FORUM

Comment on "Academic Specialties in U.S. Are Shifting: Hiring of Women Geoscientists Is Stagnating"

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The analysis of hiring trends of women by Holmes et al. (*Eos*, 28 October 2003, p. 457) is a useful contribution to our understanding of employment practices in the geosciences. While their findings indicate that "state geological surveys hired the lowest proportion of women with Ph.D.s in the geosciences; only 8% of hires in the last 10 years were female," some explanation for this observation is necessary lest state surveys be seen as less than anxious to hire women.

Two-thirds of state geological surveys are within state agencies (the balance are affiliated with academia), and state government jobs are notoriously lower-paying. State surveys are finding it increasingly difficult to recruit qualified female geoscientists at all levels because of salary competition from academia and industry. Additionally, and since employees tend to remain with state surveys once employed, the prospects for job openings and career advancement are limited for either gender.

Hence, state geological surveys are at a hiring disadvantage when recruiting qualified women geoscientists with Ph.D.s who desire good-paying jobs with faster career tracks.

—JOHN C. STEINMETZ, Association of American State Geologists and Indiana Geological Survey, Bloomington, Ind.

Reply

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We appreciate John C. Steinmetz's comments and would like to add that we reported numbers of women at different types of institutions, but offered no explanations for the numbers. We still lack critical data that would enable geoscientists to explain the numbers, but we do hope that the numbers generate discussion, self-examination, and more (and appropriate) data collection on this issue.

Missing data that might help explain the numbers include, "How many women are in the applicant pool for a given academic/survey/industry/government position?" If an applicant pool does reflect the degree recipient pool appropriate to the position, but hiring rates are lower, then the kink in the pipeline is occurring at hiring. Is this due to low numbers of offers being made to women, or to women turning offers down? Each institution can collect and examine this data to find its unique answers and appropriate solutions.

If, instead, the numbers in the applicant pool are low compared to the graduation rate at the degree required for the position, then questions will address why a particular position under-attracts female applicants. Do salaries and advancement prospects actually determine the makeup of an applicant pool? Do women look for better salaries than do men? Can women be highly selective in their acceptance of the best jobs because of their low numbers? Are women looking for non-salary compensation—more women colleagues, better mentoring, day care, and part-time, flexible, or split positions—that they do not find at a particular type of institution? Has anyone actually surveyed potential women applicants in a systematic fashion on these questions?

We welcome discussion about this and the entire challenge of diversity in the geosciences. The geosciences are the least diverse field in all of math, science, engineering, and technology (see http://www.nsf.gov/sbe/srs/nsf00327/frames.htm for data). As the U.S. population becomes more diverse, our lack of diversity will increasingly become a recruitment issue. Institutions interested in the makeup of their workforce and the workforce of the future will engage in a process of self-examination; they will collect data on their own applicant pools, compensation packages, and institutional workings to identify the reasons they have stalled in their efforts to have a workforce that reflects the diversity of our nation.

—MARY ANNE HOLMES, University of Nebraska-Lincoln; and SUZANNE O'CONNELL, Wesleyan University, Middletown, Conn.

SECTION NEWS

G E O D E S Y

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Modeling Earth's Post-Glacial Rebound

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Efforts to mathematically model the Earth's post-glacial rebound, or, in general, long-term planetary-scale viscoelastic deformations, have been ongoing for several decades. Unfortunately, research in the post-glacial rebound community has not been characterized by much exchange of knowledge. Groups around the world have developed their code independently, sometimes with profoundly different approaches, occasionally leading to inconsistent results [e.g., *Boschi et al.*, 1999].

Postglacial Rebound Calculator (TABOO) is a post-glacial rebound software that is being made freely available (through Samizdat Press at http://samizdat.mines.edu/taboo/) in the hope that it might become a common reference for all post-glacial rebound researchers. TABOO is portable and has been tested on Unix, Linux, and Windows systems; all it requires is a Fortran90 compiler supporting quadruple precision. The software is easy to use. It comes with a detailed guide that can work as a quick reference cookbook, and it is also accompanied by a textbook, The Theory Behind TABOO, collecting the most significant theoretical results from post-glacial rebound literature. TABOO is not a "black-box," although it may easily be used as such. The entire source code is provided and should be easy to understand for intermediate-level Fortran programmers.

TABOO solves the viscoelastic momentum equation of an incompressible spherically symmetric planet by propagating the analytical solution through a number of uniform layers [*Spada et al.*, 1992; *Vermeersen and Sabadini*, 1997]. Its main limitations are that no asphericity in the planet's mechanical properties is accounted for, and the number of layers must be less than or equal to 9. The latter bound can be surpassed by improving the algorithm that finds the roots of the secular polynomial, as in *Vermeersen and Sabadini* [1997]. The former problem was solved, with a normal mode approach compatible with ours, by *Tromp and Mitrovica* [2000]; in principle, after some further programming work, TABOO might be employed as the core of a *Tromp and Mitrovica* [2000]-type perturbative calculation.

