

Curriculum Vitae-abridged

W. TIMOTHY LIU

EDUCATION

University of Washington, Seattle, Washington

PH. D. in Atmospheric Sciences, March 1978

M.S. in Atmospheric Sciences, June 1974

Ohio University, Athens, Ohio

B.S., Summa Cum Laude, in Physics, June 1971

EMPLOYMENT

1979-present Jet Propulsion Laboratory

Principal investigator since 1979. Study ocean-atmosphere interaction and satellite oceanography.

Team Leader of Air-sea Interaction and Climate Team 1989-2005. Supervise a team of meteorologists and oceanographers, and lead their science investigations.

Project Scientist of a series of NASA Scatterometer Missions-NSCAT, QuikSCAT and SeaWinds, 1992-2006. Coordinate and monitor science and validation studies of the science team. Monitor sensor and data system development to meet science requirements.

NASA Ocean Vector Wind Science Team Leader. 2006-2008. Lead the investigators of the NASA selected team

Senior Research Scientist (also Principal Scientist) since 1993. The position is equivalent to a full professor at major universities.

1971-1979 University of Washington.

Research Associate, 1978-1979. Modeling planetary boundary layer and study turbulence flux measurements from aircraft.

Research Assistant, 1971-1978. Studying the transfer processes across the air-sea interface and in the atmospheric boundary layer leading to M.S. and Ph.D. degrees.

Teaching Assistant Assisting teaching of an introductory course in meteorology and a field experiment course in air-sea transfer processes.

PROFESSIONAL SERVICES

ISPRS Commission VII, Chairman of Work Group on Ocean 2008-2012

JAXA GCOM-W Science Team 2008-present

ISRO Oceansa-2 Science Team 2008-present

ESA-EUMETSAT TASCAT Science Advisory Group 2006-present

US Atlantic Meridional Overturning Current Science Team 2008-present

Pan-Oceanic Remote Sensing Conference Association, Treasurer, 2006 to present

United Kingdom Natural Environment Research Council-Earth Observation Centres of

Excellence Steering Committee 2003-2008

NASA Global Water and Energy Research Initiative Working Group 2001

Tropical Rain Measuring Mission Science Working Team, 1998-present.

Salinity Sea Ice Science Working Group, 1998-present.

JASON Science Working Team 1997-present.

EOS Distributed Active Archive Center Users Working Group 1994-present.

Interagency Science Working Group on Passive Microwave Vector Wind Sensing, 1995-1997.

South China Sea Monsoon Experiment Science Working Group 1994-1996.

Joint Science Committee Task Force on Air-Sea Fluxes, 1993-1997. Coordinate and promote international studies of air-sea fluxes.

Editorial Board, The Atmosphere-Ocean System, 1993-1998.

Environmental Task Force, 1992. Invited member of the Clouds, Radiation, Water Vapor, and Precipitation Panel. To compile for the intelligence community the data need of the environmental scientists.

NASA TOGA-COARE Science Advisory Committee, 1991-1994. Advise NASA on participation in the experiment.

NASA ESTAR (Electronically Scanned Thinned Array Radiometer) **Science Working Group**, 1990-1995.

Tropical Rain Measuring Mission Science Team 1991-1993

NASA Earth Science & Application Advisory Committee 1990-1993. Advise the NASA Division on program and policy.

WCRP Surface Radiation Budget Science Working Group, 1989-1996.-Plan and implement the production of surface radiative exchange.

Earth Observing System Investigator Working Group, 1989-present. Formulate science requirements and lead science research for the project. Member of Payload, Oceanography, Hydrology and Climate Panels.

NASA TOPEX NSCAT Archiving Working Group, 1989. Advise NASA on archiving and distributing data for NSCAT and TOPEX Projects.

International WOCE Working Group on In Situ Measurement for Surface Fluxes, 1989-1990. Recommend the best method for measuring air-sea fluxes.

