

Dr. Terence L. Kubar

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EDUCATION

Ph.D. Atmospheric Sciences	University of Washington	2008
B.A. Meteorology (Minor: Applied Math)	San Jose State University	2003

RELEVANT EXPERIENCE

Dr. Kubar is an Assistant Research Scientist at JIFRESSE at UCLA, working remotely at Jet Propulsion Laboratory in the Aerosols and Clouds Group. His research interests include satellite remote sensing of clouds, precipitation, and convection using multi-sensor A-Train data, and he has published papers on the vertical structure of tropical clouds, radiative forcing of tropical high clouds, high-topped cloud and rain rate relationships, and controlling factors of deep convective and cirrus clouds. He was the PI of a selected three-year NASA ROSES project in 2014, titled “Radiative and Large-Scale Forcing of Tropical Clouds and Their Controls on High SST Environments Using Multi-Sensor Aqua and ECMWF-Reanalysis Datasets.”

Dr. Kubar also analyzes low cloud heights and PBL depths from MODIS and GPS-RO data, using joint distributions of cloud and PBL heights in different low cloud regimes to aid in novel evaluation of three versions of CAM5, including two versions with a new subgrid low cloud parameterization (CAM5-CLUBB). Low cloud parameterization to first order, and increased vertical resolution to second order, provide significant improvement in simulations of cloud height and PBL depth. Current work on this topic includes evaluating how model climate sensitivity may be related to low cloud top biases, the ratio of shallow cumulus to stratocumulus clouds, and PBL decoupling. The importance of properly simulating regional subsidence in low cloud regions also has been shown to coincide with improved joint cloud and PBL height distributions.

Some of Dr. Kubar’s latest research interests include characterizing SST and atmosphere interactions over tropical oceans, particularly high SST regions also referred to as SST hot spots, using Lotka-Volterra (LV) equations, which historically have been used to explain ecological predator-prey interactions. In the ocean-atmosphere system, however, the LV equations can describe the intrinsic lag of deep convection to very high SSTs; in this way deep convection, absent other feedbacks, is a stabilizing mechanism on SST hot spots on a variety of spatial and temporal scales, with forecasting skill using the predator-prey system of equations of deep convection ranging from subseasonal to seasonal variability of SST over the Eastern Warm Pool (160°E-180°; 0°-10°S), to synoptic-scale over the Caribbean and Gulf of Mexico. In the latter case study, the evolution of high SST days before the development of Tropical Storm Cindy in June 2017 served as a precursor to enhanced upward heat fluxes and deep convection, and in conjunction with high-resolution remote sensing of the ocean surface, SST through the LV system of equations may be considered more broadly for improvement of tropical cyclone forecasting.

PROFESSIONAL EXPERIENCE

2014 – present: Assistant Research Scientist III – JIFRESSE/UCLA; affiliated with the Aerosols and Clouds Group at Jet Propulsion Laboratory, Pasadena, CA

2011 – 2014: Research Scientist in Department of Atmospheric Science at Colorado State University (Affiliated with Climate Physics Group at Jet Propulsion Laboratory, Pasadena, CA)

2010 – 2011: Caltech Postdoctoral Research Scholar – Climate Physics Research Group
Earth Science Division – Jet Propulsion Laboratory, Pasadena, CA

2008 – 2010: Postdoctoral Research Associated/NASA Fellow – Climate Physics Research Group
Earth Science Division – Jet Propulsion Laboratory, Pasadena, CA

SPECIAL RECOGNITION

Dr. Kubar was a group member on the team awarded the Group Achievement NASA Award in September 2017 supporting the student group projects for JPL Center for Climate Sciences Summer School.

