

THE UNIVERSITY OF BRITISH COLUMBIA
Curriculum Vitae for Faculty Members

Date: February 15, 2005

Initials:

1. **SURNAME:** Hearn **FIRST NAME:** Elizabeth
MIDDLE NAME(S): Harding
2. **DEPARTMENT/SCHOOL:** Earth and Ocean Sciences
3. **FACULTY:** Science
4. **PRESENT RANK:** Assistant Professor **SINCE:** 2002
5. **POST-SECONDARY EDUCATION**

University or Institution	Degree	Subject Area	Dates
University of Oregon	PhD	Geological Sciences	1993-1998
University of California at Berkeley	MS	Geological Sciences	1986-1988
Rice University	BS (2)	Geophysics, Geology	1983-1986
Reed College			1982-1983

Title of Dissertation and Name of Supervisor

Dissertation: 'Numerical Models of Lithosphere Deformation: Inferring Rheology and Structure from Limited Surface Observations'
Advisor: Eugene D. Humphreys

Special Professional Qualifications

Oregon Registered Geologist # RG1324 since 1992

6. EMPLOYMENT RECORD

(a) *Prior to coming to UBC*

University, Company or Organization	Rank or Title	Dates
Massachusetts Institute of Technology	Postdoctoral Fellow	1/1999-10/2002
University of Oregon	Research Assistant	9/1993-5/1998
EMCON Associates and EMCON Northwest	Staff Hydrogeologist	1/1989-9/1993
University of California at Berkeley	Research Assistant	9/1986-6/1988

(b) *At UBC*

Rank or Title	Dates
Assistant Professor	11/2002-present

(c) *Date of granting of tenure at U.B.C.:*

N/A

7. LEAVES OF ABSENCE

University, Company or Organization at which Leave was taken	Type of Leave	Dates
N/A		

8. TEACHING

(a) *Areas of special interest and accomplishments*

I have taught EOSC 453, Advanced Physics of the Earth, for three semesters. Over this time, I have made some changes to the class. I revised the course content to focus more on the Earth's evolution and structure, and less on early solar system history. I also developed a webpage with supplementary information and a frequently-updated detailed syllabus., and have made several handouts summarizing the lecture materials in which transcription errors are a problem (mainly lectures with many equations and their derivations). Most of the lecture content is not reproduced on these handouts, because students should have to take notes in class. I have done a few very simple demonstrations to reinforce concepts in which visualization is important (e.g., the stress tensor), and I plan to add more. Brett Gladman (Physics and Astronomy) is slated to give some lectures, and in exchange, I will give guest lectures in ASTR 507, his planetary science class. I have changed the structure of EOSC 453 as well, by adding a midterm exam so graded work is distributed more evenly throughout the semester (previously, 50% of the grade came from the final). The TAG workshop definitely helped me improve my presentation of the course material, and I have improved my teaching rating to 4.81 (spring 2004). I still have work to do on pacing when presenting material via overheads, and engaging students to think for themselves.

I taught the earthquakes section of EOSC 114 twice, adhering to the regimented presentation scheme in this large class, which seems to work well. All lectures are presented with computer-projected slides. I updated, corrected, and customized slides from the previous semester, to include mention of recent earthquakes, recent developments in earthquake science here in southwest BC (slow earthquakes on the Cascadia Subduction Zone), and some of my research. My scores were 3.83 and 3.98 for the two sections. I need to work on slowing down my delivery. I plan to revamp the slides for this class, and

reduce the total number of slides per lecture, before I teach this material again.

I proposed, developed, and taught a new graduate course on the mechanics of earthquakes and faulting (EOSC 562). The proposal was submitted for approval by the University in January 2004 and was approved by the Faculty of Science curriculum committee in February of 2004. I taught this class for the first time during the fall of 2004. Lori Kennedy and Carlos Ventura (Civil Engineering) gave guest lectures. (In the spirit of team teaching, I will be presenting guest lectures in ASTR 507 [Planetary Science] and EOSC 544 [Global Geodynamics], during spring term 2005.)

I am supervising an undergraduate honors student in Geophysics, Kelly Bolitho, on her thesis research. Her thesis involves calculating the increase in probability of large earthquakes in the Marmara Sea Region due to the 1999 Izmit, Turkey earthquake sequence.

