

Christopher Small

Lamont-Doherty Earth Observatory
Columbia University
Palisades, NY 10964
(845) 365-8354 small@LDEO.Columbia.edu
<http://www.LDEO.columbia.edu/~small>

Education

Scripps Institution of Oceanography, University of California San Diego
Ph.D. Earth Sciences/Geophysics, August 1993. Advisor: D. Sandwell
University of Texas at Austin
MA Geological Sciences, August 1989, Advisor: C. Wilson.
University of Wisconsin - Madison
BS Geophysics and Geology, December 1985, Advisor: C. Clay.

Experience

Lamont Doherty Earth Observatory of Columbia University, Palisades New York
Lamont Postdoctoral Fellow, 9/93-9/95; Associate Research Scientist, 9/95-4/99;
PGI/Doherty Res. Sci., 4/99-11/03; Doherty Senior Research Scientist. 11/07-2010;
Lamont Research Professor, 2010 – Present.
Columbia University, Dept. of Earth & Environmental Sciences, NYC
Adjunct Professor. Introductory & Advanced Remote Sensing, 1996 - Present
Columbia Earth Institute/CIESIN, Columbia University, NYC
NASA-SEDAC, Project Scientist, Remote Sensing Applications, 1998-Present
Scripps Institution of Oceanography, University of California San Diego, La Jolla, California
Grad. Res. Asst., Satellite Remote Sensing & Geophysics 9/89 - 5/90, 9/90 - 8/93
Exxon Production Research Co., Houston, Texas
Research Geophysicist. Satellite Remote Sensing Group 5/89 - 9/89, 5/90 - 9/90
University of Texas Institute for Geophysics, Austin, Texas
Grad. Res. Asst., Satellite Remote Sensing & Geophysics, 6/88 - 5/89.
University of Texas Dept. Geological Sciences, Austin, Texas
Grad. Teaching. Asst., Introductory Geology Laboratory, 9/87 - 6/88.
University of Maryland, Horn Point Laboratories, Cambridge, Maryland
Faculty Res. Asst., Physical Oceanography. 6/86 - 9/87.

Awards

ASPRS Leica Geosystems Award, Best Paper 3rd, 2005, w/ F. Pozzi.
Palisades Geophysical Institute - Doherty Foundation Young Scientist Position, 1998
UCAR Climate and Global Change Research Fellowship, 1997
Lamont-Doherty Post Doctoral Research Fellowship, 1993
Outstanding Student Paper, American Geophysical Union, Geodesy, 1993

Expeditions and Field Experience

Ethiopian Highland Agriculture Monitoring – Oxfam Harita Project. Subsistence agriculture monitoring for index insurance validation w/ D. Osgood & M. Victor, 2-3/2009.

Alashan Desert WinDust Project, Mapping dust storm source regions in the Gobi Desert, China w/ A. Taramelli, Q. Sun and W. Tao, 10/2005.

Ganges-Brahmaputra Delta Char Dynamics study, 2005/06, Field spectroscopy & geologic mapping of fluvial morphology in Bangladesh w/ S. Goodbred, N. Seeber, M. Steckler,

Hebrides Trench Hot Subduction Expedition, *R/V Southern Surveyor*, 10/2004, Sonar survey & geochemical sampling of incipient triple junction in North Fiji Basin w/ L. Danyusevsky.

Andean Highland Land Cover Mapping, 7/2007, 7/2004 & 8/2001, Peru, Field validation of Landsat 7, Aster & Ikonos overpasses in Sacred Valley, Sierra Vilcanota and Cuzco in collaboration w/ T. D'Altroy, A. Seimon, & K. Yager.

Biosphere 2 Rainforest Drought Remote Sensing Experiment. 9/2002, Hyperspectral imaging of rainforest canopy reflectance in collaboration w/ Uwe Rascher & Caroline Nichol.

Belize River Riparian Habitat Monitoring, 5/2001, Belize, Field validation of Landsat 7 overpass in collaboration w/ Wildlife Trust & Belize Riverkeeper.

