Figure 1: Duncan Agnew at the 2016 Trieste Earth Tide and Geodynamics Symposium

Paul-Melchior-Medal 2024

Awarded to

Professor Duncan Carr Agnew

It is a great pleasure to laudate Professor Duncan Carr Agnew (DCA) as one of two recipients of the 2024 Paul-Melchior-Medal, the other being Professor Jacques Hinderer whom I also congratulate here. It is also a duty because in the past I benefitted often from his expertise in many aspects and I cannot think of many colleagues who unselfishly supported research of others as much as he did. A short curriculum vitae can be found in the appendix as well as my list of selected publications.

One of his most important and best known contributions to the tidal community is the freely available SPOTL-package (”Some Programs for Ocean Tidal Loading”). SPOTL is widely used by the community now and needs no further appraisal. However, long before the publication of SPOTL in 1997 he frequently has helped colleagues with ocean load computations. He also contributed to the development of the Japanese tidal anylysis program BAYTAPG 08 and the seismic analysis program PITSA.

Another huge impact contribution by DCA is his involvement in the deployment, operation, and maintenance of the "International Deployment of Accelerometers" - network (IDA). He was also deeply involved in the IDA-data acquisition, distribution, and analysis. IDA provided a vast amount of data to be later used in inversions for the seismological 1-D and 3-D structure of the Earth: spheroidal mode Qs and eigenfrequencies, some splitting widths, precise measurements of eigenfrequencies and Qs of radial modes ${}_0S_0$ and ${}_1S_0$, and so forth. The IDA network after a few large earthquakes (notably the 1977 Sumbawa Island event, Mw 8.3) created a boost in normal mode seismology after 1977. The famous PREM ("Preliminary Reference Earth Model") by Dziewonski and Anderson (1981) was using among other results from seismology the spheroidal normal mode data obtained with the gravimeters of the IDA-network. Because IDA provided these data several brilliant theoreticians soon developed the theoretical framework for the free oscillations of the Earth. The late unforgotten Tony Dahlen once told me (after me asking for the theory of core modes) that he only does theories when they can be checked with data. The very first 3-D model of the earth's mantle by Masters et al. (1982) was also developed on this data base.

Starting with his Ph.D. thesis titled "Strain Tides at Piñon Flat: analysis and interpretation" DCA worked with strainmeters, especially the three 720 m - long laser strainmeters at the Piñon Flat Observatory (PFO), located in California between the well-known San Andreas and San Jacinto faults. He finished his dissertation in 1980 and then he continued to work as researcher and professor at the famous Institute of Geophysics and Planetary Physics at the University of California at San Diego by which PFO is operated. PFO still is a reference station for testing seismological and geodetical instruments. For the whole length of his career DCA was involved with PFO and many excellent papers resulted from these instruments. One of those on "Nonlinearity in rock: evidence from earth tides" was adopted by Chris Harrison for the collection of important papers in his 1985 book titled "Earth Tides". In the opinion of the writer these were the best and most productive geophysical strainmeters ever. However, here I have to mention his long-time colleague Frank Wyatt, with whom he coauthored many excellent papers, especially on the work with PFO. The motivation and emphasis of this installation was on long-term stability. DCA and Frank Wyatt together with students also shed new light on the necessary quality of monuments for permanent GPS receivers. With very careful analysis a comparison of the long term deformation at PFO with GPS measurements in Southern California became possible and showed that the two methods give consistent results.

In context with the work at PFO DCA wrote his famous review paper "Strainmeters and Tiltmeters" of 1986 which is a gold mine of information on essentially all types of such instruments and the basic physical principles, techniques, and also materials involved. Well known to write excellent reviews, DCA was invited to write the chapter "Earth Tides" in the geodesy volume of the "Treatise in Geophysics" encyclopedia (2007).