(b) *Courses Taught at UBC*

EOSC 453 Advanced Physics of the Earth

EOSC 114 Natural Disasters

EOSC 562 Mechanics of Earthquakes and Faulting

Session	Course Number	Scheduled Hours	Class Size	Hours Taught Lectures	Tutorials	Labs	Other
2002-2003	EOSC 453	3	12	3 per week	0	0	0
2003-2004	EOSC 453	3	8	3 per week	0	0	0
2003-2004	EOSC 114	3	575	10 (total)	0	0	2
2004-2005	EOSC 562	3	6	3 per week	0	0	0
2004-2005	EOSC114	3	500	10 (total)	0	0	2
2004-2005	EOSC453	3	6	3	0	0	0

(c) *Graduate Students Supervised and/or Co-Supervised*

Student Name	Program Type	Year		Principal	Co-Supervisor(s)
		Start	Finish		
Ali Vaghri	Msc	Jan 2004		E. Hearn	
Joel Podgorski	Msc	Sept 2004		E. Hearn	
Yaron Finzi	PhD	Jan 2005		E. Hearn	
Pascal Audet	PhD	Jan 2005		E. Hearn	M. Bostock, R. Clowes

(d) *Continuing Education Activities*

TAG Instructional Skills Workshop, August-September, 2003

(e) *Visiting Lecturer (indicate university/organization and dates)*(f) *Other***9. SCHOLARLY AND PROFESSIONAL ACTIVITIES**(a) *Areas of special interest and accomplishments*

I model deformation of continental lithosphere, particularly along active plate boundaries. My current foci are the dynamics of the earthquake cycle along transform plate boundaries, and whether different aseismic processes (such as aseismic fault slip or viscoelastic relaxation of subsurface bodies) may be distinguished based on patterns of transient surface deformation. An understanding the mechanics of interseismic deformation is a pre-requisite for characterizing (1) forces that drive and resist motion of tectonic plates, and (2) stresses in the continental lithosphere. I am just beginning to apply such modeling to the Cascadia subduction zone, and to investigate models of deformation over multiple earthquake cycles.

I also invert coseismic surface displacements for fault slip, using realistic elastic Earth models. The goals of this modeling are to provide a correct starting point for my postseismic deformation studies, and to better characterize how faults break during earthquakes, which may place limits on stresses (and hence rheologies) in the middle crust. My research in this area suggests that geodetic estimates of earthquake energy release from large strike-slip earthquakes are often up to 50% too low, because most inversions of geodetic data for fault slip assume that the Earth is elastically homogeneous.

The most important contribution in the past year or two is developing a conceptual model of the North Anatolian Fault Zone (NAFZ) which is consistent with the observed deformation around the fault during and between large earthquakes (taking into account the variation in strain around the fault with time between earthquakes). This is based on an analysis of my numerical models of deformation around the fault over various time scales, and will be supplemented by my upcoming work (this summer) on postseismic deformation from 1999 to 2004, from the 1999 Izmit and Düzce earthquakes. This research suggests that the classic plate tectonic view (i.e., that the lithosphere is essentially rigid and that relative motion of plates or tectonic blocks is concentrated around faults) is appropriate for central Anatolia. I plan to investigate whether this holds for other transform plate boundaries where earthquakes have

occurred recently and abundant geodetic and geophysical observations are available (e.g., the Eastern California Shear Zone).

(b) *Research or equivalent grants (indicate under COMP whether grants were obtained competitively (C) or non-competitively (NC))*

Agency	Subject	COMP	\$/yr	PI	co-PI*
NSERC	Discovery Grant	C	CAD\$28000	X	
NSF	Earth Sciences	C	US\$91,000		X
SCEC (NSF and USGS)		C	US\$15,000	X	

* I receive \$1,250 per year for travel as a co-investigator (senior scientist) from the NSF Earth Sciences grant.

- (c) *Research or equivalent contracts (indicate under COMP whether grants were obtained competitively (C) or non-competitively (NC)).*

N/A

- (d) *Invited Presentations*

Pre-2003 Invited talks:

San Francisco State University, 1998; U.S. Geological Survey, 1999, Scripps Institute of Oceanography, 2000; Harvard University, 2001; Purdue University, University of Nevada, University of Oregon, University of Minnesota, University of Illinois at Urbana-Champaign, and UBC, 2002. (preceeding were job interviews); Friends of the Pleistocene Field Trip, 1997; Harvard University, 2000; Int'l. School of Geophysics, 17th Meeting, Erice Sicily, 2000 (poster and talk); American Geophysical Union meeting invited presentations: 1998, 2000(2), 2001; Seismological Society of America (SSA) meeting invited presentation, 2001.