Volcan Baru Land Cover Mapping Project, 1/2001, Chiriqui Panama, Field validation of Landsat 7 overpass in collaboration w/ Karen Holmberg.

Galapagos Volcano Deformation Project, 12/99-1/00, GPS campaign on Sierra Negra & Fernandina volcanoes w/ D.Geist, W. Chadwick, T. Naumann, D. Johnson.

Westward Expedition, Legs 9-10, *R/V Melville*, 12/94 - 3/95, Geophysical - geochemical survey of Southeast Indian Ridge (40° - 55° S) w/ J.Cochran, D.Christie & J.C.Sempere.

Ewing Expedition, Leg 9309, *R/V Maurice Ewing*, 11/93 - 12/93, Geophysical - geochemical survey of the Southern Mid-Atlantic Ridge (35° - 53° S) with J.G. Schilling.

Gloria Expedition, Leg 3, *R/V Melville*, 1/93 - 2/93, Geophysical survey of crossgrain lineations in South/Central Pacific (15° - 21°S) w/ D. Sandwell & E.L. Winterer.

Phoenix Expedition, Leg 3, *R/V Melville*, 8/92 - 9/92, P.I. on geophysical survey of Pacific-Rivera Rise (22°-23°N), and participated in geophysical surveys with P. Lonsdale.

Chief Geophysicist on first NOAA multi-disciplinary expedition to the Antarctic Peninsula *R/V Surveyor*, 1/89-2/89. Multibeam sonar surveys in Bransfield Strait & Scotia Sea.

MECCAS Expedition, Leg 2, *R/V Cape Henlopen*, 6/85 - 7/85, Physical Oceanographic study of the Chesapeake Bay plume dynamics on the Mid Atlantic Bight.

Geologic field mapping of tertiary volcanics in Baja California Norte w/ Joann Stock. 3/91.

Invited Talks

Is New York City Greening?, *PlaNYC Million Trees Research Symp.*, NYC, 3/2010.

What Satellites Can, and Cannot, Detect From Space, Sustainable Development Symposium, *Columbia University*, NYC, 6/2009.

High Resolution Urban Hazard Mapping, *The World Bank*, Washington DC, 1/2010

Land Cover Change Impacts in the Urban Environment – *NASA Land Cover Land Use Change Science Team Meeting*, Washington, DC, 4/2009

Cities from Space: What Remote Sensing Can, and Cannot, Detect. Woodrow Wilson School of Public & International Affairs, *Princeton University*, 4/2008.

Night on Earth: Mapping Human Settlements with Night Lights, Urban Design Studio, Graduate School of Architecture, Preservation and Planning, *Columbia University*, 3/2008..

Reflectance Properties of Urban Areas, *Joint Research Centre of the European Commission*, Ispra, Italy, 5/2007.

Optical and Biophysical Properties of the Earth and their Impact on Land Surface

Processes, Dept. of Meteorology, *Pennsylvania State University*, 4/2007.

Human Settlement Patterns and Urban Remote Sensing, Penn Institute for Urban Research, *The Wharton School of the University of Pennsylvania*, 3/2007.

Remote Sensing of Urban Growth, Urban Design Studio, *The Cooper Union for the Advancement of Science and Art*, NYC, 8/2006.

Spectral Mapping of Earth Surface Properties and Dynamics, *Oman Geological Society*, Muscat, Oman, 4/2006

Night on Earth: Mapping Global Urban Extent with Night Lights, *Sultan Qaboos University*, Muscat, Oman, 4/2006.

Speculations on the Future of Urban Remote Sensing, Keynote at Urban 2006, *European Applied Remote Sensing Laboratories*, Berlin, Germany 3/2006.

Applications of Spectral Mixture Analysis to Landscape Ecology, *ISPRS Conference on Remote Sensing in Landscape Ecology*, Kaiserslautern, Germany, 2/2006.

Night on Earth: Mapping Urban Night Lights, *University of Perugia*, Italy, 1/2006.

Remote Sensing Change Detection, United Nations Workshop on Landscape Epidemiology, *CONAE Headquarters*, Cordoba Argentina, 9/2005.

