for the position of Director of the [GGOS Bureau of Networks and Observations \(GGOS-BNO\)](#). The outgoing Director, Michael Pearlman, will be stepping down once we have a new GGOS-BNO Director. So, this is your opportunity to take on this important leadership role!

GGOS-BNO is responsible for devising a strategy for the sustainable design, integration, and maintenance of the fundamental geodetic infrastructure to meet the long-term requirements for the realisation of a high-precision global geodetic frame of reference. Emphasis is placed on maintaining the necessary infrastructure to sustain the evolving global reference frames, while ensuring wider support for the scientific applications of the collected data. The GGOS-BNO Director plays a crucial role in ensuring efficient communication and collaboration among the various IAG Services and stakeholders concerned with deploying and maintaining ground and space-based geodetic infrastructure. Key responsibilities include coordinating and addressing requirements and challenges encountered by the IAG Services in an integrated manner. The activities managed by the GGOS-BNO Director encompass in particular:

- Advocating and encouraging expansion and upgrade of the global geodetic network of reference for the maintenance and improvement of the International Terrestrial Reference Frame (ITRF), the International Terrestrial Gravity Reference Frame (ITGRF) and the International Height Reference Frame (IHRF).
- Promoting broad participation of geometric and non-geometric Services in GGOS.
- Encouraging formation of partnerships to build and upgrade the network infrastructure, in particular the installation of new geodetic core sites in regions with poor coverage.
- Providing the opportunity for representatives of the IAG Services and associated GGOS-BNO Committees and Working Groups to meet and share progress and plans and discuss issues of common interest through the organisation of GGOS-BNO virtual meetings and at major international conferences such as EGU, AGU and the GGOS Days.
- Scoping of the required network and project network status in the future (5 and 10 years ahead) based on input from the stations and Services to anticipate data product quality for the ITRF, ITGRF and IHRF.
- Working with the *UN Global Geodetic Centre of Excellence (UN-GGCE)* as well as the *UN Committee of Experts on Global Geospatial Information Management (UN GGIM)* and its affiliates to develop a plan for the improvement of the global geodetic reference networks to satisfy the accuracy requirements for the monitoring of the Earth System: an accuracy of 1 mm and a stability at a level of 0.1 mm/year.
- Presenting talks and posters about the GGOS-BNO at major international conferences such as AGU, EGU, IAG, JpGU-AGU, AOGS, etc. with the aim of promoting awareness of GGOS amongst the scientific community.
- Write letters to support stations and analysis and research groups.

For the successful implementation of these activities, the GGOS-BNO Director is supported by a robust organisational structure comprised of representatives from all IAG Services, three Committees including *Performance Simulations and Architectural Trade-Offs (PLATO)*, *Satellite Missions* and *Data and Information Systems*, and the Working Group *Site Survey and Co-location* (together with the International Earth Rotation

and Reference Systems – IERS). For further insights regarding GGOS-BNO, please consult the [latest terms of reference included in the attached document](#).

The Nomination Committee is composed of Michael Pearlman, Director of the GGOS-BNO, Detlef Angermann, Director of the GGOS Bureau of Products and Standards (GGOS-BPS), and Laura Sánchez, President of GGOS.

**Qualifications:** Applications are open to anyone currently involved in any of the IAG Services or Service Products. Knowledge of the work dynamics within the IAG is desirable.

**Nomination Process:** If you know of a qualified colleague or wish to nominate yourself for the position, please submit the following information to the GGOS Coordinating Office ([co@ggos.org](mailto:co@ggos.org)), **by January 26, 2024**:

1. Full Name
2. Contact Information
3. Brief Biography
4. Statement of Interest
5. Letter of support from employer (agency, university, institute, etc.) indicating that the candidate will be able to perform the duties, commitments, roles and responsibilities outlined in this call for nomination.

**Selection Process:** Nominations will be considered by the Nomination Committee, which will seek additional information from candidates as necessary. This Committee will rank the candidates in order of preference and submit the application to the GGOS Governing Board, whose members will vote to approve the new Director. Once a decision has been made, the selected colleague will be informed. Michael Pearlman plans to remain on the GGOS-BNO and will work with the new Director to help with the transition.

**Timeline:**

- Call for Nominations: December 13, 2023
- Deadline for Nominations: January 26, 2024
- Selection Process: February 15, 2024

If you know of a qualified colleague or wish to nominate yourself for the position, we encourage all eligible colleagues to consider this important leadership opportunity. Your involvement will contribute to the success and growth of GGOS.