SELECTED PUBLICATIONS

- [1] **Kubar, T. L.**; Xie, F.; Ao, C. O.; Adhikari, L: An assessment of PBL heights and low cloud profiles in CAM5 and CAM5-CLUBB over the southeast Pacific using satellite observations. **2020**, *47*(2), <https://doi.org/10.1029/2019GL084498>.
- [2] **Kubar, T. L.**; Jiang, J. H., Net cloud thinning, low-level cloud diminishment, and Hadley circulation weakening of precipitating clouds with tropical West Pacific SST using MISR and other satellite and reanalysis data. *Remote Sens.*, **2019**, *11*(10), 1250; <https://doi.org/10.3390/rs11101250>.
- [3] **Kubar, T. L.**, G. L. Stephens, M. Lebsock, V. E. Larson, and P. A. Bogenschutz, 2015: Regional assessments of low clouds against large-scale stability in CAM5 and CAM-CLUBB using MODIS and ECMWF-Interim reanalysis data. *J. Climate*, **28**, 1685-1706.
- [4] **Kubar, T. L.**, and A. Behrangi, 2020: The coupling of convection, westerly winds and SST Hot Spots as characterized by satellite observations and reanalysis data, Part I: lagged relationships and the Predator-Prey Model. *Submitted to J. Climate in 02/19, under second revision*.
- [5] **Kubar, T. L.**, and A. Behrangi, 2020: The coupling of convection, atmospheric dynamics, and SST Hot Spots as characterized by satellite observations and reanalysis data, Part II: Horizontal structure, insights about the SPCZ, and cirrus-SST interactions. *Submitted to J. Climate in 02/19, under second revision*.
- [6] Terai, C. R., R. Wood, and **T. L. Kubar**, 2015: Satellite estimates of precipitation susceptibility in low-level marine stratiform clouds. *J. Geophys. Res.*, **120**, 8878-8889.
- [7] Li, J.-L.F., W.-L. Lee, T. Lee, E. Fetzer, J.-Y. Yu, **T. L. Kubar**, and C. Boening, 2015: The impacts of cloud snow radiative effects on Pacific Ocean surface heat fluxes, surface wind stress, and ocean temperatures in coupled GCM simulations. *J. Geophys. Res.*, **120**, 2242-2260.
- [8] Jiang, X., **T. L. Kubar**, S. Wong, W. S. Olson, and D. E. Waliser, 2014: Modulation of marine low clouds associated with the tropical intraseasonal variability over the eastern Pacific. *J. Climate*, **27**, 5560-5574.
- [9] **Kubar, T. L.**, D. E. Waliser, J.-L. Li, and X. Jiang, 2012: On the annual cycle, variability, and correlations of oceanic low-topped clouds with large-scale circulation using Aqua MODIS and ERA-Interim. *J. Climate*, **25**, 6152-6174.
- [10] Li, J.-L. F., D. E. Waliser, W.-T. Chen, B. Guan, **T. L. Kubar**, G. Stephens, H-Y Ma, D. Ming, L. Donner, C. Seman, and L. Horowitz, 2012: An observationally based evaluation of cloud ice water in CMIP3 and CMIP5 GCMs and contemporary reanalyses using contemporary satellite data., *J. Geophys. Res.*, **117**, D16105, doi:10.1029/2012JD017640.
- [11] Lee, J.-E., B. R. Lintner, J. D. Neelin, X. Jiang, P. Gentine, C. K. Boyce, J. B. Fisher, J. T. Perron, **T. L. Kubar**, J. Lee, and J. Worden, 2012: Reduction of tropical land region precipitation variability via transpiration. *Geophys. Res. Lett.*, **39**, L19704, doi: 10.1029/2012GL053417
- [12] **Kubar, T. L.**, D. E. Waliser, and J.-L. Li, 2011: Boundary layer and cloud structure controls on tropical low cloud cover using A-Train satellite data and ECMWF analyses. *J. Climate*, **24**, 194-215.
- [13] D. M. Winker, J. Pelon, J. A. Coakley Jr., S. A. Ackerman, R. J. Charlson, P. R. Colarco, P. Flamant, Q. Fu, R. M. Hoff, C. Kittaka, **T. L. Kubar**, H. Le Treut, M. P. McCormick, G. Mégie, L. Poole, K. Powell, C. Trepte, M. A. Vaughan, and B. A. Wielicki, 2010: The CALIPSO Mission: A Global 3D View of Aerosols and Clouds. *Bull. Amer. Met. Soc.*, **91**, 1211-1229.
- [14] **Kubar, T. L.**, D. L. Hartmann, and Wood, R., 2009: Understanding the Importance of Microphysics and macrophysics for Warm Rain in Marine Low Clouds - Part I. Satellite Observations. *J. Atmos. Sci.*, **66**, 2953-2972.
- [15] Wood, R., **T. L. Kubar**, and D. L. Hartmann, 2009: Understanding the importance of microphysics and macrophysics for warm rain in marine low clouds. Part II: Heuristic models of rain formation. *J. Atmos. Sci.*, **66**, 2973-2990.