As a consequence of their experience at PFO DCA with long-time colleague Frank Wyatt was funded in this century to deploy and operate long-baseline strainmeters at the so-called "Plate Boundary Observatory" (PBO), a multitude of instruments along the Pacific coast of North America (San Andreas fault and Cascadia subduction zone). Agnew and colleagues were deploying and operating six long-baseline laser strainmeters (400 to 560 m) distributed in Southern California for about 10 years. Agnew also, with student Andrew Barbour, looked at the simultaneously recording Gladwin type borehole strainmeters in the PBO and compared noise levels of all these instruments. One method known to calibrate borehole strainmeters in-situ is by looking at their earth tide records, to which DCA contributed significantly as well.

Since California is earthquake country the history of quakes in this region is of vital importance for estimating seismic risk. The recorded history is rather short compared to the repeat time of very large events. Since 1906 no magnitude eight event has occurred. Being very interested in the history of science in general DCA did several studies on historical earthquakes in California to help with the risk problem. For his work on seismic sources he was invited by Max Wyss to give a talk on tilt and strain precursors of large earthquakes at the IUGG-assembly at Boulder 1995. I kept two real aces from this talk: "Amplitudes of claimed precursory signals tend to be inversely proportional to signal-to-noise ratios" and " Show all your data, not just the precursor". Duncan was also elected to a panel of scientists charged to consult decision makers (i. e. politicians) on the value of earthquake predictions. The range of predictors reaches from serious scientists all the way to real quacks. This panel is active nation-wide, so for one example it had to evaluate a silly prediction of a major quake in the New Madrid earthquake zone, based on the earth tide "maximum" in 1990 caused by an alignment of all the planets with earth, moon, and sun. DCA was also a member of the "Southern (now renamed "Statewide") California Earthquake Center" (SCEC), a group of about 1000 scientists from Californian Universities and Government organizations concerned with the earthquake risk in this endangered state.

Other research interests are: well tides, tidal influences on wave propagation and earthquake statistics, tidal calibration of borehole sensors,tidal analysis, seismic instrumentation, co- and postseismic strains, dynamic seismic strains, recent and historical seismic sources, seismic normal modes, GPS-monuments and -measurements, earth's rotation, the "Nearly Diurnal Free Wobble", core modes, timing of data, statistical methos, noise power spectral densities, graphical methods for display of seismic information, and the history of science and a couple of famous scientists. He is known to write excellent review papers, usually doing appreciable additional research along these endeavours.

A 2024 paper by DCA in NATURE recently drew a lot of attention by the media, even in Europe: "A global time keeping problem postponed by global warming." It deals with the leap seconds regularly introduced into UTC because of the slowing of the earth's rotation. The delayed problem is: how to remove a second, while adding one is easy.

For many years now DCA serves as editor for the "Geophysical Journal International", one of the most prestigeous periodicals in geophysics. His wide expertise and scrutiny has been appreciated by many (not all) authors. Very often significant improvements were the result of his reviews. This kind of work is another unselfish (unfortunately) contribution to science and the very important peer review process. The only reward is to see the quality level of publications raised and garbage kept out of the major literature.

Considering all his contributions to several branches of Earth sciences, but especially his unselfish cooperation with many colleagues and students in a wide range of subjects in geodynamics and earth tides Duncan highly deserved to be awarded with the Paul-Melchior-Medal. Personally I thank him for many and exchanges and wish him many years of fruitful curiosity. I am also thanking Kathy here because she certainly was part of all this.

I also congratulate Professor Jacques Hinderer again to well deserved other medal of the two!

Short Curriculum Vitae

Born: September 18, 1951, Huntington, N. Y., U.S.A.
B.S. (Astronomy): California Institute of Technology,1972
Ph. D. (Earth Science): University of California, San Diego,1980
Postdoc (geophysics): CIRES, University of Colorado, Boulder, 1980
1981 - 1986 Assistant Researcher, University of California, San Diego
1986 - 1989 Associate Researcher, University of California, San Diego
1989 - 1990 Associate Professor, University of California, San Diego
1990 - now Professor, Researcher, University of California, San Diego

Selected Papers

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borehole strainmeters in southern California".
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Walter Zürn