Thank you for your support.

Sincerely,

Michael Pearlman, Detlef Angermann, Laura Sánchez

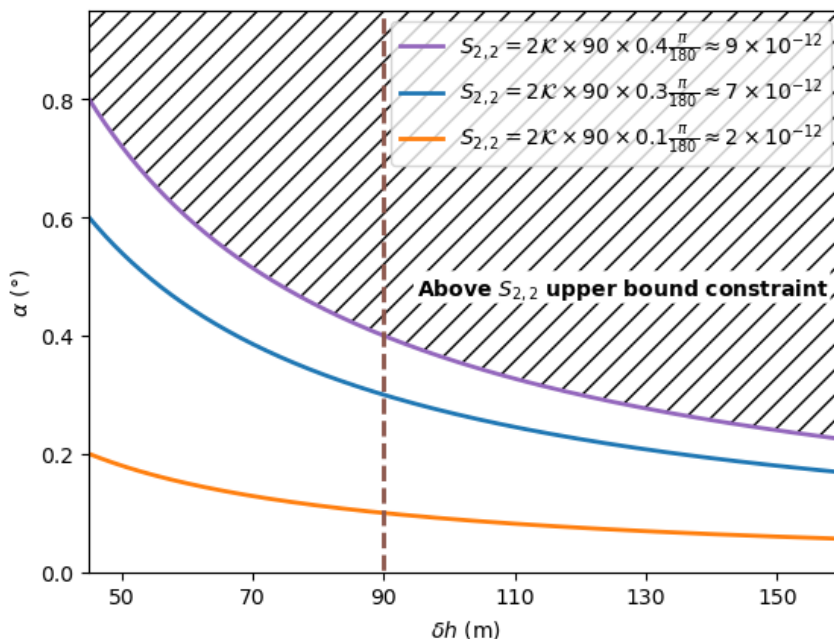
Further Information: <https://ggos.org/news/nomination-call-director-bno/>

## Highlight Paper

### ***Gravitational Constraints on the Earth's Inner Core Differential Rotation***

The Earth's inner core (IC) rotates together with the rest of the Earth, albeit with small fluctuations with respect to the mantle. These small variations are observed by seismic waves traversing the IC and are also predicted by models of the core dynamics. Rotation of the IC by an angle  $\alpha$  brings its degree 2 and order 2 topography (peak-to-peak amplitude  $\delta h$ ) out of gravitational alignment with the mantle. This causes a degree-2 and order-2 variation in the gravity field proportional to  $\alpha$  and  $\delta h$ . By analyzing gravity variations observed from SLR and GRACE(-FO), we reconstruct the time series of the Stokes coefficient  $S_{2,2}$ . We show that, assuming  $\delta h = 90$  m,  $S_{2,2}$  provides maximum bounds for  $\alpha$  of  $0.09^\circ$ ,  $0.3^\circ$  and  $0.4^\circ$ , respectively at periods about 4, 6 and 12 years. These limits are overestimated, as our estimate of  $S_{2,2}$  is most likely polluted by uncorrected hydrological signals. Tighter values for  $\alpha$  and  $\delta h$  could be obtained with a more accurate deconvolution of

interannual hydrological effects from gravity data. However, the viscous relaxation behavior of the core, still poorly modeled, may allow more flexible constraints. Finally, our results provide new constraints on the dynamics of the deepest part of our planet independently from seismology.



Upper bounds on the combination of  $\alpha$  and  $\delta h$  for periods of  $\sim 4$  (orange curve),  $\sim 6$  (blue curve), and  $\sim 12$  (purple curve) years, based on the  $S_{2,2}$  amplitudes corrected for hydrology ( $2 \times 10^{-12}$ ,  $7 \times 10^{-12}$ , and  $9 \times 10^{-12}$ , respectively). The brown dotted line corresponds to the assumption  $\delta h = 90$  m and for the upper bounds on  $\alpha$  ( $0.1^\circ$ ,  $0.3^\circ$ ,  $0.4^\circ$ ) inferred from SLR and GRACE(-FO) data. The hatched area corresponds to  $\delta h$  and  $\alpha$  values

not allowed by the observed  $S_{2,2}$  signal.  $K = (1 + \kappa_2) \frac{4\pi}{5\sqrt{15}} \frac{R_i^4}{R^2} \frac{\Delta\rho_{icb}}{M} = 7.07 \times 10^{-12}$  where

$\kappa_2 = 0.9736$  is the Love number accounting for the additional gravity signal resulting from global elastic deformations,  $R_i$  and  $R$  are the inner core and Earth's radii,  $M$  the Earth's mass and  $\Delta\rho_{icb}$  the density jump at the inner core boundary (ICB).

