

## Vita

### Vernon F. Cormier

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#### Areas of interest:

Deep earth structure, earthquake ground motion, nuclear verification, wave propagation

#### Education:

PhD., Geophysics, Columbia University, 1976  
MPhil., Geophysics, Columbia University, 1973  
B.S. with honors, Geophysics, California Institute of Technology, 1970

#### Professional Experience:

1990-present	Professor, University of Connecticut
1987-1990	Associate Professor, University of Connecticut
1984-1987	Principal Research Scientist, M.I.T.
1982-1984	Research Scientist, M.I.T.
1980-1982	Staff Scientist, M.I.T. Lincoln Laboratory
1979-1980	Research Associate, Harvard University
1976-1979	Research Associate, CIRES, University of Colorado
1970 (summer)	Engineer, ARCO
1969 (summer)	Geophysicist, Texaco

#### Visiting and Sabbatical Appointments:

2015	Benjamin Meaker Visiting Professor, Institute of Advanced Studies, Bristol University, UK
2008	Visiting Fellow, RSES, Australian National University
2000	Visiting Associate, California Institute of Technology
2000	Visiting Professor, M.I.T.
2001-present	Research Affiliate, M.I.T.
1994	Green Scholar, Institute of Geophysics and Planetary Physics, University of California, San Diego
1990	Visiting Associate Professor, University of Utrecht, Netherlands

### **Significant Professional Service:**

Editor, *Physics of the Earth and Planetary Interiors*, 2013-  
American Geophysical Union SEDI Focus Group, Chair, 2008--2010  
American Geophysical Union SEDI Focus Group, Secretary, 2005-2008  
American Geophysical Union, Lehmann Medal Committee, 2008--2010; chair  
2010- 2012  
Computational Infrastructure in Geodynamics, Science Steering Committee  
member 2010-2011  
Royal Astronomical Society, International Committee, 2009--2012  
Head, Publication Committee, Seismological Society of America, 1995-2000  
Vice President, Seismological Society of America, 1996--1998  
Board Member, Seismological Society of America, 1994--2000  
Secretary, Seismology Section, American Geophysical Union, 1992 --1994  
Editor and Head of the American Office of the *Geophysical Journal of the Royal  
Astronomical Society*, 1983--1986  
Member AGU Committee on International Participation, 1983--1985  
Member IASPEI Commission on Theoretical Seismology/Lateral  
Heterogeneity, 1985--1993

### **Refereed Publications:**

Cormier, V.F., and C.J. Sanborn (2019), Tradeoffs in parameters describing crustal heterogeneity and intrinsic attenuation from radiative transport modeling of high frequency regional seismograms, *Bull. Seism. Soc. Am.*, 109(1) 312-321, doi: 10.1785/0120180231.

Cormier, V.F., Tian, Y., and Zheng, Y., (2018) Heterogeneity spectrum of Earth's upper mantle obtained from the coherence of teleseismic P waves, *Commun. Comp. Phys.*, doi: 10.4208/cicp.OA-2018-0079, accepted.

Attanayake, J., C. Thomas, V.F. Cormier, M.S. Miller, and K.D. Koper (2018), Irregular transition layer beneath Earth's inner core boundary from observations of antipodal PKIKP and PKIKP waves, *Geochemistry, Geophysics, Geosystems*, 19(10), 3607-3622, doi: 10.1029/2018GC007562.

Sanborn, C.J., and V.F. Cormier (2018), Modeling the blockage of Lg waves from 3-D variations in crustal structure, *Geophys. J. Int.*, 214, 1426-1440, doi: 10.1083/gji/ggy206.

deSilva, S., V.F. Cormier, and Y. Zheng (2018) Inner core boundary topography explored with reflected and diffracted P waves, *Phys. Earth Planet. Int.*, 276, 202-214, doi: 10.1016/j.pepi.2017.04.008.

Sanborn, C.J., V.F. Cormier, and M. Fitzpatrick (2017), Combined effects of deterministic and statistical structure on high-frequency regional seismograms, *Geophys. J. Int.*, 210(2), 1143-1159, doi: 10.1093/gji/ggx219.

Pejić, T., H. Tkalčić, M. Sambridge, V.F. Cormier, and R. Benavente (2017) Attenuation tomography of the upper inner core, *J. Geophys. Res.*, 122, 3008-3032, doi: 10.1002/2016JB013692.