2003 Invited talks:

GSC-Pacific seminar, June 2003, “ Dynamics of the North Anatolian Fault Zone: clues from modeling deformation over multiple time intervals ”
 SCEC (Southern California Earthquake Center) Meeting, Palm Springs CA September 10, 2003, “ One Model to Explain them All: Insights from Modeling Deformation Throughout the Earthquake Cycle”, one of six science keynote talks at the meeting
 USGS Menlo Park, seminar, October, 2003, “ Dynamics of the North Anatolian Fault Zone: clues from modeling deformation over multiple time intervals ”
 University of Southern California, department seminar, October 2003. “ One Model to Explain them All: Insights from Modeling Deformation Throughout the Earthquake Cycle”
 Central Washington University, department seminar, November 2003, “ One Model to Explain them All: Integrating Models of Plate Boundary Deformation Throughout the Earthquake Cycle”

2004 Invited talks:

Simon Fraser University, department seminar, February 2004, “ One Model to Explain them All: Insights from Modeling Deformation Throughout the Earthquake Cycle”
 Seismological Society of America Meeting, California, April 2004, “ Integrated Models of Plate Boundary Deformation Throughout the Earthquake Cycle”

- (e) *Other Presentations*

Pre-2003:

MIT graduate student seminars, 2001 and 2002; American Geophysical Union meeting presentations, 1995, 1997, 2000, 2001.

2004:

AGU Fall Meeting, December 2004; “Kinematic and dynamic models of deep afterslip following the 1999 Izmit-Duzce earthquake sequence”
 SCEC Annual Meeting, September 2004. “Kinematic and dynamic models of deep afterslip following the 1999 Izmit and 1992 Landers Earthquakes”

- (f) *Other*

CBC Radio Quirks and Quarks panelist, June 2003
 Interview for Yes Magazine article on Sumatra Tsunami, January 2005

(g) *Conference Participation (Organizer, Keynote Speaker, etc.)*

Geodesy-Tectonics joint session co-chair, AGU Fall 2004 Meeting, December 2004

Geodesy Session co-chair, AGU Fall 2001 Meeting, December 2001

Plate Boundary Observatory workshop participant, 1999

SCEC Community Finite Element Modeling Workshop participant, 2002 and 2003

10. SERVICE TO THE UNIVERSITY

(a) *Memberships on committees, including offices held and dates*

Department seminar committee member, spring semester 2003

Department seminar committee chair, 2003-2004

Undergraduate advising and clubs committee (geophysics chair) 2003-present

Faculty search committee member, half-time (Geophysics), 2004

Curriculum Committee (Geophysics) 2004-present

(b) *Other service, including dates*

Comprehensive examination committee chair: Joseph Marcoline April 2, 2003

Master's defense examination committee chair: Nicholas J. Austin, July 9, 2003.

Comprehensive examination committee: Len Pasion July 12, 2003

Master's defense examination committee: Christine Bishop, September 12, 2003.

Master's defense examination, outside committee member (University of Victoria):

Lisa Wolyneec, July, 20, 2004

Master's defense examination, Fern Webb, August 26, 2004.

11. SERVICE TO THE COMMUNITY

(a) *Memberships on scholarly societies, including offices held and dates*

American Geophysical Union member 1993-2004
Seismological Society of America 2004

(b) *Memberships on other societies, including offices held and dates*

(c) *Memberships on scholarly committees, including offices held and dates*

Earthscope Plate Boundary Observatory Data Products Committee member, 2004

(d) *Memberships on other committees, including offices held and dates*

(e) *Editorships (list journal and dates)*

(f) *Reviewer (journal, agency, etc. including dates)*

Manuscript Reviews: pre-2003 (not tallied):

EOS, JGR, Nature, BSSA, GJI, GRL

2003: GRL (2) GJI (1)

2004: Can. J. Earth. Sci. (1) JGR (1) GRL (1) EPSL (2) GJI (1)

2005: JGR (1)

Proposal Reviews:

pre-2003: NSF (4)

2003: NSF (2)

2004: NSF (4) ACS (1)

2005: NSF (2)