Multiscale Remote Sensing of the Urban Environment, *Rutgers University Center for Remote Sensing and Spatial Analysis*, 4/2005.

Human Settlement Patterns and Urban Remote Sensing, *School of Architecture and Urban Planning*, Columbia University, 11/2003.

Continental Physiography, Climate and the Global Distribution of Human Population, *Nicholas School of the Environment*, Duke University, 1/2003

Geophysical Consequences of Spreading Center Migration, *European Geophysical Society Annual Meeting*, Nice, France, 4/2002.

Satellite Detection of Human Settlements and Urban Growth, *The World Bank*, Washinton, DC, 2/2002.

High Resolution Spectral Mixture Analysis, *NASA-USGS-NIMA High Resolution Imagery Workshop*, USGS Headquarters, Reston VA, 3/2002.

Spatial and Spectral Resolution of Remotely Sensed Imagery, Keynote at *AAAS Arctic Science Conference*, Anchorage, AK, 9/2001 (conference cancelled 9/12/01).

Using Remote Sensing to Understand the Urban Environment. (with R.B. Miller), *New York Academy of Science*, 4/2001.

Scaling Properties of Urban Radiance, *NASA-NIMA-USGS High Spatial Resolution Imagery Workshop*, NASA GSFC, Greenbelt, MD, 3/2001

Spectral Detection of Human Settlements from Optical Remote Sensing, *NASA Jet Propulsion Laboratory*, Pasadena, CA, 2/2001.

Geophysical Consequences of Spreading Center Migration, *Woods Hole Oceanographic Institution*, 10/2000.

Geophysical Applications of Spectral Mixture Analysis of Landsat Imagery, *Woods Hole Oceanographic Institution*, 10/2000.

What on Earth can Satellites See?, *Center for Environmental Research and Conservation*, Columbia University, 9/2000.

Synergistic Activities and Community Service

- Editorial Board, *Remote Sensing of Environment*, 1/2010- present.
- Associate Editor, *Canadian Journal of Remote Sensing*, 1/2007-present.
- European Applied Remote Sensing Laboratories Urban 2006 Conference – Keynote address and Scientific Steering Committee, Berlin, Germany, 3/2006.
- United Nations Task Force on Telemedicine & Landscape Epidemiology - Inaugural meeting in Cordoba, Argentina, 9/2005.
- Lamont Doherty Earth Observatory Executive Committee, 2005 – 2010.
- Columbia University Senate, 2003-2009.
- Senate Researchers' Committee, Columbia University Senate, 2003-2009.
- Housing Policy Committee (chair), Columbia University Senate, 2005-2009.
- University External Relations Committee, Columbia University Senate, 2004-2009.
- Libraries & Computing Committee, Columbia University Senate, 2004-2005.
- Tsunami Impact Emergency Mapping Consultant, World Bank Hazard Management Unit , January 2005.
- Expert Review – IPCC Fourth Assessment., Ch. 6, Coastal Zones, 2005.
- Expert Review – EPA Analysis of Dust Extent from the WTC collapse, 2005.
- Urban 2005 Conference Technical Evaluation Committee, Univ. Arizona, 2005.
- Invited Mentor - START/Packard Urbanization Institute. Advised Dr. Danai Thaitakoo, Chulalongkorn University, Bangkok, Thailand.
- WNYC Community Advisory Board, 2004 – 2006.
- Federal Emergency Management Agency, NYC Emergency Operations Center, Remote sensing consultant. Lidar change analysis of WTC collapse site, 9/2001.
- N.Y. Academy of Sciences/NYC Student Research Competition Judge, 2002-2004.
- Invited Panelist, NASA Conference on Coastal Hazards, Antalya Turkey, 2003
- Session chair, Third International Symposium on Remote Sensing of Urban Areas, Istanbul, Turkey, 6/2002.
- Expert Witness for Holland Knight LLP in case of United Nations v. Indian Ocean Company, Remote sensing image interpretation and expert testimony, 11/2000.
- Joint Oceanographic Institutions, Scientific Steering and Evaluation Panel (Interior), Ocean Drilling Program, 1999 - 2001.
- Lamont Doherty Web Advisory Committee (chair), 2001-2003.
- Lamont Doherty Remote Sensing Search Committee (co-chair), 2002.
- Promotions and Careers Subcommittee of the Lamont Doherty Executive Committee, 1999 - 2002.
- Observatory Planning Subcommittee of the Lamont Doherty Executive Committee, 1999-Present.
- Established and co-teach Columbia accredited courses DEES 4050 and DEES 4051 w/ J. Weissel one semester per year, 1996 - Present.
- Established LDEO/CEI Remote Sensing Visualization Laboratory w/ J. Weissel, 1998

