

## NASA NEWS ANNUAL / FINAL REPORT – 9/14/09

Predictability and Model Verification of the Water and Energy Cycles:  
Linking Local, Regional and Global Scales

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### 1. Project status and progress

This project received its final increment of funding in FY'09. Accomplishments are described in the "Topics and Collaboration" and "Publications" Section. The NEWS funding supported or co-supported the publications listed.

### 2. Topics and Collaborations

Each publication is highlighted by a preceding superscript that corresponds to the itemized list of collaboration(s) described below.

1. Synergistic contributions to NASA-MAP Subseasonal Project (PI S. Schubert). This concerns prediction, predictability and model verification issues, associated with intraseasonal variability.
2. NEWS integration provided for the development of a substantial area of research with Olson, Tao & L'Ecuyer on MJO TRMM heating retrievals, which has even received follow-on funding via NSF through UCLA.
3. NEWS integration provided for the first ever characterization of the water cycle of the MJO, of which one publication included Liu's moisture convergence retrievals.
4. Synergistic activities with the CLIVAR MJO Working Group have provided the means to better quantify model error associated with the MJO and has led to an international and operational MJO prediction activity. (co-chair of MJOWG).
5. Contribute Water Cycle Modeling and Projection associated with regional climate changes, specifically the western US. This also served as contributions to California's Biennial Climate Change report put together by the California Energy Commission
6. Development and implementation activities for the WCRP/WWRP YOTC Program.
7. Global Water Cycle studies: 1) *new* methodology to retrieval global runoff and evapotranspiration estimates, 2) evaluation of global water cycle from IPCC models.
8. Other water cycle related activities related to GRACE, AIRS and subtropical humidity maintenance.

### 3. Publications

#### MODELING, PREDICTION AND PREDICTABILITY

- <sup>1</sup>Jiang, X., **D. E. Waliser**, M. Wheeler, C. Jones, M.-I. Lee, and S. Schubert, 2008: Assessing the skill of an all-season statistical forecast model for the Madden-Julian Oscillation. *Mon. Wea. Rev.*, 136, 1940-1956.
- <sup>1</sup>Jiang, X., **D.E. Waliser**, H.L. Pan, H. van den Dool, S. Schubert, 2008: Internannual prediction skill and predictability of the global water cycle in the NCEP Coupled Forecast System. *J. Climate*, In Preparation.
- <sup>1,4</sup>Gottschalck, J., M. Wheeler, K. Weickmann, F. Vitart, N. Savage, H. Lin, H. Hendon, **D. Waliser**, K. Sperber, M. Nakagawa, C. Prestrelo, M. Flatau, W. Higgins, 2009, Establishing and Assessing Operational Model MJO Forecasts: A Project of the CLIVAR Madden-Julian Oscillation Working Group, *Bull. Am. Meteor. Soc.*, Submitted.
- <sup>1,4</sup>Goswami, B.N., M. Wheeler, J. Gottschalck, and **D. E. Waliser**, 2008, Intraseasonal Variability and Forecasting: A Review of Recent Research, WMO Fourth International Workshop on Monsoons, 20-15 October 2008, Beijing, China. To appear as a WMO Tech. Report.
- <sup>1,4</sup>Sperber, K.R., and **D. E. Waliser**, 2008: New Approaches to Understanding, Simulating, and Forecasting the Madden-Julian Oscillation, *Bulletin of the American Meteorology Society*, DOI: 10.1175/2008BAMS2700.1.
- <sup>5</sup>**Waliser, D.**, J. Kim, Y. Xue, Chao, Y., A. Eldering, R. Fovell, A. Hall, Q. Li, K. Liou, J. McWilliams, S. Kapnick, R. Vasic, Fs. De Sale, and Y. Yu, 2009, Simulating the Sierra Nevada snowpack: The impact of snow albedo and multi-layer snow physics, Biennial California Climate Change Center Report, CEC-500-2008-XXX. To be submitted to a special issue of *Climatic Change*.
- <sup>5</sup>Kim, J., Y. Chao, A. Eldering, R. Fovell, A. Hall, Q. Li, K. Liou, J. McWilliams, **D. Waliser**, Y. Xue, and Sarah Kapnick, 2009: A projection of the cold season hydroclimate in California in mid-21st century under the SRES-A1B emission scenario, Biennial California Climate Change Center Report, CEC-500-2008-XXX. To be submitted to a special issue of *Climatic Change*.