(g) *External examiner (indicate universities and dates)*

(h) *Consultant (indicate organization and dates)*

(i) *Other service to the community*

12. AWARDS AND DISTINCTIONS

(a) *Awards for Teaching (indicate name of award, awarding organizations, date)*

(b) *Awards for Scholarship (indicate name of award, awarding organizations, date)*

NASA Earth Systems Science Graduate Fellowship, 1997-1998

AGU Student Talk Award, Tectonophysics Section, Fall AGU Meeting, 1994

NASA - LPI Student Internship (Johnson Space Center), 1986

NAGT - USGS Summer Field Camp Award, 1985

(c) *Awards for Service (indicate name of award, awarding organizations, date)*

(d) *Other Awards*

13. OTHER RELEVANT INFORMATION (Maximum One Page)

THE UNIVERSITY OF BRITISH COLUMBIA
Publications Record

SURNAME: Hearn

FIRST NAME: Elizabeth

Initials:

MIDDLE NAME(S): Harding

Date: February 15, 2005

1. REFEREED PUBLICATIONS

(a) *Journals*

- Hearn, E.H., What can GPS Tell us About the Dynamics of Postseismic Deformation?, *Geophys. J. Int.*, 155, 753-777, 2003.
- Hearn, E.H., Hager, B., and Reilinger, R., Viscoelastic Deformation from North Anatolian Fault Zone Earthquakes and the Eastern Mediterranean GPS Velocity Field, *Geophys. Res. Lett.*, 29, 10.1029/2002GL014889, 2002.
- Hearn, E.H., R. Bürgmann, R., and R.E. Reilinger, Dynamics of Izmit Earthquake Postseismic Deformation and Loading of the Düzce Earthquake Hypocenter, *Bull. Seis. Soc. Am.*, 92, 172-193, 2002.
- Bürgmann, R., S. Ergintav, P. Segall, E. Hearn, S. McClusky, R. Reilinger, H. Woith, and J. Zschau, Time-Space Variable Afterslip on and Deep Below the Izmit Earthquake Rupture, *Bull. Seis. Soc. Am.*, 92, 126-137, 2002.
- Reilinger, R., S. Ergintav, R. Bürgmann, S. McClusky, O. Lenk, A. Barka, O. Gurkan, E. Hearn, K.L. Feigl, R. Cakmak, B. Aktug, H. Ozener, and M.N.Toksoz, Coseismic and Postseismic Fault Slip for the 17 August 1999, M = 7.5, Izmit, Turkey Earthquake, *Science*, 289,1519-1524, 2000.
- Hearn, E. H. and E. D. Humphreys, Kinematics of the Southern Walker Lane Belt, California, *J. Geophys. Res.*, 103, 27033-27049, 1998.
- Hearn, E. H., E. D. Humphreys, J. M. Brown, and M. Chai, Correction to “The Effect of Anisotropy on Oceanic Upper Mantle Temperatures, Structure, and Dynamics”, *J. Geophys. Res.*, 104, 1193-1195, 1999.
- Hearn, E. H., E. D. Humphreys, J. M. Brown, and M. Chai, The Effect of Anisotropy on Oceanic Upper Mantle Temperatures, Structure, and Dynamics, *J. Geophys. Res.*, 102, 11943-11956, 1997.
- Hearn, E. H., B. M. Kennedy, and A. E. Truesdell, Coupled Variations in Helium Isotopes and Fluid Chemistry: Shoshone Geyser Basin, Yellowstone National Park, *Geochim.Cosmochim. Acta*, 54, 3103-3113, 1990.

(b) *Conference Proceedings*

- Hearn, E.H., Kinematic and dynamic models of deep afterslip following the 1999 Izmit-Duzce earthquake sequence , *EOS Trans. AGU Suppl.*, 2004.
- Hearn, E.H., Kinematic and dynamic models of deep afterslip following the 1999 Izmit and 1992 Landers Earthquakes, 2004 SCEC Annual Meeting Proc. Abs. Vol. XIV, p. 106.
- Hearn, E. H., Integrated Models of Transform Plate Boundary Deformation Throughout the Earthquake Cycle, *Seis. Res. Lett.*, 74, 240, 2004. (invited)
- Hearn, E.H., One model to explain them all: Integrating models of transform plate boundary deformation throughout the earthquake cycle, 2003 SCEC Annual Meeting Proc. Abs. Vol. XIII. (invited)
- Ergintav, S., R. Reilinger, R. Cakmak, S. McClusky, E. Hearn, O. Lenk, E. Evren, and H. Ozener, Geodetic Constraints on the Earthquake Deformation Cycle along the Western North Anatolian

