Jacques Hinderer – An Appreciation

Jacques entered the Louis Pasteur University in Strasbourg around 1975 when he was about 20 years old. He found an environment defined by two outstanding geophysicists. The first was Robert Lecolazet who had been at the University since 1937 and set the direction of Geophysics by installing the first spring tidal gravimeters in France in 1954; IPGS thus became the first world station to continuously record the tides.

The second was Hilaire Legros, a much beloved figure at IPGS, who began a teaching position in 1970, first in seismology and switching to global geodynamics in 1978. Jacques studied under Legros and in 1977 achieved a Masters, followed by a doctorate (PhD 3rd cycle) in 1980 and the highest degree, the State Habilitation, in 1987. Interestingly this was also the year that Hilaire received the same degree.

I first met Jacques at the IUGG in Vancouver, 1987. At that time he was deeply involved in running a newly acquired SG in Strasbourg, and the Canadian gravity group had just received a grant to purchase their SG. In 1988, after the SEDI Symposium in Blanes, Spain, three of us visited the SG sites running at the time: Strasbourg (Hinderer), Bad Homberg (Richter), and Brussels (Melchior). Jacques and I connected frequently after that, most usefully through the discussions of SG data processing at the Bonn Workshops organized by Gerhardt Jentzsch.

Jacques will further address his career, so I will instead outline the categories in which he has excelled.

1. First, he has a wide range of interests and skills. Jacques has learned many different approaches for tackling geophysical problems; from local to global, theoretical to experimental, and laboratory to fieldwork. He continued with Hilaire Legros in the development of gravity and tides from first principles and ending with measurable quantities at the Earth's surface. He made extensive use of Love numbers and developed copious variations of these quantities for various regions throughout the Earth [SLIDE]. Then he progressed to instrumentation, learning the mechanics and electronics of modern gravimeters; from there to data analysis, its theory, programming, and interpretation. Along the way he has excelled at science project management, and he has had great success working with people. These all contribute to his successful career.

2 . His publications have been prolific. The major body of work for most scientists are refereed publications, being especially notable when in the top-rated journals. Jacques has more than 208 refereed papers, including 51% of which he is the first or second author. The majority have been in top-class journals. His productivity on non-refereed and conference papers is equally impressive, he has 47 papers in conference proceedings and about 10 others in miscellaneous form. Clearly, he relishes an active participation in collaborative scientific projects, their realization, and their reporting. It is significant that, unlike many scientists, he did not just have an early spike in papers after his doctorate, but his productivity has been maintained consistently up to about 2020 at about 10 papers/year.

Of course he did not have extensive teaching responsibilities; nonetheless, his output is still impressive.

3. Jacques has an extraordinary ability to teach and work with students. I have seen this first-hand whenever I visited IPGS. His approach was always through the apprenticeship model in which he would sit down with students as though they were colleagues, and they did the work alongside his coaching. He was always generous with students during their presentations, but nevertheless he could be a persistent and insightful interrogator. His graduation of students was invariably successful, with many of them continuing in a scientific career path after their degree. One only needs to mention, Sophie Lambotte, Caroline de Linage, Anthony Memin, Julia Pfeffer, Basil Hector, Yann Ziegler, and Quentin Chaffaut to recognize many of them as well-trained and productive researchers and authors.

Three of the most successful of his students are playing very active roles in science, and with us today in the audience:

Jean-Paul Boy (PhD 1998-2000) - Effect of atmospheric loading on gravity variations and surface movements of the Earth. At EOST he is a prolific author and contributor to global data analyses of gravity and position data.

Severine Rosat (PhD 2001-2004) - Temporal variations of Earth's gravity in connection with the dynamics of the liquid core and the oceanic and atmospheric fluid layers. She has become a key member of the EOST geodynamics group – and largely responsible for organizing this conference.

Marta Calvo (PhD 2011-2015) - Analysis of long-term gravity records in Europe: consequences for the retrieval of small amplitude and low frequency signals including the core resonance effects. Stationed in Madrid, she has recently taken on a leading roles in IGETS.

Jacques' work with students always seemed to me to be effortless, but that is due to his skilled mentoring.

