

## **ROBERT LEBEN**

Research Professor  
Colorado Center for Astrodynamics Research  
University of Colorado, Boulder

### **EDUCATION**

Ph.D., Aerospace Engineering Sciences	1986	University of Colorado, Boulder
M.S., Aerospace Engineering Sciences	1982	University of Colorado, Boulder
B.S., Aerospace Engineering Sciences	1981	University of Colorado, Boulder

### **PROFESSIONAL EXPERIENCE**

Research Professor, Univ. of Colorado, Boulder, July 2006 to present.  
Research Associate Professor, Univ. of Colorado, Boulder, July 1994 to June 2006.  
Research Assistant Professor, Univ. of Colorado, Boulder, January 1989 to July 1994.  
Research Associate, Univ. of Colorado, Boulder, August 1986 to January 1989.

Dr. Robert R. Leben is a Research Professor in the Department of Aerospace Engineering Sciences at the University of Colorado Boulder and a member of the Colorado Center for Astrodynamics Research (CCAR). His primary area of expertise is satellite altimetry and its application to ocean circulation and climate monitoring. He has published over 60 peer-reviewed publications in this area. He is currently a P.I. on the Jason-2/OSTM altimeter mission and also is a member of the NASA Sea Level Change Team. He was a Co-P.I. on the TOPEX/POSEIDON and Jason-1 missions. He has made significant contributions to oceanographic research in the Gulf of Mexico as a P.I or Co-P.I. on nine Gulf research programs and has consulted on the development and skill assessment of ocean nowcast and forecast systems for the offshore oil and gas industry working in the Gulf of Mexico and off the southeast Brazil coast.

### **SPECIAL ACTIVITIES AND AWARDS**

Dr. Leben a member of the American Geophysical Union and the American Meteorological Society. Among the awards he has received are: the NASA Certificate of Appreciation, TOPEX/POSEIDON Project, 1995, the NASA Group Achievement Award, TOPEX/POSEIDON Verification Team, 1994, NASA Group Achievement Award, TOPEX/POSEIDON Mission Design Team, 1993, The Yalov B. Zeldovich Award, 1992, and an ASEE Summer Faculty Fellowship, 1990.

### **SELECTED PUBLICATIONS AND REPORTS**

Donohue, K. A., D.R. Watts, P. Hamilton, R. Leben, M. Kennelly, and A. Lugo-Fernandez (2016): Gulf of Mexico Loop Current path variability, Dynamics of Atmospheres and Oceans, Special Issue on the Loop Current Dynamics Experiment, Vol. 76, Part 2, pp. 174-194.  
Donohue, K. A., D.R. Watts, P. Hamilton, R. Leben, and M. Kennelly (2016): Loop Current eddy formation and baroclinic instability, Dynamics of Atmospheres and Oceans, Special Issue on the Loop Current Dynamics Experiment, Vol. 76, Part