- Fault:: Implications for earthquake mechanics and seismic hazards; EGS-EUG-AGU Joint Assembly, Nice, France, 2003. (invited)
- Hearn, E.H., Relating Measurements of Decaying Postseismic Surface Deformation to Viscoelastic Relaxation: This is no Time for Elsasser Time, EOS Trans. AGU Suppl., 82, F268, 2001.
- Hearn, E.H. and R. Burgmann, Estimates of Coseismic Slip and Crustal Stress Changes from Surface Displacement Data and Elastically Layered Earth Models: Findings from the 1999 Izmit, Turkey Earthquake, EOS Trans. AGU Suppl., 82, F809-810 (invited), 2001.
- Hearn, E.H., Incorporating Layered Elastic Structure in Earthquake Models: Effects on Inversions for Slip, Coulomb Stress Change, and Rheological Parameters, Seis. Res. Lett., 72, 252, 2001 (invited).
- Hearn, E. H., and R. Bürgmann, Dynamic models of post-Izmit afterslip and loading of adjacent fault segments, International School of Geophysics, 17th Course, Erice, Sicily, June 17-23, 2000.
- Hearn, E. H., GPS Constraints on the Dynamics of Izmit Earthquake Afterslip, EOS Trans. AGU Suppl., 81, F1244, 2000 (invited).
- Hearn, E.H., R. Bürgmann, and R. Reilinger, Modeled Coseismic and Postseismic Coulomb Stress Changes on the Izmit and Düzce Rupture Surfaces Incorporating the Effects of Layered Elastic Parameters and Frictional Afterslip, EOS Trans. AGU Suppl., 81, S307, 2000.
- Hearn, E. H., Postseismic Deformation Following the 1992 Landers Earthquake: A Comparison of Earthquake Cycle models, EOS Trans. AGU Suppl., 80, S325, 2000 (invited).
- Hearn, E.H. and E.D. Humphreys, Kinematics of the Southern Walker Lane Belt, EOS Trans. AGU Suppl., 79, F207 (invited), 1998.
- Hearn, E.H. and E.D. Humphreys, A Comparison of Models for Postseismic Deformation Following the Landers Earthquake, EOS Trans. AGU Suppl., 78, F702, 1997.
- Hearn, E.H. and E.D. Humphreys, A Kinematic Model of the Southern Walker Lane Belt, EOS Trans. AGU Suppl., 76, F638, 1995.
- Hearn, E.H., K. Dueker, and E.D. Humphreys, Effect of Mechanical Anisotropy on the Evolution of Oceanic Asthenosphere, EOS Trans. AGU Suppl., 75, 648, 1994 (AGU Student talk award).

(c) *Other*

2. NON-REFEREED PUBLICATIONS

(a) *Journals*

Hearn, E.H., Shock Delay, Nature (News and Views), 411, 150-151, 2001.

(b) *Conference Proceedings*

(c) *Other*

Hearn, E.H. and E.D. Humphreys, Kinematics of the Southern Walker Lane Belt, Pacific Cell Friends of the Pleistocene 1997 field trip guidebook, Owens Valley, California, pp. A-4 - A-13., 1997.

3. BOOKS

(a) *Authored*

(b) *Edited*

(c) *Chapters*

4. **PATENTS**

5. **SPECIAL COPYRIGHTS**

6. **ARTISTIC WORKS, PERFORMANCES, DESIGNS**

7. **OTHER WORKS**

8. **WORK SUBMITTED (including publisher and date of submission)**

Hearn, E. H., and R. Bürgmann, The Effect of Elastic Layering on Inversions of GPS Data for Earthquake Slip, submitted to Bull. Seis. Soc. Am., August 2004. Accepted January 2005, pending minor revisions.

9. **WORK IN PROGRESS (including degree of completion)**

Hearn, E. H., S. McClusky, R. Reilinger, Kinematic and dynamic models of deep afterslip following the 1999 Izmit-Duzce earthquake sequence. 50% complete.

Hearn, E.H., Depth of coseismic ruptures on continental strike-slip faults: Clues to tectonic style, 20% complete.