TOGA COARE Science Working Group, 1989-1992. Refine the objectives, to design the experimental approach, and to define an implementation methodology for the TOGA/COARE. Chairman of Air-Sea Fluxes Subgroup.

NASA Wetnet, 1988-1995. Design and implement an interactive science network centered on SSMI data.

Interagency Sea Surface Temperature Archiving Science Working Group, 1988-89. Assess the quality and availability of sea surface temperature data.

WOCE Advisory Group for Model-based Air-sea Flux Estimates, 1988-1995. Advise WOCE on air-sea fluxes estimates using numerical models.

TOPEX/POSEIDON Science Working Team 1987-1997. Formulate science requirements and to conduct research for the joint U.S/French ocean altimetric mission. Member of the Science Steering Group.

JSC/CCCO Working Group on Air-Sea Fluxes, 1987-93. Promote the optimal use of oceanographic satellite data for the determination of air-sea interface quantities. Appointed by the Joint Science Committee and the Committee on Climate Changes and the Ocean (CCCO).

NSCAT Science Working Team 1986-present. Conduct science research and to formulate requirements for the NASA Scatterometer Project (NSCAT). Chairman of the Subcommittee on Data Level and Contents.

WOCE/TOGA Working Group on Data Management 1985-1988. Develop a data management system for WOCE and TOGA.

WOCE Working Group on Atmosphere-ocean Exchanges, 1984-1988. Assess present capabilities of describing atmosphere-ocean exchanges of physical properties.

NASA Ocean Energy Fluxes Science Working Group 1984. Assess geophysical retrieval algorithms of DMSP/SSMI (Special Sensor Microwave Imager) and Geosat/altimeter and to review the scientific problems that can be addressed using their geophysical parameters.

Guest Lecturer: (1) NATO Advanced Study Institute at Corsica France, 1983. (2) California Space Institute Summer School on Climate Remote Sensing 1987, (3) University of Southern California-graduate course in tropical oceanography, 1990 and 1992. (4) NASA Summer School on Earth Sciences, 1992.

HONORS AND AWARDS

Fellow of American Association for the Advancement of Science 2007-
Space Systems Award, American Institute of Aeronautics and Astronautics, 2006
Science Advisor, Hong Kong Observatory, 2003-present
Distinguished Science Award, Pan Oceanic Remote Sensing Assoc., 2002
NASA Group Achievement Award 2001-Satellite Ocean Atlas.
Fellow of American Meteorological Society, 2000
NASA Group Achievement Award, 2000 – Quikscat Mission Team
NASA Group Achievement Award, 1998 - NSCAT Science Team
NASA Exceptional Achievement Medal, 1998 - Leadership in NSCAT Sci.. Research
NASA Group Achievement Award 1997 - NSCAT Management and Outreach
Visiting Professorship at Ocean University Tsingtao, 1996
NASA Group Achievement Award 1994 - Topex Verification
NASA Group Achievement Award 1993 - Topex Mission Design
NASA Certificates of Recognition 1993 - Hydrologic Balance and Greenhouse Warming
NASA Certificates of Recognition 1991 - Remote Sensing of Turbulent Flux
NASA Medal for Exceptional Scientific Achievement, 1990-Air-sea Interaction
NATO Fellowship to Advanced Study Institute on Air-Sea Interaction, 1978.
Sigma Xi 1975
Phi Beta Kappa 1971
Ohio University Trustee Scholarship 1967-1971
Dean's List 1969-1970
Sigma Pi Sigma 1970

SUMMARY OF PROFESSIONAL ACCOMPLISHMENTS

W. Timothy Liu's experience and expertise are in ocean-atmosphere interaction and application of spacebased observations.