4. Jacques has a passion for field work. Early on Jacques had a strong orientation for instrumentation, principally for gravity, and he used the convenient field site of J9 just outside Strasbourg as a test bed for experimentation. It did not take long for him to improve his skills with gravity measurements and become involved with projects elsewhere. Gravity, as part of the world geodetic network, lends itself to measurements in a huge range of environments, from continental interiors to coastal areas, from the desert to the polar regions, and both above and below ground.

Looking at the history of his scientific missions reveals an impressive range of fieldwork. Between 1997 and 2020 (23 years) he went on 64 missions with a total duration of 685 days; in order of decreasing time spent in the field the main countries were France, Iran (yes, surprisingly!), Egypt, Chile, Norway, Taiwan, Italy, Iceland, Tunisia, Ethiopia, Djibouti,

Greece, and S. Africa, with many shorter 1-week field campaigns in a variety of other locations.

In addition to the above fieldwork he engaged in a major hydrology study in Niger-Benin between 2008-2013 which required more than a dozen missions and a total of 285 days of fieldwork in the sub-Sahara region. Considering not just the field days, but all the planning, logistics and travel involved, this represents a huge effort on his part - no wonder he was sometimes difficult to contact. Many colleagues in the tidal community do fieldwork as a matter of course, but few have built such an impressive body of work and data from so many, frequently very remote, locations (this is not just stepping out to a local field site). This fieldwork reflects Jacques' lifetime affinity with world travel and culture.

5. **He is highly regarded as a collaborator.** In all his various activities Jacques brings humility and friendship to the people he works with. His attendance at many of the major international conferences and assemblies in gravimetry has been notable [SEVERAL SLIDES]. He has an outstanding number (448) of international conference papers, again with a good number of them as the first or second author. He never lets a conference talk pass without contributing to the subsequent proceedings. He spent 2 years in a research position at McGill University in Canada, and 1 year at NASA Goddard Space Flight Center. He also made an essential contribution to GGP from 1995-2015 as General Secretary with unflagging enthusiasm and dedication.

6. **He has been a central figure in the French geophysical community.** He has achieved the highest level of CNRS management within gravimetry in France. He has also taken on various management roles within IPGS - now EOST – the most demanding of which was Head of IPGS from 2005-2012 with responsibility for 80 permanent personnel. In effect he has been the center of gravity (pun intended) of the gravity group in Strasbourg for most of his professional career. France has recognized his abilities, as demonstrated by his receipt of the CNRS Excellence prize in 2013 [SLIDE].

7. Obviously he is a global expert in tides. Of particular relevance to the Melchior Medal stipulations, Jacques has been a recognized expert in the tidal community almost from the very start (beginning 1982) and including his first tidal paper in 1987. Tidal analysis and corrections became crucial for all who worked on tides since the 1990's, particularly after the significant improvements in the data that arose from the widespread use of SGs. Referring to his publications, almost all of which are relevant to the criteria of the Melchior Medal, many of them are of the review type (with colleagues), and these in particular are frequently cited within the tidal community and in the wider geophysical world.

8. He has extensive experience with field gravimeters. In the 1980's, along with Richter (Germany), Melchior (Belgium), and Hsu (China), he installed an SG at J9 in Strasbourg which led to his first paper in 1991 and was a decision that defined most of his subsequent career. Jacques developed valuable skills in handling the challenges of the first SG's – the TT70's were very different from their modern counterparts. He became fascinated by the

performance differences between instruments such as SGs, absolute and spring gravimeters, long-period seismometers, GPS sensors and hydrological monitoring equipment. Familiarity with instrumentation was a key skill for Jacques that enabled him to perform quality measurements worldwide, as discussed above.

9. Finally, he is a leader in hydro and geothermal gravimetry. Has been one of the leaders in new fields made possible by the excellent performance of SGs. This refers to both hydro-gravimetry (dating from the early 2000's) and in underground gravimetry (e.g. hydrothermal studies in France) and to hybrid gravimetry with the simultaneous measurement of gravity with multiple instruments and at various spacings. In all this he has been assisted by many talented colleagues with similar interests, but Jacques frequently has been the instigator, proposal writer, and organizer of this work.

Summary
Of all these qualities, I would single these out as the most important:

1. Inspiration for students
2. Creative and difficult fieldwork
3. Collegial cooperation in research

It seems fitting that Jacques was selected for the Melchior Medal at this Symposium [SLIDE]. We knew he was going to be present, and that the honor is conferred in his home town.

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St. Louis University, September 9, 2024.