- 2, pp. 195-216.
- Hall, C. A., and R. R. Leben (2016): Observational evidence of seasonality in the timing of Loop Current eddy separation, *Dynamics of Atmospheres and Oceans, Special Issue on the Loop Current Dynamics Experiment*, Vol. 76, Part 2, pp. 240-267.
- Lugo-Fernandez, A., R. R. Leben, and C. A. Hall (2016): Kinematic metrics of the Loop Current in the Gulf of Mexico from satellite altimetry, *Dynamics of Atmospheres and Oceans, Special Issue on the Loop Current Dynamics Experiment*, Vol. 76, Part 2, pp. 268-282.
- Hamlington, B. D., R. R. Leben, K.-Y. Kim, R. S. Nerem, L. P. Atkinson, and P. R. Thompson (2016): The effect of the El Niño-Southern Oscillation on U.S. regional and coastal sea level, *J. Geophys. Res. Oceans*, 121(7), pp. 5084-5097.
- Hamilton, P., K. Speer, R. Snyder, N. Wienders, and R. R. Leben (2015): Shelf break exchange events near the De Soto Canyon, *Continental Shelf Research*, Vol. 110, pp. 25-38.
- Dukhovskoy, D. S., R. R. Leben, E. P. Chassignet, C.A. Hall, S. L. Morey, R. Nedbor-Gross (2015): Characterization of the uncertainty of Loop Current metrics using a multidecadal numerical simulation and altimeter observations, *Deep Sea Research Part I: Oceanographic Research Papers*, Volume 100, June 2015, Pages 140-158. doi:10.1016/j.dsr.2015.01.005
- Strassburg, M. W., Hamlington, B. D., Leben, R. R., Manurung, P., Lumban Gaol, J., Nababan, B., ... & Kim, K. Y. (2015): Sea level trends in Southeast Asian seas. *Climate of the Past*, 11(5), 743-750.
- Athié, G., Sheinbaum, J., Leben, R., Ochoa, J., Shannon, M. R. and Candela, J. (2015): Interannual variability in the Yucatan Channel flow. *Geophys. Res. Lett.*, 42: 1496–1503. doi: 10.1002/2014GL062674.
- Lumban-Gaol, J., Leben, R. R., Vignudelli, S., Mahapatra, K., Okada, Y., Nababan, B., ... and Syahdan, M. (2015): Variability of satellite-derived sea surface height anomaly, and its relationship with Bigeye tuna (*Thunnus obesus*) catch in the Eastern Indian Ocean. *European Journal of Remote Sensing*, 48, 465-477.
- Hamilton, P., K. Donohue, C. Hall, R. R. Leben, H. Quian, J. Sheinbaum, and D. R. Watts. Observations and dynamics of the Loop Current. OCS Study BOEM 2015-006, U. S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA, 2015. 417.
- Walker, N. D., R. R. Leben, C. T. Pilley, M. Shannon, D. C. Herndon, I.-F. Pun, I.-I. Lin, and C. L. Gentemann (2014), Slow translation speed causes rapid collapse of northeast Pacific Hurricane Kenneth over cold core eddy, *Geophys. Res. Lett.*, 41, 7595–7601, doi:10.1002/2014GL061584.
- Han W, Meehl GA, Hu A, Alexander MA, Yamagata T, Yuan D, Ishii M, Pegion P, Zheng J, B. D. Hamlington, X.-W. Quan, and R. R. Leben, Intensification of decadal and multi-decadal sea level variability in the western tropical Pacific during recent decades. *CLIMATE DYNAMICS* 43(5-6):1357-1379 Sep 2014.
- Strassburg, M. W., B. D. Hamlington, R. R. Leben, and K.-Y. Kim (2014), A comparative study of sea level reconstruction techniques using 20 years of satellite altimetry data, *J. Geophys. Res. Oceans*, 119, 4068–4082.
- Hamlington, B.D., M.W. Strassburg, R.R. Leben, W. Han, R.S. Nerem, K.-Y. Kim (2014): “Uncovering an Anthropogenic Sea Level Rise Signal in the Pacific Ocean”, *Nature Climate Change*, 4, 782-785.
- Hamlington, B. D., Leben, R. R., Strassburg, M. W. and Kim, K.-Y. (2014):