Reference:

Lecomte, H., Rosat, S., Manda, M., & Dumberry, M. (2023). Gravitational constraints on the Earth's inner core differential rotation. *Geophysical Research Letters*, 50, e2023GL104790. <https://doi.org/10.1029/2023GL104790>

Lecomte, H., Rosat, S., Manda, M., Dumberry, M.

## Meeting Announcements

### Meetings Calendar

#### IAG Sponsored Meetings

##### IVS 13th General Meeting and 25th Anniversary

March 4 – 8, 2024, Tsukuba, Japan

URL: <https://www.youtube.com/watch?v=mQkA8VHKWD4>

**20th Geodynamics and Earth Tides Symposium (G-ETS 2024)**

August 25 – 30, 2024, Strasbourg, France

URL: <https://g-ets2024.sciencesconf.org/>

**Gravity, Geoid and Height Systems 2024**

August 26 – 29, 2024, Thessaloniki, Greece

URL: <https://www.gghs2024.com/>

**GGOS Days 2024 and GGOS Focus Areas Topical Meeting**

October 7 – 11, 2024, Potsdam, Germany

URL: <https://ggos.org/event/ggos-days-fa-meeting-2024/>

**IAG Scientific Assembly 2025**

September 1 – 5, 2025, Rimini, Italy

URL: <https://www.iag-aig.org/events/107>

**IAG Related Meetings**

**Recent Achievements and Future Perspectives in Geodesy**

February 21 – 22, 2024, Potsdam, Germany

URL: [https://leibnizsozietaet.de/wp-content/uploads/2023/09/Colloquium\\_in\\_honor\\_of\\_Harald\\_Schuh-save-the-date.pdf](https://leibnizsozietaet.de/wp-content/uploads/2023/09/Colloquium_in_honor_of_Harald_Schuh-save-the-date.pdf)

**EGU General Assembly 2024**

April 14 – 19, 2024, Vienna, Austria

URL: <https://www.egu24.eu/>

**ION Pacific PNT Conference**

April 15 – 18, 2024, Honolulu, Hawaii

URL: <https://www.ion.org/pnt/index.cfm>

**FIG Working Week**

May 19 – 24, 2024, Accra, Ghana

URL: <https://www.fig.net/fig2024/index.htm>

**Japan Geoscience Union Meeting 2024**

May 26 – 31, 2024, Chiba, Japan

URL: [https://www.jpгу.org/meeting\\_e2024/](https://www.jpгу.org/meeting_e2024/)

**34th Conference on Mathematical Geophysics**

June 2 – 7, 2024, Bombay, Mumbai, India

URL: <https://www.cmg2024.org>

**18th Symposium of SEDI**

June 23 – 28, 2024, Great Barrington, MA, USA

URL: <https://sedi-conference-2024-2675c.ingress-baronn.ewp.live/>

**45th COSPAR Scientific Assembly**

July 13 – 21, 2024, Busan, Korea

URL: <https://www.cospa2024.org/>

### **32th IAU General Assembly**

August 6 – 15, 2024, Cape Town, South Africa

URL: <https://astronomy2024.org/>

### **2024 European Polar Science Week conference**

September 3 – 6, 2024, Copenhagen, Denmark

URL: <https://www.europeanpolarboard.org/news-events/events/event/events/2024-european-polar-science-week-conference/>

## **Reports**

### **14th International School on “The Determination and Use of the Geoid”**

November 13 - 17, 2023, National Geographic Institute, Buenos Aires, Argentina

One of the main tasks of the International Geoid Service (IGS) of the International Association of Geodesy (IAG) is to organize or support schools on gravimetric geoid estimations.

The first international school for the determination and use of the geoid was organized in Milan in 1994, and since then there have been other editions of the school, held in several countries with the support of local organizing committees. In Latin America, in 1997, the second international school was developed in Rio de Janeiro, Brazil, and in 2009, the ninth international school was developed in La Plata, Argentina.