While a student at the University of Washington, Timothy Liu conducted both laboratory and field experiments to study interfacial transport and turbulent transfer in the surface (constant flux) layer over the ocean. His postulation of the behavior of the moisture transfer coefficients, at low and high winds were unconventional at that time, and led later to the validation effort in the Humidity Exchange Over Sea (HEXOS) experiment and Tropical Ocean Global Atmosphere (TOGA)-Couple Ocean and Response Experiment (COARE) in the eighties and nineties. Its impact is still felt more than two decades later. His formulation of temperature profile and transport theory in the molecular sub-layer, which is based on gas transfer studies, are being used by the communities studying gas transfer and ocean skin layer today.

Timothy Liu developed the first credible method of using satellite data to estimate evaporation and latent heat flux in the early 1980s, and was one of the first scientists to use a combination of satellite sensors to study the global relation between surface thermal forcing and ocean temperature response. In the past two decade, a generation of scientists have been involved in the estimation of heat flux from space, based on his methodology. With a new generation of microwave radiometers and atmospheric sounders, he has just begun to lead a renewed effort again to retrieve evaporation directly from the radiance measured by spacebased microwave radiometer.

Since he joint JPL, he has been selected to the science teams of numerous space missions, including NSCAT, QuikSCAT, Topex/Poseidon, JASON, TRMM, EOS, Aqua, ERS-1, AMSR, and Aquarius. He has made many innovative science applications of various combinations of these spacebased measurements. His present interest includes relating the fluxes to storage and transport through the depths of the ocean and atmosphere. He is leading research effort to combine a variety of satellite data synergistically to study global climate and environmental changes. He has recently made important advances in studying the water balance over global ocean and their influence on terrestrial and cryospheric water cycles, using a combination of spacebased observations.

Through 17 years as Team Leader and 14 years as Project Scientist, Timothy Liu was able to lead various groups of scientists through many cycles of fiscal gyration and changes of national and institutional priority, securing their funding support, communicating and promoting their results to the science community and to the public, and keeping the team spirit and cohesiveness.

PUBLICATIONS

W. Timothy Liu has 266 publications (not including abstracts), of which 143 are refereed journal articles or reviewed book chapters (marked by *).

2008 9(143)