- Cyclostationary empirical orthogonal function sea-level reconstruction. *Geoscience Data Journal*, 1: 13–19.
- Hamlington, B. D., R. R. Leben, M. W. Strassburg, R. S. Nerem, K.-Y. Kim, 2013: Contribution of the Pacific Decadal Oscillation to Global Mean Sea Level Trends, *Geophys. Res. Lett.*, 40, 50950.
- Haosheng Huang, Nan D. Walker, Ya Hsueh, Yi Chao, and Robert R. Leben, 2013: An Analysis of Loop Current Frontal Eddies in a  $\frac{1}{6}^\circ$  Atlantic Ocean Model Simulation. *J. Phys. Oceanogr.*, 43, 1924–1939.
- Hamlington, B. D., R. R. Leben, and K.-Y. Kim, 2012, Improving sea level reconstructions using non-sea level measurements, *J. Geophys. Res.*, 117, C10025, doi:10.1029/2012JC008277.
- Hamlington, B. D., R. R. Leben, L. A. Wright, L. A., and K.-Y. Kim, 2012: Regional Sea Level Reconstruction in the Pacific Ocean, *Marine Geodesy*, 35(S1):98-117, doi:10.1080/01490419.2012.718210.
- Hamlington, B. D., R. R. Leben, O. A. Godin, E. Gica, V. V. Titov, B. J. Haines, and S. D. Desai, 2012: Could satellite altimetry have improved early detection and warning of the 2011 Tohoku tsunami?, *Geophys. Res. Lett.*, 39, L15605, doi:10.1029/2012GL052386.
- Leben, R. R., B. D. Hamlington, and B. J. Haines, 2011: SEASAT and GEOSAT revisited: using sea level measurements to improve satellite altimeter orbits, *The Journal of the Astronautical Sciences*, Vol. 58, pp. 479-493.
- Walker N. D., C. T. Pilley, V. V. Raghunathan, E. J. D'Sa, R. R. Leben, N. G. Hoffmann, P. J. Brickley, P. D. Coholan, N. Sharma, H. C. Graber, R. E. Turner, 2011: Loop Current Cyclonic Eddy Merger Impacts 2010 Gulf of Mexico Oil Spill, In *Monitoring and Modeling the Deepwater Horizon Oil Spill: A Record Breaking Enterprise*, Y. Liu, A. MacFadyen, Z.-G. Ji, and R. H. Weisberg, Editors, AGU Geophysical Monograph 195, pp. 103–116, doi:10.1029/2011GM001120.
- Hamilton, P., K. A. Donohue, R. R. Leben, A. Lugo-Fernández, and R. E. Green, 2011: Loop Current Observations during Spring and Summer of 2010: Description and Historical Perspective, In *Monitoring and Modeling the Deepwater Horizon Oil Spill: A Record Breaking Enterprise*, Y. Liu, A. MacFadyen, Z.-G. Ji, and R. H. Weisberg, Editors, AGU Geophysical Monograph 195, pp. 117–130, doi: 10.1029/2011GM001116.
- Hamlington, B. D., R. R. Leben, R. S. Nerem, K.-Y. Kim, W. Han, 2011: Reconstructing sea level using cyclostationary empirical orthogonal functions, *J. Geophys. Res.*, Vol. 116, C12015, 17 pp., 2011, doi:1029/2011JC007529.
- Hamlington, Benjamin D., Oleg A. Godin, Vladimir G. Irisov and Robert R. Leben, 2011. Detection of Tsunamis from Changes in Ocean Surface Roughness, *The Tsunami Threat - Research and Technology*, Nils-Axel Mörner (Ed.), ISBN: 978-953-307-552-5, InTech, <http://www.intechopen.com/articles/show/title/detection-of-tsunamis-from-changes-in-ocean-surface-roughness>.
- Hamlington, B. D., Leben, R. R., Godin, O. A., Legeais, J. F., Gica, E., and Titov, V. V., 2011: Detection of the 2010 Chilean tsunami using satellite altimetry, *Nat. Hazards Earth Syst. Sci.*, 11, 2391-2406, doi:10.5194/nhess-11-2391-2011.
- Hamlington, B. D., R. R. Leben, R. S. Nerem, K.-Y. Kim, 2011: The effect of signal-to-noise ratio on the study of sea level trends, *J. Climate*, Vol. 24, 1396–1407.