Cormier, V.F. (2015) Detection of inner core solidification from observations of antipodal PKIKP, *Geophys. Res. Lett.*, 42, 7459-7466, doi: 10.1002/2015GL065367.

Cormier, V.F., (2015) Forward modeling: Synthetic body wave seismograms, In: *Treatise on Geophysics*, 2<sup>nd</sup> edition, G Schubert (ed.), Volume 1: Deep Earth Seismology, A. Dziewonski and B. Romanowicz (eds.), Oxford: Elsevier Ltd., pp.201-230.

Attanayake, J., V.F. Cormier, and S.M. deSilva, (2014) Uppermost Inner Core Seismic Structure - New Insights from Body Waveform Inversion, *Earth Planet. Sci. Lett.*, 385, 49-58.

Cormier, V.F., and J. Attanayake (2013), Earth's Solid Inner Core: Seismic Implications of Freezing and Melting, *J. Earth Sci.*, 24(5), 683-698, doi: 10.1007/s12583-013-0363-9.

Geballe, Z.M., M. Lasbleis, V.F. Cormier, and E.A. Day (2013), Sharp hemisphere boundaries in a translating inner core, *Geophys. Res. Lett.*, 40, 1-5, doi: 10.1002/grl.50372.

Cormier, V.F., J. Attanayake, and K. He, (2011) Inner core freezing and melting: constraints from seismic body waves, *Phys. Earth Planet. Int.*, 188, 163-172, doi: 10.1016/j.pepi.2011.07.007.

Cormier, V.F., (2011) Seismic viscoelastic attenuation, In: *Encyclopedia of Solid Earth Geophysics*, H. Gupta (ed.), pp. 1279-1290, doi: 10.1007/978-90-481-8702-7, Springer.

Ivan, M., and V.F. Cormier (2010), High frequency PKKP-BC around 2.5 Hz recorded globally, *Pure. Appl. Geophys.*, doi: 10.1007/s00024-010-0192-z

Rondenay, S., V.F. Cormier, and E. Van Ark, (2010) SKS and SPdKS sensitivity to two-dimensional ultra-low velocity zones, *J. Geophys. Res.*, 115, B04311, doi:10.1029/2009JB006733.

Tkalcic, H., V.F. Cormier, B.L.N. Kennett, and K. He (2010) Steep reflections from the Earth's core reveal small-scale heterogeneity in the upper mantle, *Phys. Earth Planet. Int.*, 178, 80-91, doi: 10.1016/j.pepi.2009.08.004.

Cormier, V.F., (2009) A glassy lowermost outer core, *Geophys. J. Int.*, 179, 374-380, doi: 10.1111/j.1365-246X.2009.04283.x

Tkalčić, H., B.L.N. Kennett, and V.F. Cormier (2009) On the inner-outer core density contrast from PKiKP/PcP amplitude ratios and uncertainties caused by seismic noise, *Geophys. J. Int.*, 179, 425-443, doi: 10.1111/j.1365-246X.2009.04294.x.

Zou, Z., K. Koper, and V.F. Cormier (2008), The structure of the base of the outer core inferred from seismic waves diffracted around the inner core, *J. Geophys. Res.*, doi:10.1029/2007JB005316.

Cormier, V.F. (2007) Texture of the uppermost inner core from forward and back scattered seismic waves, *Earth Planet. Sci. Lett.*, doi: 10.1016/j.epsl.2007.04.003.

Cormier, V.F., (2007) Forward modeling: Synthetic body wave seismograms, In: *Treatise on Geophysics*, G Schubert (ed.), Volume I, Seismology and Structure of the Earth, A. Dziewonski and B. Romanowicz (eds.), pp.157-190, Oxford: Elsevier Ltd.

Hirose, K, S-I. Karato, V.F. Cormier, J. P. Brodholt, and D.A. Yuen, (2006) Unsolved problems in the lowermost mantle, *Geophys. Res. Lett.* , 33, L12S01, doi:10.1029/2006GL025691.

Tkalčić, H., M. P. Flanagan, and V.F. Cormier, (2006) Observation of near-podal P'P' precursors: Evidence for back scattering from the 150-220 km zone in the Earth's upper mantle, *Geophys. Res. Lett.*, 33, doi: 10.1029/2005GL024645.