#### OBSERVATIONS AND MODEL VERIFICATION

- <sup>1,3</sup>Schwartz, M. J., **D. E. Waliser**, B. Tian, J. F. Li, D. L. Wu, J. H. Jiang, and W. G. Read, 2008: MJO in EOS MLS cloud ice and water vapor. *Geophys. Res. Lett.*, 35, L08812, doi:10.1029/2008GL033675.
- <sup>1,3</sup>**Waliser, D. E.**, B. J. Tian, M. J. Schwartz, X. Xie, W. T. Liu, and E. J. Fetzer, 2008: How well can satellite data characterize the Water Cycle of the Madden-Julian Oscillation?, *Geophys. Res. Lett.* In Press.
- <sup>1,3</sup>Tian, B. **D. E. Waliser**, X. Xie, W. T. Liu, and E. J. Fetzer, 2009: On the Low-level Moisture Preconditioning of the Madden-Julian Oscillation, *Geoph. Res. Letters*, Submitted.
- <sup>2</sup>Jiang, X., **D.E. Waliser**, J.-L. Li, B. Tian, Y. L. Yung, W. Olson, M. Grecu, W.-K. Tao, S. E. Lang, 2008, Characterizing the vertical heating structure of the MJO using TRMM, *J. Climate TRMM Special Issue*, In Press.
- <sup>1,4</sup>**US CLIVAR Madden-Julian Oscillation Working Group**, 2008: MJO Simulation Diagnostics, *J. Clim.*, 22, DOI: 10.1175/2008JCLI2731.1.

- <sup>6</sup>Waliser, D. E., and M. Moncrieff, 2008, The Year of Tropical Convection (YOTC) Science Plan: A joint WCRP - WWRP/THORPEX International Initiative. WMO/TD No. 1452, WCRP - 130, WWRP/THORPEX - No 9. WMO, Geneva, Switzerland.
- <sup>6</sup>Waliser, D. E., and M. Moncrieff, 2009, The Year of Tropical Convection (YOTC) Implementation Plan: A joint WCRP - WWRP/THORPEX International Initiative. Draft.
- <sup>7</sup>Seo, K.-W., D. E. Waliser, B. J. Tian, J. Famiglietti, and T. Syed, 2009: Evaluation of global land-to-ocean fresh water discharge and evapotranspiration using space-based observations. *J. Hydrology*, 373 (2009) 508–515.
- <sup>7</sup>Waliser, D. E., K. Seo, S. Schubert, E. Njoku, 2007: Global Water Cycle Agreement in IPCC AR4 Model Simulations, *Geoph. Res. Let.*, 34, L16705, doi:10.1029/2007GL030675.
- <sup>8</sup>Seo, K., C. R. Wilson, S.-C. Han and D. E. Waliser, 2008: Gravity Recovery and Climate Experiment (GRACE) alias error from ocean tides. *J. Geophys. Res.*, 113, B03405, doi:10.1029/2006JB004747.
- <sup>7</sup>Seo, K., C. R. Wilson, J. Chen and D. E. Waliser, 2007: GRACE's spatial aliasing error, *Geophys. J. Int.*, 172, 41-48, doi: 10.1111j.1365-246X.2007.03611.x.
- <sup>7</sup>Fetzer, E. J., W. G. Read, D. Waliser, B. H. Kahn, B. Tian, H. Vomel, F. W. Irion, H. Su, A. Eldering, M. d. I. T. Juarez, J. H. Jiang, and V. Dang, 2008: Comparison of Upper Tropospheric Water Vapor Observations from the Microwave Limb Sounder and Atmospheric Infrared Sounder. *J. Geophys. Res.*, 113, D22110, doi:10.1029/2008JD010000.
- <sup>7</sup>Couhert, A., T. Schneider, J.-L. Li, D. E. Waliser, A.M. Tompkins, 2009: The maintenance of the relative humidity of the subtropical free troposphere, *J. Climate*, In Press.

#### 4. Issues or concerns

- TRMM-based estimates are beginning to be useful to describe heating although models don't routinely output the necessary output for comparisons.
- There is a lack of comprehensive water and energy cycle components provided from conventional model hindcast/forecast and IPCC AR4 data sets that allow for robust diagnostics.
- Significant challenges remain on closing water cycle budget from satellite observations for the large time and space scales e.g., MJO. See <sup>1,3</sup>Waliser et al. 2009.
- GEOS5 delays impacted some aspects of original goals but collaborative opportunities provided the means for many other productive activities.

#### 5. Integration

Overall integration was challenging to address as individuals or even in the context of the programmatic efforts but the opportunities for collaborative activities were significant and facilitated by the program. These opportunities provided our team with numerous avenues for important and new areas of research relevant to the water cycle and its simulation and prediction/predictability.