- Emery, W. J., T. Strub, R. Leben, M. Foreman, J. C. McWilliams, G. Han, C. Ladd, and H. Ueno, 2011: "Satellite Altimetry Applications off the Coasts of North America", in Coastal Altimetry edited by S. Vignudelli, A. Kostianoy, P. Cipollini, and J. Benveniste, pp. 417-451, doi:10.1007/978-3-642-12796-0\_16.
- Cox, J., C. Coomes, S. DiMarco, K. Donohue, G. Z. Forristall, P. Hamilton, R. R. Leben, and D. R. Watts. 2010. Study of Deepwater Currents in the Eastern Gulf of Mexico. U. S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEMRE 2010-0431. 473 pp.
- Lugo-Fernández, Alexis, Robert R. Leben, 2010: "On the linear relationship between Loop Current retreat latitude and eddy separation period," *J. Phys. Oceanogr.*, 40, 2778–2784.
- Sturges, W., N. G. Hoffmann, R. R. Leben, 2010, A trigger mechanism for Loop Current ring separations, *J. Phys. Oceanog.*, Vol. 40, No. 5, 900-913.
- Forristall, G.Z., R.R. Leben, C.A. Hall, 2010: "A Statistical Hindcast and Forecast Model for the Loop Current", Offshore Technology Conference, 3-6 May 2010, Houston, Texas, USA, Paper OTC-20602-MS, 12 pp., DOI:10.4043/20602-MS.
- Godin, O.A , V. G. Irisov, R. R. Leben, B. D. Hamlington, and G. A. Wick, Variations in sea surface roughness induced by the 2004 Sumatra-Andaman tsunami, *Nat. Hazards Earth Syst. Sci.*, 9, 1135-1147, 2009.
- Powell, B. S., A. M. Moore, H. G. Arango, R. F. Milliff, and R. R. Leben, 2009, Real-Time Assimilation and Prediction in the Intra-Americas Sea with the Regional Ocean Modeling System (ROMS). *Dyn. Atmos. Oceans*, Vol. 48, No. 1-3, 48-46.
- Donohue, K., P. Hamilton, R. Leben, D. R. Watts and E. Waddell, 2008, Study of Deepwater Currents in the Northwestern Gulf of Mexico. Volume II: Technical Report, U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study 2008-031, 364 pp.
- Wilczak, J. M., R. R. Leben, and D. S. McCollum, 2007. Upper-ocean thermal structure and heat content off of the U. S. west coast during the 1997-1998 El Niño event based on AXBT and satellite altimetry data, *Progress in Oceanography*, Vol. 74, pp. 48-70.
- Walker, N. D., A. Haag, S. Balasubramanian, R. Leben, I. V. Heerden, P. Kemp, H. Mashriqui, Hurricane Prediction: A Century of Advances, *Oceanography*, 19, 24-36, 2006.
- Willet, C. S., R. R. Leben, and M. F. Lavín, 2006, Eddies and tropical instability waves in the eastern tropical Pacific: A review, *Progress in Oceanography*, Vol. 69: (2-4), 218-238, 2006.
- Donohue, K., P. Hamilton, K. Leaman, R. Leben, M. Prater, D.R.Watts and E. Waddell, 2006, Exploratory Study of Deepwater Currents in the Gulf of Mexico. Volume II: Technical Report, U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2006-074, 430 pp.
- Powell, B. S., R. R. Leben, and N. L. Guinasso, Jr., 2006, Comparison of buoy and altimeter-derived shelf currents using an optimal operator, *IEEE Geoscience and Remote Sensing Letters*, Vol. 3. No. 2. April 2006.
- Leben, R. R. and D. J. Honaker, What do we know and what can we predict about the timing of Loop Current eddy separation? *ESA SP-614, Proceedings of the*