Nonetheless, TABOO in its present form can carry out a large variety of tasks. It is designed to be a simple and versatile didactic tool. It implements semi-analytical formulae with the desirable property of a singularity-free [*Boschi et al.*, 1999] secular polynomial. It is, then, a perfect benchmark for numerical algorithms. The numerical approach allows for rheological profiles of higher complexity, but, in view of our limited knowledge of the Earth's viscosity, results derived from a nine-layer model might be no less accurate than those based on more complicated assumptions.

TABOO can be used to find the global deformations produced on a viscoelastic or elastic planet by any surface forcing with no constraints on its geometry or time history. It provides explicitly, as functions of time, the planet's Love numbers, load/deformation coefficients, surface deformation and deformation rate, and Stokes coefficients' variations (hence, perturbations in the geoid height and in the planet's inertia tensor). Because interpreting geodetic signals is becoming increasingly important for our knowledge of the Earth's rheology, TABOO also provides time variations of Very Long Baseline Interferometry or GPS baselines.

Naturally, the usefulness of TABOO is not limited to post-glacial rebound calculations. The effects, for example, of snow loading, mountain building, or the weight of a large dam's water reservoir can be modeled in much the same way. TABOO will soon be followed by another software package, Sea-level Equation Solver, which will explicitly calculate sea level rise, a task not covered by TABOO in its current form.

The software described here can be freely downloaded from Samizdat Press at http://samizdat.mines.edu/.

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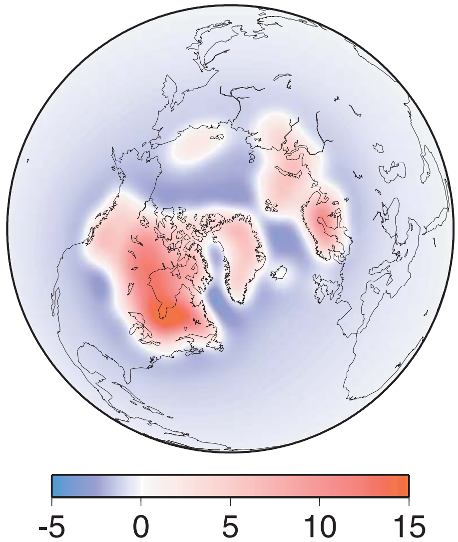

Fig. 1. Present-day rate of vertical velocity (harmonic degrees 0-64) according to deglaciation chronology ICE-3G [Tushingham and Peltier, *1991]. Antarctica ice aggregate and ocean load are neglected. Lower- and upper-mantle viscosities are 10^{22} and 10^{21} Pa.s, respectively. The lithosphere is 120 km thick.*

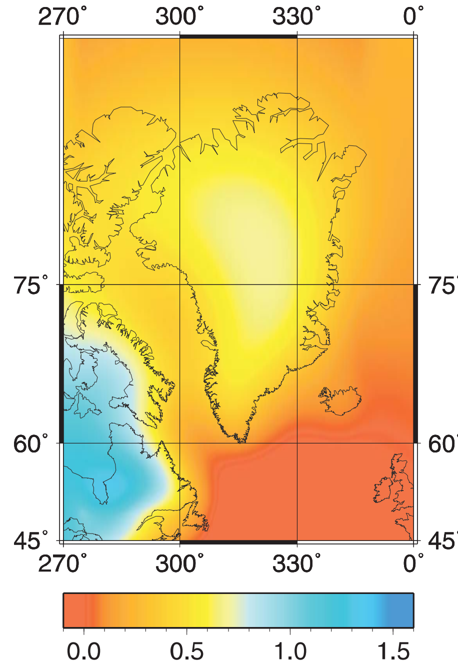

*Fig. 2. Rate of present-day geoid change for Greenland. Full ICE-3G model is employed, and lower-mantle viscosity equals 2*10^{21} Pa.s. Ocean load is uniform. Max. harmonic degree and lithospheric thickness are as in Figure 1.*

—GIORGIO SPADA, Università degli Studi di Urbino Istituto di Fisica, Urbino, Italy; ANDREA ANTONIOLI, Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy; LAPO BOSCHI, Università di Napoli Federico II, Dipartimento di Scienze Fisiche, Napoli, Italy and ETH Hoenggerberg, HPP, Zurich, Switzerland; VALTER BRANDI, Università degli Studi di Urbino Istituto di Fisica, Urbino, Italy; SPINA CIANETTI, Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy; GABRIELE GALVANI, Università degli Studi di Urbino Istituto di Fisica, Urbino, Italy; CARLO GIUNCHI, Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy; BRUNA PERNIOLA, Università degli Studi di Urbino Istituto di Fisica, Urbino, Italy; NICOLA PIANA AGOSTINETTI, Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy; ANTONIO PIERSANTI, Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy; and PAOLO STOCCHI, Università degli Studi di Urbino Istituto di Fisica, Urbino, Italy

For additional information, contact Giorgio Spada at spada@fis.uniurb.it