- [16] Lopez, M. A., D. L. Hartmann, P. N. Blossey, R. Wood, C. S. Bretherton, and **T. L. Kubar**, 2009: A test of the simulation of tropical convective cloudiness by a cloud-resolving model. *J. Climate*, **22**, 2834-2849.
- [17] **Kubar, T. L.**, and D. L. Hartmann, 2008: Vertical structure of tropical oceanic convective clouds and its relation to precipitation. *Geophys. Res. Lett.*, **35**, L03804, doi: 10.1029/2007GL032811.
- [18] **Kubar, T. L.**, D. L. Hartmann, and R. Wood, 2007: Radiative and convective driving of tropical high clouds. *J. Climate*, **20**, 5510-5526.

Selected Presentations at Scientific Meetings/Research Institutes/Universities

- *Aerosols and Clouds Group Meeting, Jet Propulsion Laboratory (January 2020):* “From Amplifying to Stabilizing: Tropical Cloud-SST Interactions from a Counter-Iris Effect to the Predator-Prey Model”
- *MISR Science Team Meeting, Pasadena, CA (February 2019), Oral Presentation:* “Net Cloud Thinning and Hadley Circulation Weakening with Tropical West Pacific SST using MISR and other satellite and reanalysis data”
- *Aerosols and Clouds Group Meeting, Jet Propulsion Laboratory (January 2019):* “The Importance of the Redistribution of Local SSTs on Cloud Thinning, Transition to Cloud Top-Heaviness, and Hadley Circulation Weakening with Tropical West Pacific SST Using MISR, CERES, TRMM and Reanalysis Data”
- *JIFRESSE Open House, Los Angeles, CA (March 2017), Oral Presentation:* Large-Scale Interactions and Teleconnections with SST Hot Spots: Feedbacks and Relationships With and Without ENSO Using MODIS, ERA-Interim, CERES, and TRMM”
- *American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2016), Poster Presentation:* “Ocean-Atmosphere Coupling in SST Hot Spot Regimes and ENSO Relationships, Larger-Scale Interactions with El Niño and Hot Spots, and Remote Tropical and Extratropical Connections Using Multi-Satellite Observations and ERA-Interim Reanalysis.”
- *Aerosols and Cloud Group Meeting, Jet Propulsion Laboratory (October 2016), Short Seminar:* “A Short Introduction to the Iris Hypothesis From the Perspective of MODIS, TRMM, CERES, and ECMWF-Interim”
- *MODIS Science Team Meeting (June 2016), Poster Presentation:* “Deep Convection and SST Hot Spot Interrelationships as Characterized by Multi-Sensor Aqua, TRMM, and ECMWF-Reanalysis Datasets: Time Scale Controls, SPCZ Insights, and Large-Scale Climate Interactions.”
- *Aerosols and Cloud Group Meeting, Jet Propulsion Laboratory (February 2016), Oral Presentation:* “The Coupling of Convection, Large-Scale Atmospheric Dynamics, and Sea-Surface Temperature Hot Spots as Characterized by Satellite and Reanalysis Data”
- *American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2015), Poster Presentation:* “The Coupling of Convection, Large-Scale Atmospheric Dynamics, Surface Radiation, and Sea-Surface Temperature Hot Spots as Characterized by MODIS, TRMM, CERES, and ECMWF-Interim Reanalysis Data”
- *MODIS Science Team Meeting, Silver Spring, MD (May 2015), Poster and Oral Presentations:* “The Coupling of Convection, Large-Scale Atmospheric Dynamics, and Sea-Surface Temperature Hot Spots as Characterized by MODIS, TRMM, and ECMWF-Interim Reanalysis Data”
- *American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2014), Poster Presentation:* “Synoptic to Subseasonal Vertical Correlations with MBL Cloud Top Heights over the Southeastern Pacific and Cloud Top Height/Vertical Velocity Relationships in a Baroclinic Atmosphere Using Satellite and Re-Analysis Data”
- *American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2013), Oral Presentation:* “Regional Assessments of Low Clouds Against Large-Scale Forcing in CAM5 and CAM-CLUBB using MODIS and ECMWF-Interim Reanalysis Data”
- *Boundary Layer Cloud Group Meeting, JPL (February 2013):* “CAM-CLUBB Results and PDF Comparisons with Satellite Data in the Southeast Pacific Cross Section along 20°S”
- *Climate Process Team Annual Meeting, NCAR at Boulder, CO (February 14-February 15, 2013), Oral Presentation:* “CAMCLUBB Results and PDF Comparisons with Satellite Data in the Southeast Pacific Cross Section along 20°S”
- *American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2012),*

Oral Presentation: “Synoptic Scale Variability of Low Cloud Fraction/Depth and Large-Scale Dynamics over the Southeastern Pacific 20°S Cross Section Using MODIS and ERA-Reanalysis Data”

• *Climate Process Team Annual Meeting, NCAR at Boulder, CO (January 31-February 1, 2012), Oral Presentation:* “Satellite and Reanalysis Data Insights of VOCA and the Larger Southeastern Pacific Domain”.