Collaboration

Research Advisees N. Boelman (LDEO), D. Chapel (Smith), S. Difiore (CERC), J. Hermann (Colorado), C. Ho (Barnard), N. Horsch (Johns Hopkins), K.Konda (Barnard), J. Kohen (Barnard), K. Ludwig (Stanford), C.Martinez (Middlebury), D. Simons (Brown), J. Stephen (Leeds), K.Yager (Yale) C. Rumbaitis del Rio (Columbia).

Doctoral Advisor: D.T. Sandwell (SIO) *Post-Doctoral Advisor:* J.R. Cochran (LDEO)

Collaborators: J. Cohen (Rockefeller), R.B. Miller (CIESIN), P. Kinney (CU/SPH), U. Rascher (B2C); C. Elvidge (NGDC), C. Nichol (Edinburgh); R. Nicholls (Middlesex); S. Ngheim (NASA JPL); S. Findley (CU/SPH), L. Danyushevsky (Tasmania), T. Naumann (Alaska), F. Pozzi (CIESIN), V. Gornitz (NASA/GISS), B.Cairns (NASA/GISS), C. Rosenzweig (NASA/GISS), W. Solecki (Hunter), D. Abbott (LDEO), R. Bell (LDEO); S.Chillrud (LDEO); D.Kent (LDEO/Rutgers), C. Scholz (LDEO), W.H.F.Smith (NOAA), Y.Chen (OSU), J-C Sempere (Exxon), P. Lonsdale (SIO), R. Parker (SIO); D.Sandwell (SIO), J.G.Schilling (URI),

Educational Instruction

Developed course curriculum and taught DEES W4050 *Global Monitoring and Assessment with Remote Sensing* with J. Weissel, Introduction to optical and microwave remote sensing and image analysis and applications. 1996 - present.

Developed course curriculum and taught DEES W4051 *Advanced Topics in Remote Sensing and Image Analysis* with J. Weissel. Focus on dissertation level research applications of remote sensing tools and spatial analysis. 1999 - present.

Taught short course on Image Processing and Spatial Analysis, Columbia University Remote Sensing Image Analysis Laboratory, June 1999.

Taught Remote Sensing section of CERC Biodiversity and Conservation continuing education curriculum with Eleanor Sterling 6/98.

Taught *Seafloor Mapping with Ships and Satellites* for *Earth2Class* Secondary School Teachers Workshop w/ Michael Passow, Jan. 1998 - Present.

Internet Presence

Designed and maintain:

<http://www.ldeo.columbia.edu/rsvlab/> - Remote Sensing & Image Analysis
<http://www.ldeo.columbia.edu/~small/GDEM.html> - Global Topography Data
<http://www.ldeo.columbia.edu/~small/Urban.html> - Urban Remote Sensing
<http://www.ldeo.columbia.edu/~small/NYCveg.html> - New York from Space