On this occasion, the XIV International School on “The Determination and Use of the Geoid” has taken place at the National Geographic Institute of Argentina. It is organised by SIRGAS (Geocentric Reference System for the Americas), in cooperation with IGN (Instituto Geográfico Nacional de la República Argentina), Instituto Panamericano de Geografía e Historia, Universidade Federal de Uberlândia, Universidad Nacional de La Plata and ISG (International Service for the Geoid) with financing from the project of the Pan American Institute of Geography and History (PAIGH): “SIRGAS2023: Geodetic Reference Framework for the Sustainable Development of the Americas”, the National Geographic Institute, and the IAG.

The general purpose of this intensive school is to prepare students, young scientists, and employees of national agencies to calculate and use gravimetric geoids for scientific and technical applications in geodesy. The school provides an excellent opportunity to become familiar with the latest developments in geoid determination and to enhance international contacts and collaborations between scientists involved in modeling the Earth's gravity field.

Furthermore, it is of great importance that the scientific community is linked to the mapping agencies responsible for the implementation of the Global Geodetic Reference Framework for Sustainable Development (GGRF). Gravimetric geoid modeling plays a fundamental role in the implementation of the International Height Reference Frame (IHRF) and the unification of height systems.

The school is structured into theoretical and practical lessons; students will become familiar with different theoretical formulations for calculating the gravimetric geoid and the software necessary to carry out their calculations. English was the official language of the School. The School took place only on site.

### **Faculty**

- Prof. Fernando Sanso mentor y creator of the International School on “The Determination and Use of the Geoid” (Politecnico di Milano, Italy) (virtual)
- Prof. Riccardo Barzaghi (Politecnico di Milano, Italy) (in person).
- Prof. Nikos Pavlis (National Geospatial Intelligence Agency, (In person).
- Prof. Rene Forsberg (National Space Insitut, DTU, Denmark). (In person).
- Prof. Laura Sánchez (DGFI-TUM), Germany. (In person).



**Organizing Committee**

- Surveyor Eng. Sergio Cimbaro (President Instituto Geográfico Nacional, Argentina)
- Cnel. Gustavo Caubarrère (President SIRGAS)
- Dra. Daniela Carrion ISG, Politecnico di Milano, Italy)
- Dr. Mirko Reguzzoni (ISG, Politecnico di Milano, Italy)
- Dr. Gabriel Guimarães (Universidade Federal de Uberlândia, Brazil)
- Dra. Claudia Tocho (National University of La Plata, Argentina)
- Surveyor Eng. Hernán Guagni (Instituto Geográfico Nacional, Argentina)
- Cabo. 2ª Laura Camacho (SIRGAS)
- Surveyor Eng. Mariana Eiko (Universidade Federal de Uberlândia, Brazil)

**Participants**

Following the preliminary contacts, the school started with 40 participants from Argentina, Austria, Brazil, Cameroon, Chile, Colombia, Costa Rica, Guyana, Mexico, Nepal, Switzerland, Uganda and USA.





**Venue**

Instituto Geográfico Nacional  
Avda.Cabildo 381 C1426 - Ciudad Autónoma de Buenos Aires. República Argentina

**Distributed documents**

Presentations, software, data for exercises, and GRAVSOFTE manual were distributed to the students. Each student received a participation certificate.

**Technical Visit**

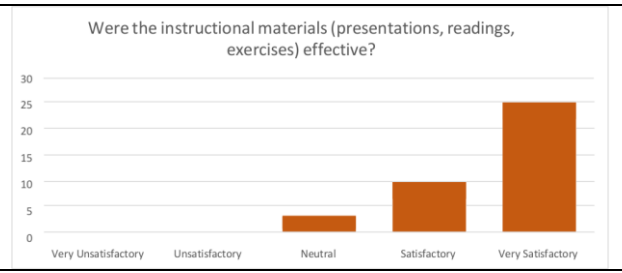
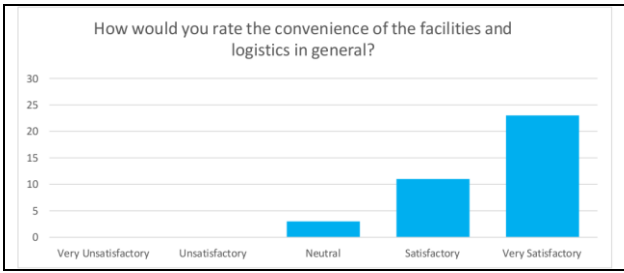
A visit to the Argentine-German Geodetic Observatory (AGGO) was realized on Friday. The Argentinean–German Geodetic Observatory (AGGO) is a fundamental geodetic observatory located close to the city of La Plata, Argentina, where all major geodetic techniques are co-located.