- *266 Liu, W.T., 2008: Sea surface wind/stress vector. Encyclopedia of Remote Sensing. Springer Press, Heidelberg, in press.
 - *264 Lin, I-I, C.-H. Chen, I.-F. Pun, W.T. Liu, and C.-C. Wu, 2008: Warm ocean anomaly, air sea fluxes and the rapid intensification of tropical cyclone Nargis (2008). *Geophys. Res. Lett.*, in press.
 - *263 Han, W., P.J. Webster, J.-L. Lin, W.T. Liu, R. Fu, D. Yuan, A. Hu, 2007: Dynamics of intraseasonal sea level and thermocline variability in the equatorial Atlantic during 2002-2003, *J. Phys. Oceanogr.*, **38**, 945-967.
 - *262 Wang, H., R. Fu, J.K. Schemm, W. Tang, and W.T. Liu, 2006: Prediction of South American low-level jet using QuikSCAT ocean surface wind. *Int. J. Remote Sens.*, **29**(21), 6117-6172.
 - *261 Liu, W.T., W. Tang, X. Xie, R. Navalgund, and K. Xu, 2007: Power density of ocean surface wind-stress from International scatterometer tandem missions. *Int. J. Remote Sens.*, **29**(21), 6109-6116.
 - 260 Liu, W.T., X. Xie, and W. Tang, 2007: Energy and water cycles observed by Advanced Scanning Microwave Radiometer. *Report to Japan Aerospace Exploration agency*, In press.
 - *259 Liu, W.T., W. Tang, X. Xie, 2008: Windpower distribution over global ocean. *Geophys. Res. Lett.*, **35**, L13808, DOI:10.1029/2008GL034172.
 - *258 Liu, W.T. and X. Xie, 2008: Ocean-atmosphere momentum coupling in the Kuroshio Extension observed from space. *J. Oceanogr.*, **64** (4), 631-637.
 - *257 Han, W., P.J. Webster, J.-L. Lin, W.T. Liu, R. Fu, D. Yuan, A. Hu, 2007: Dynamics of intraseasonal sea level and thermocline variability in the equatorial Atlantic during 2002-2003, *J. Phys. Oceanogr.*, **38**, 945-967.
 - *256 Yan, X., Y. Jo, L. Jiang, Z. Wan, W. T. Liu, Y. Li, J. Zhan, and T. Du (2008), Impact of the Three Gorges Dam water storage on the Yangtze River outflow into the East China Sea, *Geophys. Res. Lett.*, **35**, L05610, doi:10.1029/2007GL032908.
 - *255 Pu, Z., X. Li, C. Velden, S. Aberson, W. T. Liu, 2007: The impact of aircraft dropsonde and satellite wind data on numerical simulations of two landfalling tropical storms during tropical cloud systems and processes experiment. *Wea. Forecasting*, **23**, 62-79.
 - 254 Liu, W.T. and X. Xie, 2008: Latent heat flux and ocean-atmosphere water exchanges. *Flux News*, **5**, 19-21, CLIVAR International Project Office, Southampton, United Kingdom.
 - *253 Xie, X., W.T. Liu, and B. Tang, 2008: Spacebased estimation of moisture transport in marine atmosphere using support vector machine, *Remote Sens. Environment*, **112**, 1846-1855.
- ### 2007 5(134)
- *252 Liu, W.T., X. Xie, and P.P. Niiler, 2007: Ocean-atmosphere interaction over Agulhas Extension Meanders. *J. Climate*, **20**(23), 5784-5797.
 - 251 Liu, W.T., and X. Xie, 2007: QuikSCAT shows rough seas/atmospheric conditions at time of two Java Sea disasters. *The Earth Observer*, **19**(3), 4.