• *American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2011), Oral Presentation:* “On the Annual Cycle, Variability, and Correlations of Oceanic Low-Topped Clouds With Large-Scale Circulation using MODIS and ERA-Interim.”

• *World Climate Research Programme Open Science Conference (October 2011), Poster Presentation:* “On the Annual Cycle, Variability, and Correlations of Oceanic Low-Topped Clouds and the Large-Scale Circulation Using Aqua MODIS and ECMWF-Interim.”

• *Talk at JPL Climate Physics Group Meeting (August 2011):* “On the Annual Cycle, Variability, and Correlations of Oceanic Low-Topped Clouds With Large-Scale Circulation Using Aqua MODIS and ECMWF-Interim.”

• *Gordon Research Conference on Radiation and Climate, Colby College, Waterville, ME (July 2011), Poster Presentation:* “On the Annual Cycle, Variability, and Correlations of Oceanic Low-Topped Clouds and the Large-Scale Circulation Using AQUA MODIS and ECMWF-Interim.”

• *American Meteorological Society Annual Meeting, Seattle, WA (January 2011), Oral Presentation:* “Low Cloud and SST Annual Cycle, Variability, and Dynamics Over the Tropical and Subtropical Oceans Using Aqua MODIS and ECMWF Analysis.”

• *American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2010), Poster Presentation:* “Low Cloud and SST Annual Cycle, Variability, and Microphysical Relationships in Primary Tropical and Subtropical Stratocumulus Regimes Using Aqua MODIS.”

• *Keck Institute for Space Studies, Innovative Satellite Observations to Characterize the Cloudy Boundary Layer, Pasadena, CA (September 2010), Poster Presentation:* “Controls on Tropical Low Cloud Cover Using A-Train Satellite Data and ECMWF Analyses”

• *Seminar at JPL Aerosol-Cloud Seminar Series, Pasadena, CA (September 2010):* “Controls on Tropical Low Cloud Cover and Cloud Heterogeneity Using A-Train Satellite Data and ECMWF Analyses”

• *JPL Postdoc Poster Day, Pasadena, CA (August 2010):* “Controls on Tropical Low Cloud Cover Using A-Train Satellite Data and ECMWF Analyses”

• *Seminars at Academia Sinica and National Taiwan University, Taipei, Taiwan (June/July 2010):* “Controls on Tropical Low Cloud Cover and Cloud Heterogeneity Using A-Train Satellite Data and ECMWF Analyses”

• *Western Pacific Geophysics Meeting, Taipei, Taiwan (June 2010), Poster Presentation:* “Boundary Layer and Cloud Structure Controls on Tropical Low Cloud Cover Using A-Train Satellite Data and ECMWF Analyses”

• *American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2009): Poster Presentation:* “An Understanding of the Boundary Layer Cloud Frequency and Vertical Structure in the Tropical and Subtropical Pacific Using A-Train Satellite Data and ECMWF-YOTC Analyses.”

• *Yuk Lunch Seminar Series, Caltech, Pasadena, CA (November 2009):* A Better Understanding of the Boundary Layer and Cloud Structure and Dynamic and Stability Controls on Cloud Cover in the Tropics and Subtropics Using A-Train Satellite Data and ECMWF Dynamical and Cloud Fields”

• *JPL Postdoc Poster Day, Pasadena, CA (September 2009):* “An Improved Understanding of the Boundary Layer Cloud Frequency and Vertical Structure in the Tropical and Subtropical Pacific Using A-Train Satellite Data and ECMWF Analyses”

• *CALIPSO/CloudSat Science Team Meeting, Madison, WI (July 2009): Oral Presentation:* “Towards an Improved Understanding of the Boundary Layer and Vertical Cloud Structure in the Transition from the Tropical to Subtropical Pacific Cross Section.”