- Symposium on 15 years of progress in radar altimetry*, Venice (Italy), 13-16 March 2006.
- Leben, R. R., 2005, Altimeter-derived Loop Current Metrics. In *Circulation in the Gulf of Mexico: Observations and Models*, W. Sturges and A. Lugo-Fernandez, Editors, AGU Geophysical Monograph 161, p. 181-202.
- Biggs, D. C., A. E. Jochens, M. K. Howard, S. F. DiMarco, K. D. Mullin, R. R. Leben, F. E. Muller-Karger, and C. Hu, 2005: Eddy Forced Variations in On- and Off-Margin Summertime Circulation Along the 1000-m Isobath of the Northern Gulf of Mexico, 200-2003, and the Links With Sperm Whale Distributions Along the Middle Slope. . In *Circulation in the Gulf of Mexico: Observations and Models*, W. Sturges and A. Lugo-Fernandez, Editors, AGU Geophysical Monograph 161, p. 71-86.
- Glorioso, P. D., A. R. Piola, and R. R. Leben, 2005, Mesoscale eddies in the subantarctic Front – Southwest Atlantic, *Scientia Marina*, 69 (Suppl. 2): 7-15, 2005.
- Leben, R. R. and K. Corcoran, 2005, HYCOM and Ocean FOCUS™ numerical ocean model nowcast and forecast skill assessment in the Gulf of Mexico, November 7, 2005, 31 pages, with four CDROM appendices.
- Walker, N. D., R. R. Leben, and S. Balasubramanian, 2005, Hurricane-forced upwelling and chlorophyll a enhancement within cold-core cyclones in the Gulf of Mexico, *Geophys. Res. Lett.*, Vol. 32, L18610, doi:10.1029/2005GL023716.
- Leben, R. R. and K. Corcoran, 2005, Horizon Marine Inc. numerical ocean model nowcast and forecast skill assessment in the Gulf of Mexico, Consulting Report submitted to Horizon Marine, Inc. September 1, 2005, 36 pages, with six CDROM appendices.
- Smith, S. R., G. A. Jacobs, R. R. Leben, 2005, Determining the applicability of the barotropic approximate to the mean seasonal flow through the Tushima/Korean Strait using variational assimilation, *Deep-Sea Research Part II- Topical Studies in Oceanography*, 52(11-13), 1763-1783.
- Leben, R. R. and G. H. Born, 2005, Near real-time satellite altimeter products: Pacific Ocean tools and applications, in *Recent Advances in Marine Science and Technology, 2004*, N. K. Saxena, Editor, Pacon International, Honolulu, HI, 2005, pp. 45-53.
- Stone, G.W., N. D. Walker, S. A. Hsu, A. Babin, B. Lui, B. D. Keim, W. Teague, D. Mitchell, and R. Leben, 2005, *EOS, Transactions*, American Geophysical Union. 86:497,500-501, No. 48, 29 November 2005.
- Powell, B. S. and R. R. Leben, 2004, An optimal filter for geostrophic mesoscale currents from along-track satellite altimetry, *J. Atmos. Ocean. Tech.*, 21:1633–1642.
- Leben R. R., and B. S. Powell. 2003. Accuracy assessment of Jason-1 and TOPEX/POSEIDON along-track sea surface slope. *Marine Geodesy*, 26(3–4):355-366.
- Fu, L.-L. D. Stammer, R. R. Leben and D. B. Chelton, 2003, Improved spatial resolution of ocean surface topography from the T/P –Jason-1 altimeter mission, *EOS, Transactions*, American Geophysical Union. 84:241,247–249, No. 2, 1 July 2003.
- Wolanski, E., R. H. Richmond, G. Davis, E. Deleersnijder, and R. R. Leben, 2003, Eddies around Guam, an island in the Mariana Island group, *Continental Shelf Research*, 23:991–1003.