- 250 Liu, W.T., and X. Xie, 2007: Ocean-atmosphere coupling in the western Pacific and Asian marginal seas observed from space. *Pacific Asian Marginal Sea*. 46-49, Arata Kaneko (ed), Hiroshima Univ. Press.
- *249 Pun, I.-F., I-I Lin, C.-R. Wu, D.-S. Ko, and W.T. Liu, 2007: Validation and application of altimetry-derived upper ocean thermal structure in the western North Pacific Ocean for typhoon intensity forecast. *IEEE Trans. Geosci. Remote Sens.*, 45(6). 1616-1630.
- *248 Liu, W. T., and X. Xie, 2007: Winds over ocean. *Glimpses of a Changing World: Views of Planet Earth from Space*, M. D. King, C. L. Parkinson, K. C. Partington, and R. G. Williams, Eds., Cambridge University Press, 140-143.
- *247 Han, W., D. Yuan, W. T. Liu, and D. J. Halkides, 2007: Intraseasonal variability of Indian Ocean sea surface temperature during boreal winter: Madden-Julian Oscillation versus submonthly forcing and processes, *J. Geophys. Res.*, **112**, C04001, doi:10.1029/2006JC003791
- 2006 6(129)
- 246 Liu, W.T, and X. Xie, 2006: International scatterometer tandem missions and potential synergism. Pan Oceanic Remote Sensing Conference, Korean Society of Remote Sensing Press, Seoul.
- *245 Xie, S.-P., H. Xu, N.H. Saji, Y. Wang, and W.T. Liu, 2006: Role of narrow mountains in large-scale organization of Asian monsoon convection. *J. Climate*, **19**, 3420-3429.
- *244 Zheng, Q., R.J. Lai, N.E. Huang, J. Pan, Y. Yuan, and W.T. Liu, 2006: Observation of ocean current response to 1998 Hurricane Georges in the Gulf of Mexico. *Acta Oceanologica Sinica*, **25** (1), 1-14.
- *242 Han, W., W. T. Liu, and J. Lin, 2006: Impact of atmospheric submonthly oscillations on sea surface temperature of the tropical Indian Ocean. *Geophys. Res. Lett.*, **33**, L03609, doi:10.1029/2005GL025082.
- *241 Liu, W. T., X. Xie, W. Tang, and V. Zlotnicki, 2006: Spacebased observations of oceanic influence on the annual variation of South American water balance, *Geophys. Res. Lett.*, **33**, L08710, doi:10.1029/2006GL025683.
- *240 Liu, W.T., and X. Xie 2006: Measuring ocean surface wind from space. *Remote Sensing of the Marine Environment, Manual of Remote Sensing, Third Edition*, Vol. 6, , J. Gower (ed.), Amer. Soc. for Photogrammetry and Remote Sens. Chapter 5, 149-178.
- *239 Yan, X.-H., Y.-H. Jo, W.T. Liu, and M.-X. He, 2006: A new study of the Mediterranean outflow, air-sea interactions and Meddies using multi-sensor data. *J. Phys. Oceanogr.*, 36(4), 691-710..
- 2005 5(123)
- 238 Liu, W.T., X. Xie, and W. Tang, 2005: Monsoon, orography, and human influence on Asian rainfall. *Proc. First International Symposium on Cloud-prone and Rainy Areas Remote Sensing*. Hong Kong Chinese Univ. Press.
- *237 Sprintall, J. and W.T. Liu, 2005: Ekman mass and heat transport in the Indonesian Seas. *Oceanography*, **18**(4), 88-97,
- *236 Evans, D., W. Alpers, A. Cazenave, C. Elachi, T. Farr, D. Glackin, B. Holt, L. Jones, W.T. Liu, W. McCandless, Y. Menard, R. Moore, and E. Njoku, 2005: Seasat – a 25-year legacy of success. *Remote Sens. Envir*, **94**, 384-404.
- 235 Liu, W.T. and X. Xie, 2005: Potential scientific applications of SeaWinds and its follow-on. *Proc. of IGARSS 2005*. IEEE.
<http://216.228.1.34/Conf/igarss05/versions/47683/PID84283.pdf>