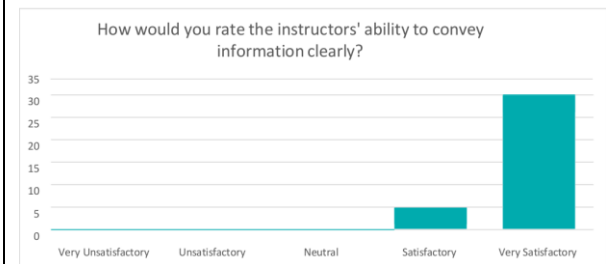
**Feedback questionnaire**

A satisfaction questionnaire has been filled up. These results are depicted in the following figures.

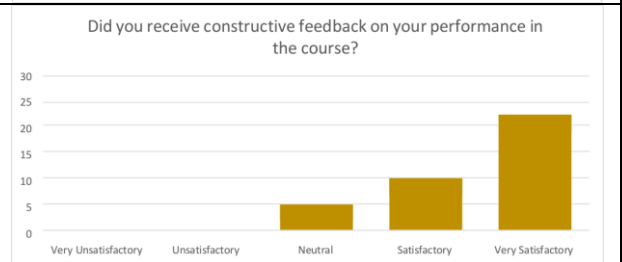
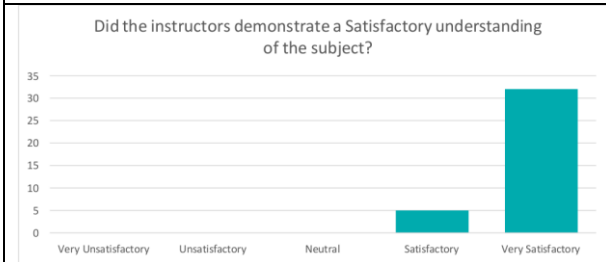
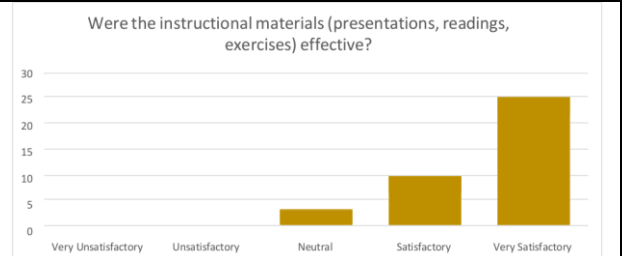
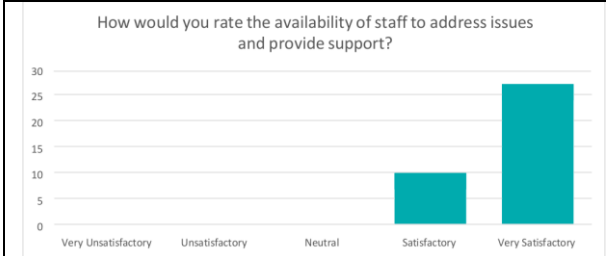
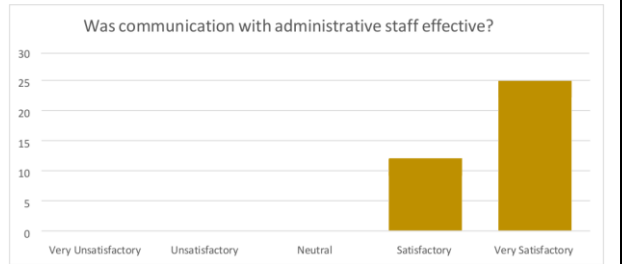