- Candela, J., J. Sheinbaum, J. Ochoa, A. Bedan and R. Leben, 2002, The potential vorticity flux through the Yucatan Channel and the Loop Current in the Gulf of Mexico, *Geophys. Res. Lett.*, **29**, 16-1 to 16-4.
- Leben R. R., G. H. Born and B. R. Engebret, 2002, Operational altimeter data processing for mesoscale monitoring, *Marine Geodesy*, **25**:3–18.
- Weller, R. A., Fischer A. S., Rudnick D. L., Ericksen C. C., Dickey, T. D., Marra J., Fox, C. and R. Leben, 2002, Moored observations of upper-ocean response to monsoons in the Arabian Sea during 1994-1995, *Deep-Sea Research Part II-Topical Studies in Oceanography*, **49**(12):2195-2230.
- Fischer A. S., Weller R. A., Rudnick D. L., Ericksen C. C., Lee C. M., Brink, K. H., Fox, C. A. and R. R. Leben, 2002, Mesoscale eddies, costal upwelling, and the upper-ocean heat budget in the Arabian Sea, *Deep-Sea Research Part II-Topical Studies in Oceanography*, **49**(12):2231-2264.
- Harlan, J. A., S. E. Swearer, R. R. Leben and C. A. Fox, 2002, Surface circulation in a Caribbean island wake, *Continental Shelf Research*, **22**(3):417-434
- Davis, R. W., J. G. Ortega-Ortiz, C. A. Ribic, W. E. Evans, D. C. Biggs, P. H. Ressler, R. B. Cady, R. R. Leben, K. D. Mullin and B. Wursig. 2002, Cetacean habitat in the northern oceanic Gulf of Mexico, *Deep-Sea Research Part I- Oceanographic Research Papers*, **49**(1):121-142.
- Ohlmann, J. C., P. P. Niiler, C. A. Fox, and R. R. Leben, 2001, Eddy energy and shelf interactions in the Gulf of Mexico, *J. Geophys. Res.*, **106**, 2605– 2520.
- Biggs, D. C., R. R. Leben and J. G. Ortega-Ortiz, 2000, Ship and satellite studies of mesoscale circulation and sperm whale habitats in the northeast Gulf of Mexico during GulfCet II, *Gulf of Mexico Science*, **2000**(1), 15–22
- Sturges, W, and R. Leben, 2001, Frequency of ring separations from the Loop Current in the Gulf of Mexico: A revised estimate", *J. Phys. Oceanog.*, **30**, 1814–1819, 2000.
- Hamilton, P., T. J. Berger, J. J. Singer, E. Waddell, J. H. Churchill, R. R. Leben, T. N. Lee, and W. Sturges, 2000. DeSoto Canyon Eddy Intrusion Study, Final Report, Volume II: Technical Report. OCS Study MMS 2000-80. U.S. Dept of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. 275 pp.
- Webster, P., J. Loschnigg, A. Moore and R. Leben, 1999: Coupled ocean–atmosphere dynamics in the Indian Ocean during 1997–98, *Nature*, **401**, 356–360, doi:10.1038/43848.
- Hetland, R., Y. Hsueh, P. Niiler, and R. Leben, 1999, A Loop Current-induced jet along the edge of the West Florida Shelf, *Geophys. Res. Lett.*, **26**, 2239–2242.
- Georges, T, J. Harlan, T. Lee and R. Leben, 1998, Observations of the Florida Current with two over-the-horizon radars', *Radio Science*, **33** (4), 1227–1239.
- Lillibridge, J., F. Vossepoel and R. Leben, 1997, Real-time altimetry from ERS-2,' *Proceedings 3rd ERS Symposium*, Florence, Italy, March 11–14, .
- Biggs, D.C., G.S. Fargion, P. Hamilton, and R.R. Leben, 1996. Cleavage of a Gulf of Mexico Loop Current eddy by a deep water cyclone, *J. Geophys. Res.*, **101**, 20,629–642.
- Hendricks, J. R, G. H. Born, C. Koblinsky and R. R. Leben, 1996, EOF analysis of global TOPEX/POSEIDON data and implications for detection of global sea level rise, *J. Geophys. Res.*, **101**, 14,131–14,146.

Leben R. and G. H. Born, 1993, Tracking Loop Current eddies with satellite altimetry, *Advances in Space Research*, **13(11)**, 325–333.