- 234 Liu, W.T., X. Xie, and W. Tang, 2005: Oceanic influence on global hydrologic cycle observed from space. *Proc.of IGARSS 2005*, IEEE.
<http://216.228.1.34/Conf/igarss05/versions/47683/PID84601.pdf>
- *233 Lee, T. and W.T. Liu, 2005: Effects of high-frequency wind sampling on simulated mixed layer depth and upper ocean temperature. *J. Geophys. Res.*, 110(C5), C05002, 10.1029/2004JC002746.
- 232 Ebuchi, N. and W.T. Liu (eds), 2005: Synergism of SeaWinds and AMSR. 33pp,
<http://airsea.jpl.nasa.gov/publication/paper/SeaWinds-AMSR-synergism-s.pdf>
- 231 Xie, X. and W.T. Liu, 2005: Hydrological budget in the Tropical Pacific. *16th Conf.on Climate Variability and Change*, Amer. Meteor. Soc., Boston
<http://ams.confex.com/ams/pdfpapers/85220.pdf>
- *230 Jo, Y.-H., X.-H. Yan, B. Dzwonkowski, and W.T. Liu, A study of freshwater discharge from the Amazon River into the tropical Atlantic using multi-sensor data. *Geophys. Res. Lett.*, 32. :02605, doi:10.1029/2004GL021840.
- *229 Liu, W.T. and W. Tang, 2005: Estimating moisture transport over ocean using spacebased observations from space. *J. Geophys. Res.* 110, D10101, doi:10.1029/2004JD005300.
- 2004-8(118)
- 228 Liu, W.T. and W. Tang, 2004: Oceanic Influence on the precipitation in India and China as observed by TRMM and QuikSCAT. Proc. TRMM Conf.
<http://airsea.jpl.nasa.gov/publication/paper/Liu-Tang-2004-trmm.pdf>
- *227 Liu, Q., X. Jiang, S.-P. Xie, and W.T. Liu, 2004: A gap in the Indo-Pacific warm pool over the South China Sea in boreal winter: seasonal development and interannual variability. *J. Geophys. Res.*, 109,C07012, doi:10/1029/2003JC002179.
- *226 Hashizume, H. and W. T. Liu, 2003: Systematic error of microwave scatterometer wind related to the basin scale plankton bloom. *Geophys. Res. Lett.*, 31, L06307, doi:10.1029/2003GTL01841.
- *225 Zhou, Y.H., X. H. Yan, X. L. Ding, X. H. Liao, D. W. Zheng, J. Y. Pan, M. Q. Fang, M. X. He, W. T. Liu, 2003: Excitation of non-atmospheric polar motion by the migration of the Pacific Warm Pool, *J. Geodesy*, 78,109-113
- *224 Yan, X.-H., J. Pan, M.-X. He, W.T. Liu, and Y.-H. Jo, 2003: The role of winds on estimation of the ocean heat storage anomaly using satellite data. *J. Geophys. Res.*, 109. doi:10.1029/2003JC002202.
- *223 Tang, W., W.T. Liu, and B.W. Stiles, 2003: Evaluation of high-resolution ocean surface vector winds measured by QuikSCAT scatterometer in coastal region. *IEEE Trans. Geoscience and Remote Sens.* 42, 1762-1769.
- *222 Pan, J. X-H Yan, Y.H. Jo, Q. Zheng, and W.T. Liu, 2003: A new method of estimation of the sensible heat flux under unstable conditions using satellite vector winds, *J. Phys. Oceanogr.*, 34,968-977.
- *221 Jo, Y.-H., X.-H. Yan, J. Pan and W.T. Liu, 2004: Sensible and Latent Heat Flux in the Tropical Pacific from Satellite Multi-Sensor Data. *Remote Sens. Environment*, **90**, 166-177.
- *220 Zheng, Q., P. Clemete-Colon, X.-H. Yan, W.T. Liu., N.E. Huang, 2004: Satellite synthetic aperture radar detection of Delaware Bay plumes: jet-like feature analysis. *J. Geophys. Res.*, **109(C3)** 10, 1029/2003JC002100.
- 219 Liu, W.T, W. Tang, X. Xie, 2004: Long-term variability of ocean surface winds. Proc. Decadal Climate Variability Workshop, Kona.
<http://airsea.jpl.nasa.gov/publication/paper/Liu-etal-2004-decadal.pdf>