Publications

Refereed Journals and Books

- Small, C., C. Elvidge, D. Balk, M. Montgomery, Spatial Scaling of Stable Night Lights, *Remote Sensing of Environment*, In Press.
- Small, C, Projecting the Urban Future: Contributions From Remote Sensing, Invited book chapter in *Projecting the Urban Future: New Methods and Data for Developing Countries*, Edited by D. Balk, To be published by IUSSP, In Press.
- Small, C., The Human Habitat: Physical Environment and the Global Distribution of Human Population, Invited Book Chapter for *Demographic Ecogeography*, Springer Verlag, In Press.
- Buck, W.R., C. Small and W.B.F. Ryan, Constraints on asthenospheric flow from the deepest spreading centers, *G-cubed*, v.10, n.9, 2009.
- Small, C, M. Steckler, N. Seeber, H. Akhter, S. Goodbred, B. Mia, B. Imam, Spectroscopy of Sediments in the Ganges-Brahmaputra Delta: Spectral Effects of Moisture, Grain Size and Lithology, *Remote Sensing of Environment*, 113, p.342-361, 2009.
- Small, C. The Color of Cities: An Overview of Urban Spectral Diversity, Invited chapter in *Global Mapping of Human Settlements*, M. Herold & P. Gamba (eds), Taylor & Francis, 2009.
- S.V. Nghiem, D. Balk, E. Rodriguez, G. Neumann, A. Sorichetta, C. Small, C.D. Elvidge, Observations of urban and suburban environments with global satellite scatterometer data, *ISPRS Journal of Photogrammetry & Remote Sensing*, v.64, p.367-380.
- Elvidge, C.D., Safran, J., Tuttle, B., Sutton, P., Cinzano, P., Pettit, D., Arveson, J., Small, C., Potential for global mapping of development via a NightSat mission. *GeoJournal*, v. 69, p. 45-53, 2007.
- Elvidge, C.D., Cinzano, P., Pettit, D.R., Arveson, J., Sutton, P., Small, C., Nemani, R., Longcore, T., Rich, C., Safran, J., Weeks, J., Ebener, S., 2007, The Nightsat mission concept, *International Journal of Remote Sensing*, 28, 12, 2645-2670, 2007.
- Rascher, U, C. Nichol, C. Small and L. Hendricks, Monitoring Spatio-temporal Dynamics of Photosynthesis with a Portable Hyperspectral Imaging System , *Photogrammetric Engineering and Remote Sensing*, v.73, n.1, p. 45-56, 2007.
- Small, C. Comparative Analysis of Urban Reflectance and Surface Temperature, Invited submission , *Remote Sensing of Environment*, v.104, p.168-189, 2006.
- Small, C. High Spatial Resolution Urban Vegetation Mapping and Analysis, Invited book chapter in: *Applied Remote Sensing for Urban Planning, Governance and Sustainability* , Springer-Verlag, Berlin - Heidelberg: Springer Press, p.24-39, 2007..
- Small, C., Urban Remote Sensing: Global Comparisons, Invited Chapter for Special Issue of *Architectural Design - AD 178: Sensing the 21st Century City - Close-Up and Remote*, Editors: Brian McGrath & Grahame Shane, November 2005
- Small, C. and J. Lu, Estimation and Vicarious Validation of Urban Vegetation Abundance by Spectral Mixture Analysis, *Remote Sensing of Environment*, v.100, p.441-456, 2006.