Cormier, V.F., and A. Stroujkova, (2005) Waveform search for the innermost inner core, *Earth Planet. Sci. Lett.* , 236, 96-105, 10.1016/j.epsl.2005.05.016.

Stroujkova, A., and V.F. Cormier, (2004) Regional variations in the uppermost 100 km of the Earth's inner core, *J. Geophys. Res.*, 109(B10), doi: 10.129/2004JB002976, (8 pp.).

Cormier, V.F., and T. S. Anderson, (2004) Efficiency of Lg propagation from SmS ray tracing in three-dimensionally varying crustal waveguides, *Pure and Appl. Geophys.*, 161(8), 1613-1633, doi:10.1007/s00024-004-2524-3.

Ni, S., V.F. Cormier, and D.V. Helmberger (2003) A comparison of synthetic seismograms for 2-D structures: semianalytical versus numerical, *Bull. Seism. Soc. Am.*, 93, 2752- 2757.

Li, X, and V.F. Cormier, (2002) Frequency dependent attenuation in the inner core: Part I. A viscoelastic interpretation, *J. Geophys. Res.* 107(B12), doi: 10.1029/2002JB001795, (20 pp)

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Xu, L., V.F. Cormier, and M.N Toksoz, (2002), Complex source mechanism of the 17 August 1999 Izmit, Turkey, earthquake, *Bull. Seism. Soc. Am.*, 92, 267-277.

Cormier, V.F., (2000). D" as a transition in the heterogeneity spectrum of the lowermost mantle., *J. Geophys. Res.* , 105, 16,193-16,205.

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Cormier, V.F., L. Xu, and G.L. Choy, (1998). Seismic attenuation of the inner core: viscoelastic or stratigraphic? *Geophys. Res. Lett.*, 25 , 4019-4025.

Cormier, V.F., (1995). Time domain modeling of PKIKP precursors for constraints on the heterogeneity in the lowermost mantle, *Geophys. J. Int.* , 121, 725-736.

Cormier, V.F., and Su, W-J., (1994). Effects of three-dimensional crustal structure on the estimated slip history and ground motion of the Loma Prieta Earthquake, *Bull. Seism. Soc. Am.*, 84, 284-294.

- Cormier, V.F., B. Mandal and D. Harvey (1991). Incorporation of velocity gradients in the synthesis of complete seismograms by the locked mode method, *Bull. Seism.Soc. Am.*, 81 , 897-930.
- Cormier, V.F., and W. Kim, (1990). Vicinity ray tracing: an alternative to dynamic ray tracing, *Geophys. J. Int.*, 103, 639-656.
- Cormier, V.F., Slab diffraction of S waves, (1989). *J. Geophys. Res.*, 94 , 3006-3024.
- Engdahl, E.R., J.E. Vidale, and V.F. Cormier (1989). Wave propagation in subducted lithospheric slabs, *Proceedings of the 6th Course: Digital Seismology and Fine Modeling of the Lithosphere, International School of Applied Geophysics*, Majorana Center, Erice, Sicily, Plenum Publishing Co.
- Cormier, V.F., (1989). Seismic attenuation: observation and measurement, In: *Encyclopedia of Geophysics* , D.E. James (ed.), Van Nostrand, pp.1005-1018.
- Cormier, V.F., and P.G. Richards (1988). Spectral synthesis of body waves in Earth models specified by vertically varying layers, In: *Seismological Algorithms*, D. Doornbos (ed.), Academic Press, pp. 3-45.
- Cormier, V.F., (1987). The focusing and defocusing of teleseismic P waves by known three-dimensional structure beneath Pahute Mesa, Nevada Test Site, *Bull. Seism. Soc. Am.*, 77, 1688-1703.
- Cormier, V.F., and G.C. Beroza, (1987). Calculation of strong ground motion due to an extended earthquake source in a laterally varying structure, *Bull. Seism. Soc. Am.*, 77 , 1-13.
- Cormier, V.F., and G.L. Choy, (1986). A search for lateral heterogeneity in the inner core from differential travel times near PKP-D and PKP-C, *Geophys. Res. Lett.* , 13, 1553-1556.
- Cormier, V.F., (1986). An application of the propagator matrix of dynamic ray tracing: The focusing and defocusing of body waves by three-dimensional velocity structure in the source region, *Geophys. J. R. Astr. Soc.*, 87 , 1159-1180.
- Cormier, V.F., (1986). Synthesis of body waves in transversely isotropic earth models, *Bull. Seism. Soc. Am.*, 76 , 231-240.
- Choy, G.L., and V.F. Cormier (1986). Direct measurement of the mantle attenuation operator from broadband P and S waves, *J. Geophys. Res.*, 91, 7326-7342.
- Der, Z.A., A.C. Lees, V.F. Cormier, and L.M. Anderson (1986). Frequency dependence of Q in the mantle underlying the shield areas of Eurasia, Part I: analysis of short and intermediate period data, *Geophys. J. R. Astr. Soc.* , 87, 1057-1084.
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Der, Z.A., A.C. Lees, and V.F. Cormier (1986). Frequency dependence of Q in the mantle underlying the shield areas of Eurasia, Part III: the Q model, *Geophys. J. R. Astr. Soc.*, 87, 1103-1112.