- 218 Liu, W.T., S.-B. Kim, T. Lee, Y.T. Song, W. Tang, and R. Atlas, 2004: Scientific Impacts of Wind Direction Errors. JPL Publ. 04-008, Jet Propulsion Laboratory, Pasadena, 19 pp. <http://airsea.jpl.nasa.gov/publication/paper/Liu-etal-2004-winderror.pdf>
- 217 Lin, I-I, C.C. Wu, K.A. Emanuel, W.T. Liu, and I-H. Lee, 2004: The rapid intensification of super-typhoon Maemi (2003) when encountering a warm ocean eddy. *26th Conf. on Hurricanes and Tropical Meteorology*, Miami, Amer. Meteor. Soc., Boston.
- 216 Liu, W.T. and W. Tang, 2004: Calibration/validation of SeaWinds on ADEOS-2, in Sensors, Systems, and Next-Generation Satellites VII, edited by R. Meynart, S.P.Neeck, H. Shimoda, J.B. Lurie., M.L. Aten, Proc. Of SPIE, Vol. 5234, SPIE, Bellingha, WA, 47-52.
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- 215 Liu, W.T., 2003: Scientific Opportunity Provided by SeaWinds in Tandem. JPL Publications 03-12, Jet Propulsion Laboratory, Pasadena, 38 pp. <http://airsea.jpl.nasa.gov/publication/paper/Liu-etal-2003-tandem.pdf>
- *214 Yueh. S.H. *, B. Stiles, and W. T. Liu, 2003: QuikSCAT Geophysical Model Function and Winds for Tropical Cyclones. *IEEE Trans. Geophys. Remote Sens.*, 41, 2616-2628.
- *213 Chen, D., W. T. Liu, W. Tang, and Z. Wang, 2003: Air-sea interaction at an oceanic front: implications for frontogenesis and primary production. *Geophys. Res. Lett.*, 30(14), 1745, doi:10.1029/2003GL017536.
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- *211 Xie, S.-P., Q. Xie, D. Wang, and W.T. Llu, 2003: Summer upwelling in the South China Sea and its role in regional climate variations. *J. Geophys. Res.*, 108(C8), 3261, doi:10/1029, 2003JC001867.
- *210 Lin, I-I, W. Alpers, and W.T. Liu, 2003: First evidence for the detection of natural surface films by the scatterometer. *Geophys. Res. Lett.*, 30(13),1713, doi:10.1029/2003GL017415.
- *209 Hu, H., and W.T. Liu, 2003: Oceanic thermal and biological responses in Santa Ana Winds, *Geophys. Res. Lett.*, 30(11), 1596, doi:10.1029/2003GL017208.
- *208 Lin, I-I, W.T. Liu, C.-C. Wu, G. T.F. Wong, C.Hu, Z. Chen, W.-D. Liang, Y. Yang, and K.-K. Liu, 2003: New evidence for enhanced ocean primary production triggered by tropical cyclone. *Geophys. Res. Lett.*, 30(13), 1718, doi:10.1029/2003GL017141.
- *207 Bourras, D., and W. T. Liu, 2003: Regional correction of ocean surface specific humidity derived from satellite sensor data. *Remote Sens. Lett, , Internat. J. of Remote Sensing*, 24(15), 3163-3169.
- *206 Yu, L., R.A. Weller, and W.T. Liu, 2003: Case analysis of a role of ENSO in regulating westerly wind bursts in the Western Equatorial Pacific.*J. Geophys. Res.*, 108(c4), 3128, doi:10.1029/2002JC001498.
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- *203 Polito, P., and W.T. Liu, 2002: Global characterization of planetary waves at several spectral bands. *J. Geophys. Res.*, 108 (C1), 3018, doi:10.1029/2000JC000607..
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- 201 Lin, I-I, and W.T. Liu, 2003: Oceanic biological response to a typhoon. *Proc. 12th Conf Satellite Meteor. And Oceanogr.* Amer. Meteor. Soc., Boston,.
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- *197 Jo, Y. -H., X.-H. Yan, J. Pan, M.-X. He, and W.T. Liu, 2002: Calculation of the Bowen Ratio in the tropical Pacific using sea surface temperature data. *J. Geophys. Res.*, **107**(C9), 3134, doi:10.1029/2001JC001150,.
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- *195 Yan. X.-H.,Y. Zhou, J. Pan, D. Zheng, M. Fang, X. Liao, M. He³, W. T. Liu, X. Ding, 2002: Western Pacific warm pool excitation, Earth rotation and El Niño Southern Oscillations. *Geophys. Res. Lett.* 29(21). 2032, doi:10.1029/2002GL015685.
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- 188 Liu, W.T., 2002: Air-sea Interaction – New Results. Proc. PORSEC 02, Special Vol., 21-25.
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- *185 Veldon, C., K. Bruske, C. Kummerow, W.T. Liu, J. Simpson, S. Braun, and R. Anthes, 2002: The burgeoning role of weather satellites. *Coping with Hurricanes*. Chapter 11, 217-218, R. Simpson, M. Garstang, and R. Anthes (eds.), Amer. Geophys. Union.
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