- DeFries, R., G. Asner, F. Achard, C. Justice, N. Laporte, K. Price, C. Small and J. Townshend, Monitoring tropical deforestation for emerging carbon markets, Chapter 3 in *Tropical Deforestation and Climate Change*, P. Moutinho & S. Schwartzman (eds), IPAM/Environmental Defense, Belem, Para Brazil, Wash. D.C., 2005.
- Small, C., F. Pozzi and C. Elvidge, Spatial Analysis of Global Urban Extent from DMSP-OLS Night Lights, *Remote Sensing of Environment*, v.96, p.277-291, 2005.
- Small, C., Global Analysis of Urban Reflectance, *International Journal of Remote Sensing*, v.26, n.4, p.661-681, 2005.
- Kwarteng, A. and C. Small, Remote Sensing of Urban Environmental Conditions, Invited chapter in: *Remote Sensing of Urban and Suburban Areas*, In Press - to be published by Kluwer, in 2006
- Pozzi, F. and C. Small, Land cover and population density in urban and suburban areas in the U.S.A., *Photogrammetric Engineering & Remote Sensing*, v.71, p.719-726, 2005
- Small, C., The Landsat ETM+ Spectral Mixing Space, *Remote Sensing of Environment*, v.93, p.1-17, 2004.
- Carbotte, S, C. Small and K. Donnelly, Spreading Center Migration and Magmatic Segmentation at Mid-ocean Ridges, *Nature*, v.429, p.743-745, 2004.
- Small, C. and J. Cohen, Continental Physiography, Climate and the Global Distribution of Human Population, Invited submission, *Current Anthropology*, v.45, p.269-277, 2004.
- Small, C., Global Population Distribution and Urban Land Use in Geophysical Parameter Space, *Earth Interactions*, v.8, p.1-18, 2004.
- Knowlton, K., C. Rosenzweig, R. Goldberg, B. Lynn, S. Gaffin, C. Hogrefe, K. Civerolo, J.Y. Ku, W. Solecki, C. Small, C. Oliveri, J. Cox, J. Rosenthal, and P.L. Kinney, Evaluating global climate change impacts on local health across a diverse urban region, *Epidemiology*, 15 (4), S100-S100, 2004.
- Landrigan, P.J., P.J. Liroy, G. Thurston, G. Berkowitz, L.C. Chen, S.N. Chillrud, S.H. Gavett, P.G. Georgopoulos, A.S. Geyh, S. Levin, F. Perera, S.M. Rappaport, C. Small, and N.W.T.C.W. Grp, Health and environmental consequences of the world trade center disaster, *Environmental Health Perspectives*, 112 (6), 731-739, 2004.
- van Geen, A., Y. Zheng, R. Versteeg, M. Stute, A. Horneman, R. Dhar, M. Steckler, A. Gelman, C. Small, H. Ahsan, J.H. Graziano, I. Hussain, and K.M. Ahmed, Spatial variability of arsenic in 6000 tube wells in a 25 km² area of Bangladesh, *Water Resources Research*, 39 (5), -, 2003.
- Small, C. and R. Nicholls, A Global Analysis of Human Settlement of Coastal Zones, *Journal of Coastal Research*, v. 19, n. 3, p. 584-599, Summer 2003.
- Small, C., High Resolution Spectral Mixture Analysis of Urban Reflectance, Invited submission to *Remote Sensing of Environment*, v. 88, p.170-186, 2003.
- Small, C. and L. Danyushevsky, Geophysical Consequences of Spreading Center Migration, *Geology*, v. 31, n. 5, p. 399-402, 2003.
- Miller, R.B. and C. Small, Cities from Space: Applications of remote sensing in urban environmental research and policy, *Environmental Science and Policy*, v.6, n. 2, p. 129-137, 2003.
- van Geen, A., H. Ahsan, A.H. Horneman, R.K. Dhar, Y. Zheng, I. Hussain, K.M. Ahmed, A. Gelman, M. Stute, H.J. Simpson, S. Wallace, C. Small, F. Parvez, V. Slavkovich, N.J. Lolocono, M. Becker, Z. Cheng, H. Momotaj, M. Shahnewaz, A.A.