Cormier, V.F., (1985). Some problems with S, SKS, and ScS observations for the structure of the base of the mantle and outer core, *J. Geophys.*, 57, 14-22.

Esmersoy, C., V.F. Cormier, and M.N. Toksoz (1985). Three-component array processing, In: *The Vela Program, a Twenty Five Year Review of Basic Research*, A.U. Kerr (ed.), Executive Graphic Services.

Cormier, V.F., (1984). The polarization of S waves in a heterogeneous isotropic earth model, *J. Geophys.*, 56, 20-23.

Cormier, V.F., and M.H. Mellen (1984). Application of asymptotic ray theory to synthetic vertical seismic profiling, In: *Vertical Seismic Profiling: Advanced Concepts*, Toksoz and Stewart(eds.), Geophysical Press.

Cormier, V.F., and P. Spudich (1984). Amplification of ground motion and waveform complexity in fault zones: examples from the San Andreas and Calaveras faults, *Geophys. J. R. Astr. Soc.*, 79, 135-152.

Bullitt, J.T., and V.F. Cormier (1984). Relative performance of  $m_s$  and alternative measures of elastic energy in estimating source size and explosion yield, *Bull. Seism. Soc. Am.*, 74, 1863-1882.

Choy, G.L., and V.F. Cormier (1983). The structure of the inner core inferred from short-period and broad-band GDSN data, *Geophys. J. R. Astr. Soc.*, 72, 1-21.

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Cormier, V.F. (1982). The effect of attenuation on seismic body waves, *Bull. Seism. Soc. Am.*, 72B, 143-174.

Cormier, V.F. (1981). Short period PKP and the anelastic mechanism of the inner core, *Phys. Earth Planet Int.*, 24, 291-301.

Cormier, V.F., and G.L. Choy (1981), Theoretical body wave interactions with upper mantle structure, *J. Geophys. Res.*, 86, 1673-1678.

Lundquist, G.M., and V.F. Cormier (1980), Constraints on the absorption band model of Q, *J. Geophys. Res.*, 85, 5244-5256.

Cormier, V.F., (1980). The synthesis of complete seismograms in an earth model specified by radially inhomogeneous layers, *Bull. Seism. Soc. Am.*, 70, 691-716.

Rial, J.A., and V.F. Cormier (1980). Seismic waves at the epicenter's antipode, *J. Geophys. Res.*, 85, 2661-2668.

Choy, G.L., V.F. Cormier, R. Kind, G. Muller, and P.G. Richards (1980). A comparison of synthetic seismograms of phases generated by the full wave theory and by the reflectivity method, *Geophys. J. R. Astr. Soc.*, 61, 21-39.

Cormier, V.F., and P.G. Richards (1977). Full wave theory applied to a discontinuous velocity increase: the inner core boundary, *J. Geophys.*, 43, 3-31.

Cormier, V.F., and P.G. Richards (1976). Comments on "The Damping of Core Waves" by Anthony Qamar and Alfredo Eisenberg, *J. Geophys. Res.* , 81, 3066-3068.

Cormier, V.F., (1975). Tectonics near the junction of the Aleutian and Kuril-Kamchatka arcs and a mechanism for middle Tertiary magmatism in the Kamchatka Basin, *Geol. Soc. Am. Bull.* , 86, 443-453.

Dev, S., J.E. Anderson, V. Cormier, N.P. Damodaran, and J.D. Roberts (1968). Nuclear magnetic resonance spectroscopy. The conformational mobility of humulene and zerumbone, *J. Am. Chem. Soc.*, 90, 1246-1248.