• *Gordon Conference on Radiation and Climate, Colby-Sawyer College, New London, NH (July 2009):* “Towards an Improved Understanding of Boundary Layer and Vertical Cloud Structure in the Transition from the Tropical to Subtropical Pacific Cross Section.”

• *American Meteorological Society Annual Meeting, Phoenix, AZ (January 2009): Oral Presentation:* “Understanding the Importance of Microphysics and Macrophysics for Warm Rain in Marine Low

Clouds Using MODIS and CloudSat'

- American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2007): Poster Presentation: "The Vertical Structure of Tropical Oceanic Convective Clouds and its Relation to Precipitation"*

- Gordon Conference on Radiation and Climate, Colby-Sawyer College, New London, NH (July/August 2007): Poster Presentation: "Vertical Structure of Tropical Clouds and Precipitation Across the ITCZ"*

- American Geophysical Union Joint Assembly and Fall Meeting, San Francisco, CA (December 2006): Oral Presentation: "Radiative Driving of Tropical High Clouds"*

•**Reviewer for the following Journals:**

Journal of Climate; Monthly Weather Review; Weather Climate and Society; Journal of the Atmospheric Sciences; Journal of Hydrometeorology; Journal of Applied Meteorology and Climatology; Weather and Forecasting; Journal of Geophysical Research; Geophysical Research Letters; International Journal of Climatology; Journal of the Meteorological Society of Japan; Journal of Advances in Modeling Earth Systems; Atmosphere; Dynamics of Oceans and Atmospheres; Remote Sensing; Quarterly Journal of the Royal Meteorological Society; Journal of Atmospheric and Oceanic Technology; Asia-Pacific Journal of Atmospheric Sciences; Atmospheric Chemistry and Physics; Scientific Online Letters on the Atmosphere; Climate Dynamics; Journal of Hydrometeorology

•**Public Seminars/Talks**

- Presentation to Whitney High School Ecology and Wildlife Club in Cerritos, CA (May 2018): "Cloudy Skies, Feedbacks, and Climate in a Warming World"*

- Presentation to JPL in-house Green Club (June 2012): "Scientific Controversies, Past and Present"*

- Talk at JPL to Student Interns (1 April 2011): "Cloudy Skies, Feedbacks, and Climate"*

- JPL Climate Day 2010 – Bringing scientists, students, and communities together to promote climate literacy, Pasadena, CA (March 2010): "Cloudy Skies and Climate Change"*

- Centers for Ocean Sciences Education Excellence Talk at JPL, Pasadena, CA (February 2010): "Cloud Structure, Composition, and Feedbacks in the Current Climate and a Warming World"*

- Centers for Ocean Sciences Education Excellence Talk at Natural History Museum, University of Southern California, Los Angeles, CA (February 2010): "Cloud Structure, Composition, and Feedbacks in the Current Climate and a Warming World"*

- Public Talk at Neighborhood Church, Pasadena, CA (September 2009): "Removing the Mystery of Predicting Climate Change"*

•**Professional Society Membership**

- American Meteorological Society •American Geophysical Union

•**Honors/Awards**

- (2016): Was invited and served on the proposal review panel of approximately 20 members for the Atmospheric System Research Program with the Department of Energy's Office of Science for the **Convective and Boundary Layer/Mixed-phase Cloud Processes Panel** near Washington, D.C. in North Bethesda, MD

- (2015): Was invited and served on the proposal review panel of approximately 20 members for the Atmospheric System Research Program within the Department of Energy's Office of Science for the **Convective Processes Panel** near Washington, D.C. in Rockville, MD.

- (2014): Selected Award for NASA ROSES as **Principal Investigator** of the Science of Terra and Aqua, entitled: "Radiative and Large-Scale Forcing of Tropical Clouds and Their Controls on High SST Environments Using Multi-Sensor Aqua and ECMWF-Reanalysis Datasets", with funding for three years

- (2010-2011): Caltech Postdoctoral Scholar

- (2008-2010): NASA Postdoctoral Program Fellowship Award Recipient
- (2005): University of Washington Department of Atmospheric Sciences forecasting competition champion
- (2003): Graduate School Top Scholar Award recipient
- (1999-2003): President's Scholar (five awards per year), San Jose State University
- (2001-2003): Golden Key International Honour Society Member
- (2001-2003): Dean's Scholar, San Jose State University
- Computational Skills**
- Languages*: IDL (**16+ years of experience**), FORTRAN, C, Matlab
- Operating Systems*: Unix/Linux, Windows