- Seddique, and J.H. Graziano, Promotion of well-switching to mitigate the current arsenic crisis in Bangladesh, *Bulletin of the World Health Organization*, 80 (9), 732-737, 2002.
- Small, C., Multitemporal analysis of urban reflectance, *Remote Sensing of Environment*, v.81, p.427-442, 2002
- Small, C. and T. Naumann, Holocene Volcanism and the Global Distribution of Human Population, *Environmental Hazards*, v.3, p.93-109, 2001.
- Small, C., Estimation of Urban Vegetation Abundance by Spectral Mixture Analysis, *International Journal of Remote Sensing*, v.21, n.7, 2001.
- Small, C., V.Gornitz and J. Cohen, Coastal Hazards and the Global Distribution of Human Population, *Environmental Geosciences*, v.7(1),p.3-12, 2000.
- Bell, R., C. Small and R. Arko, Development of a new generation gravity map of Antarctica, *Annali di Geofisica*, v.42, n.2, p.261-264, 1999.
- Small, C., J. Cochran, J.C. Sempere and D. Christie, The Structure and Segmentation of the Southeast Indian Ridge, *Marine Geology*, 1999.
- Cohen, J. and C. Small, Hypsographic Demography: The Distribution of Human Population by Altitude, *Proceedings National Academy of Sciences.*, 1998.
- Small, C., Global Systematics of Mid-Ocean Ridge Morphology, *American Geophysical Union Monograph: Faulting and Magmatism at Mid-Ocean Ridges*, 1998
- Small, C. and D. Abbott, Subduction Obstruction and the Crack Up of the Pacific Plate, *Geology*, Sept. 1998
- Scholz, C. and C. Small, The Effect of Seamount Subduction on Seismic Coupling *Geology*, 25, p.487-489, 1997.
- Sempéré, J.-C., J. R. Cochran, and SEIR Scientific Team, The Southeast Indian Ridge between 88°E and 118°E: Variations in crustal accretion at constant spreading rate, *J. Geophysical Research*, 102, 1997.
- Cochran, J. R., J.-C. Sempéré and SEIR Scientific Team, The Southeast Indian Ridge between 88°E and 118°E: Gravity anomalies and crustal accretion at intermediate spreading rates, *J. Geophysical Research*, 102, 1997.
- Small, C. Observations of Ridge-Hotspot Interaction in the Southern Ocean, *J. Geophysical Research*, 100, p.17931-46, 1995.
- Douglass, J., J.G. Schilling, R. Kingsley and C. Small, Influence of Discovery & Shona mantle plumes on Mid-Atlantic Ridge, *Geoph. Res Lett* ,v22, 1995.
- Small, C. and D.T. Sandwell, Imaging mid-ocean ridge transitions with satellite gravity, *Geology*, 22, 123-126, 1994
- Small, C., A quantitative analysis of global mid-ocean ridge axial topography. *Geophysical Journal International*, 116, 64-84, 1994.
- Small, C. and D.T. Sandwell, Comparison of satellite and shipboard gravity measurements in the Gulf of Mexico, *Geophysics* , 57, p.885-893, 1992.
- Small, C. and D.T. Sandwell, An analysis of ridge axis gravity roughness and spreading rate, *J. Geophys. Res.*, 97, p.3235-3246, 1992.
- Small, C., and D. T. Sandwell, An abrupt change in ridge axis gravity with spreading rate, *J. Geophys. Res.*, 94, 17383-17392, 1989.

Manuscripts In Review and Preparation

- Small, C., A detection threshold model for multi-scale, multi-temporal spectral mixture analysis, In Revision for *Remote Sensing of Environment*.
- Small, C., D. Balk, R. Defries, C. Elvidge, M. Montgomery, Scaling Properties of Anthropogenic Land Use, Internal Review, Anticipated submission to *Proceedings of the National Academy of Sciences*.
- Tan, K., C. Small, X. Xing, C. Elvidge, Multitemporal analysis of urban growth and development in China, Internal Review, Anticipated submission to *Photogrammetric Engineering and Remote Sensing*.
- Small, C. J. Lu, J. Braden, G. Russell, Is New York City Greening?, In Prep.

Selected Non-Refereed Publications (1999 - 2002)