## Instructor Performance



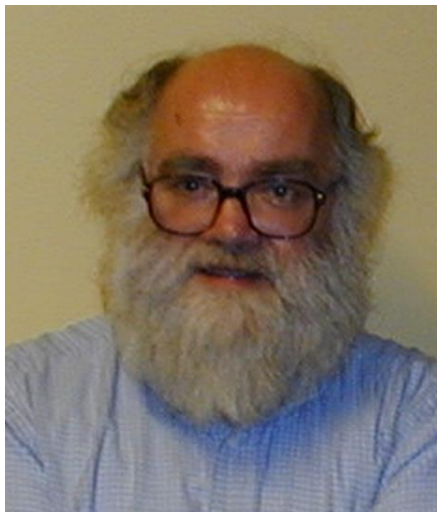
## Participant Support



For more information, visit the web page: <https://sirgas.ipgh.org/escuela-geoide/>

Claudia Tocho

### **Hilaire Legros (1941-2023)**



Prof. Hilaire Legros passed away suddenly on 31 January 2023, his 82nd birthday. He was Professor Emeritus of the University of Strasbourg (France) at EOST (School and Observatory of Earth Sciences) and a member of the 'Global Dynamics' team at ITES (Institut Terre et Environnement de Strasbourg).

After obtaining a degree in Mathematics in Besançon, he studied internal geophysics in Strasbourg, where he obtained a postgraduate doctorate in seismology in 1973, followed by a state doctorate in planetary dynamics in 1987. He began his teaching career in 1970 as an assistant professor at the University Louis Pasteur in Strasbourg, following his DEA (equivalent Msc) in internal geophysics. He was appointed Senior Lecturer in 1988, Professor in 1997 and Professor Emeritus in 2006.

Between 1970 and 1978, Hilaire Legros developed theoretical research in seismology on seismic sources and then, from 1978 until his death, he worked on the global dynamics of the Earth and planets. His theoretical studies on the deformation of elastic or viscoelastic Earth models in rotation were initiated by an experimental result linked to the observation, in lunisolar tides, of the resonance effect of the Earth's liquid core. This resonance phenomenon, which affects certain diurnal tidal waves, was first detected in 1975 in Strasbourg, by Professor Robert Lecolazet, in records of time-varying gravity using a LaCoste Romberg mechanical gravimeter (ET05). Subsequently, the observed variations in gravity seemed to correlate with variations in the Earth's axial rotation, and hence the length of the day. It was in this context, in order to propose a theoretical explanation, that Hilaire Legros, in collaboration with Martine Amalvict and Jacques Hinderer, began his research into the rotation and deformation of models of an elastic Earth with a fluid core. This was the start of a long series of published studies that explored many aspects of the Earth's dynamics by incorporating a solid central inner core, an ocean and an atmosphere into the models.

The rheological aspects were also developed because, while the Earth behaves elastically for rapid movements such as seismic eigenmodes and semi-diurnal and diurnal tidal waves, its visco-elasticity must be considered for phenomena with characteristic times ranging from several hundred to several thousand years, such as the post-glacial rebound following the last major deglaciation of our planet ten to fifteen thousand years ago.

Hilaire Legros supervised several doctoral students who defended their theses in these areas of research: Jacques Hinderer in 1980 on the dynamic effects of the fluid core, Marianne Lefftz in 1991 on the viscosity of the mantle and the Earth's rotation, and Pascal Gegout in 1995 on surface loading and the variability of rotation and gravity.

All these theoretical studies were also invaluable in interpreting the observations of time-varying gravity when, in 1987, the global dynamics team acquired a superconducting gravimeter (GWR TT70) to replace the previous mechanical gravimeter. These multiple theory-observation comparisons were at the heart of the activities of the team led by Hilaire Legros.

He was also interested in the history of science, and it was then natural that, following Vincent Deparis's thesis entitled 'Dynamique lithosphérique. Recherches sur l'histoire de la dynamique terrestre' (Research into the history of terrestrial dynamics), supervised by Hilaire Legros and defended in 1997, the research led to the development of ideas on the evolution of concepts about the Earth's interior from Antiquity to the present day. This history of ideas led to the publication in 2000 of the book 'Voyage à l'intérieur de la Terre' (Travel into the Earth's interior), co-authored by Vincent Deparis and Hilaire Legros, which remains a reference today.

Alongside his work as a researcher, Hilaire Legros was also a remarkable teacher. His courses covered general geophysics, mathematics, geodesy, dynamics and physics of the Earth. Several generations of students who attended his courses at the Geophysical school (EOST) or at the University of Strasbourg (1st and 2nd cycles) were impressed by him and are grateful to him for his knowledge and teaching skills.

Séverine Rosat