### **Grants as PI:**

(Total Costs included for 2005-present)

#### **NSF**

EAR 17-54498, Seismic signatures of inner core solidification, 2/1/18-01/31/20, \$333,867

EAR 14-46509, Characterizing small-scale heterogeneity in Earth, 05/01/15-04/30/18, \$300,000

EAR 11-60917, Combined Geodynamical and Seismological Modeling of the Inner Core Boundary Region, 05/01/12-04/30/16, \$239,604

EAR 07-38492, Solidification Texture of Earth's Inner Core, 1/01/08-12/31/10, \$300,000

EAR 02-36721, Acquisition of Computational and Analytical Facilities for 3-Dimensional Imaging and Visualization in Geophysics, Petrology, and Hydrogeology, 04/15/2003 -- 03/31/2006

EAR 02-29586, Heterogeneity, Anisotropy, and Seismic Attenuation in Earth's Inner Core and Lower Mantle, 01/01/2003 -- 12/31/2007

EAR 99- 80355, Heterogeneity, Anisotropy, and Anelasticity in the Lowermost Mantle and Inner Core, 03/01/2000 -- 02/28/2003

EAR 96-14525 Heterogeneity, Anisotropy, and Anelasticity in the Lowermost Mantle and Inner Core, 03/01/1997 -- 06/30/2000

EAR 95-- 06613, Upgrade of the Geophysics Computing Facility at the University of Connecticut, 09/01/1995 -- 08/31/1997

EAR 92-18693, Waveform Modeling Applied to Three Deep Structure Problems: Slabs, D", and the Inner Core , 04/01/1993 -- 09/30/1997

EAR 90-11439 , Fault Zone and Laterally Heterogeneous Structure: Effects on the Rupture History and Strong Ground Motion of the Loma Prieta Earthquake , 08/15/1990 - 07/31/1992

EAR 89-16253 , Upgrade of Computer Equipment in Support of Research in Deep Earth Structure and Seismic Wave Propagation, 02/15/1990 -- 07/31/1991

EAR 89- 04236, Determination of the Deep Structure of Descending Lithospheric Slabs from Their Effects on Seismic Body Waves, 09/01/1989 -- 07/31/1992

EAR 87-09456, Slab Diffracted S Waves , 09/01/1987 -- 02/28/1990

EAR 85-18151, Prediction of Strong Ground Motion Due to Extended Earthquake Sources in a Three-Dimensionally Varying Medium, 02/01/1986 -- 07/31/1988

EAR 84-16921, Seismic Velocity Structure Surrounding the Inner Core Boundary 05/01/1985 -- 10/31/1987

EAR 82-18737 A Study of the Lateral Variation in the Structure of the Earth's Lower Mantle From the Synthesis of Seismic Body Waves in a Three-Dimensionally Varying Medium, 05/01/1983 -- 10/31/1984

#### **AFGL/DTRA/AFRL**

(list incomplete before 1990)

AFRL, FA-9453-15-C-0069, Modeling high frequency regional seismograms, 06/01/15-05/31/18, \$440,439

AFRL, FA9453-12-C-0207, Modeling the Combined Effects of Deterministic and Statistical Structure for Optimization of Regional Monitoring, 05/01/12- 04/30/15, \$307,000

DTRA (Defense Threat Reduction Agency), DTRA01-00-C-0029, Seismic Calibration for IMS stations in Eastern Asia (Group 1: Table 1), 3/26/00--3/26/03

AFGL, F49620-94-1-0059, Investigation of Lg Attenuation and Blockage in Models of the Eurasian Crust, 1994-1996

AFGL, Crust and Upper Mantle Gradients in the Vicinity of the East Kazakh Test Site, 1990-1992

AFGL, Effects of a Descending Lithospheric Slab on Yield Estimates of Underground Nuclear Tests, 1990-1992

#### **Recent PhD Students**

Kuang He, PHYS, PhD, 2011

Januka Attanayake, GSCI, PhD, 2012

Michele Fitzpatrick, GSCI, PhD, 2015

Christopher Sanborn, PHYS, PhD, 2017

Susini de Silva, PHYS, PhD, 2017

Tian Yiteng, PHYS, PhD, 2018

Ravi Wickramathilake, PHYS