- Pozzi, F., C. Small and G. Yetman, Modeling the distribution of human population with night-time satellite imagery and gridded population of the world, *Proceedings of the ASPRS Pecora Land Remote Sensing Conference*, Denver CO, 2002.
- Small, C., Global analysis of urban reflectance, *Proceedings of the Third International Symposium on Remote Sensing of Urban Areas*, Istanbul, Turkey, 2002.
- Pozzi, F. and C. Small, Vegetation and population density in urban and suburban areas in the U.S.A., *Proceedings of the Third International Symposium on Remote Sensing of Urban Areas*, Istanbul, Turkey, 2002.
- Small, C., Multiresolution analysis of urban reflectance, *IEEE/ISPRS Conference on Remote Sensing of Urban Areas*, Rome, Italy, 2001.
- Pozzi, F and C. Small, Analysis of suburban landcover & population density in the USA, *IEEE/ISPRS Conference on Remote Sensing of Urban Areas*, Rome, Italy, 2001.
- Small, C. Global analysis of urban population distributions and the physical environment, *Proceedings of the 2001 Open Meeting of the Human Dimensions of Global Environmental Change Research Community*, Rio de Janeiro, Brazil, 2001.
- Small, C. Spectral dimensionality of urban radiance, *Proceedings of 10th JPL Airborne Earth Science Workshop*, NASA Jet Propulsion Laboratory, Pasadena, CA, 2001.
- Passow, M.J, J.Ortiz, D.Witter, C. Small and 7 others, Earth2Class: What research scientists can share with classroom teachers, 10th Symposium on Education, American Meteorological Society, Boston, MA, 2001.
- Small, C. and R.B. Miller, Spatiotemporal Monitoring of Urban Vegetation, *Proceedings of the International Symposium on Remote Sensing of Environment*, Capetown South Africa, 3/2000.
- Small, C. and J.E. Cohen, Continental Physiography, Climate and the Global Distribution of Human Population, *Proceedings of the International Symposium on Digital Earth*, Beijing China, p.965-971, 1999

- Small, C. and R.B. Miller, Digital Cities II: Monitoring the Urban Environment from Space, Proceedings of the *International Symposium on Digital Earth*, Beijing China, p.671-677, 1999.
- Miller, R.B. and C. Small, Digital Cities I: Information Needs and Future Prospects, Proceedings of the *International Symposium on Digital Earth*, Beijing China, 1999.

Selected Abstracts and Published Presentations (1998 - 2004)

- Small, C, F. Pozzi, D. Balk and G. Yetman, Global Analysis of Human Settlement Patterns from Night Lights, Presented at the *2003 Open Meeting of the Human Dimensions of Global Environmental Change Research Community*, Montreal, Canada, 16-18 October 2003.
- Small, C., F. Pozzi, A Global Analysis of Human Settlement in Coastal Zones, presented at *Studying Land Use Effects in Coastal Zones with Remote Sensing and GIS*, 13-16 August, Kemer/Antalya, Turkey
- Small, C., Spectral properties of pervious and impervious surfaces, *Proceedings of the ASPRS Pecora Land Remote Sensing Conference*, Denver CO, 2002.
- Small, C., Characteristics of urban reflectance, *Proceedings of the ASPRS Pecora Land Remote Sensing Conference*, Denver CO, 2002.
- Small, C. Global multihazard analysis, *European Geophysical Society*, Nice, France, 2002
- Small, C. and L. Danyushevsky, Geophysical consequences of spreading center migration, *European Geophysical Society*, Nice, France, 2002
- High Resolution Spectral Mixture Analysis, Presentation for *NASA-USGS-NIMA High Resolution Imagery Workshop*, USGS Headquarters, Reston VA, 3/2002.
- Spatial and Spectral Resolution of Remotely Sensed Imagery, Keynote at *AAAS Arctic Science Conference*, Anchorage, AK, 9/2001 (conference cancelled 9/12/01).
- Scaling Properties of Urban Radiance, Presentation for *NASA-NIMA-USGS High Spatial Resolution Imagery Workshop*, NASA GSFC, Greenbelt, MD, 3/2001
- Small, C. and T. Naumann, The Global Distribution of Human Populations and Recent Volcanism, Colima Volcano Sixth International Meeting, Universidad de Colima, 1998.
- Naumann, T. and C. Small, Spatial Distribution of People and Volcanoes in Tropical Climates, Colima Volcano Sixth International Meeting, Universidad de Colima, 1998.

Other Publications

- R. Nicholls and C. Small, Improved estimates of coastal population and exposure to hazards released, *Eos*, v.83, n.28, p.301-305, 2002.
- J. Cohen, C. Small, A. Mellinger, J. Gallup and J. Sachs, Estimates of coastal populations, letter to *Science*, v.278, p.1211, 1997

- C. Small and J. Cohen, How Many People Can The Beach Support?, *Earth Matters*, Columbia Earth Institute, 1998
- C. Small and D.T. Sandwell, Sights Unseen, *Natural History*, March 1996
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