

Shraddhanand Shukla, PhD

Assistant Researcher-II

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RESEARCH INTERESTS

- Large scale hydrology and hydrologic modeling.
- Drought monitoring and forecasting.
- Impact of climate change on the water resources and climate change adaptation.

EDUCATION

- **Department of Civil and Environmental Engineering-University of Washington**, Seattle, WA
PhD in Hydrology and Water Resources, (09/2006 – 06/2012)
Dissertation Title: "Towards the Improvement of Drought Monitoring and Seasonal Drought Prediction in the United States"
- **Indian Institute of Technology**, Kharagpur, India
Masters in Water Resources Development and Management, (07/2003 – 06/2005)
- **Chandra Shekhar Azad University of Agricultural and Technology**, Kanpur, India
Bachelors in Technology in Agricultural Engineering, (07/1999 – 06/2003)

POSITIONS HELD

- Assistant Researcher-II, University of California, Santa Barbara (UCSB), CA, USA (08/2014-Present)
- UCAR's PACE Postdoctoral Fellow, University of California, Santa Barbara (UCSB), CA, USA (09/2012-08/2014)
- Postdoctoral Research Associate, University of Washington (UW), Seattle, WA, CA, USA (06/2012-08/2012)
- Pre-Doctoral Research Associate, University of Washington, Seattle, WA, CA, USA (09/2006-06/2012)
- Research Assistant, Ecole Polytechnique Federal de Lausanne, Lausanne, Switzerland. (07/2005-06/2006)

PROFESSIONAL AFFILIATIONS

- American Geophysical Union
- American Meteorological Society
- Chi Epsilon Honorary Society
- American Water Resources Association

FELLOWSHIPS/AWARDS

- One of two recipients of the University Corporation for Atmospheric Research (UCAR)'s 2012 Postdocs Applying Climate Expertise (PACE) Fellowship to pursue Postdoctoral research. (2012-2014)
- Earth System Science Interdisciplinary Center (ESSIC) travel award to attend NOAA's 36th Climate Diagnostics and Prediction Workshop (CDPW) at Fort Worth, TX. (10/03/2011 – 10/06/2011)
- Won the best student oral presentation award at the Water Center Annual Review of Research, Seattle, WA. (02/2008)
- Awarded a NOAA student travel grant to attend Climate Diagnostics and Prediction Workshop in 2008.
- Invited (with full financial support) by The Abdus Salam International Centre for Theoretical Physics (ICTP) to attend International Summer School on Hydrological Drought & Global Change at Trieste, Italy. (06/21/2008-06/27/2008)
- Awarded departmental student travel grants to attend and present my research work at American Geophysical Union fall meeting in 2007 and 2010.

- Recipient of Federal Commission Scholarship by the Swiss Government for the pursuit of a nine-month research project at EPFL in Lausanne, Switzerland. (2005-2006)
- Recipient of the Ministry of Human Resources and Development Scholarship for the pursuit of a Master's degree at the Indian Institute of Technology. (2003-2005)

ACADEMIC SERVICES

- Editor of the journal *Advances in Meteorology* (April 2015-present) <http://www.hindawi.com/54286867/>
- Proposal reviewer for the US National Science Foundation (NSF) Hydrologic Sciences program and the Mississippi-Alabama Sea Grant Consortium
- Reviewer of high impact journals (Water Resources Research, Bulletin of the American Meteorological Society, Geophysical Research Letters, Journal of Geophysical Research, Environmental Research Letters, Journal of Hydrometeorology, Hydrology and Earth System Sciences, Climate Research, Climatic Change, Intl. Journal of Climatology, Journal of Hydrology etc)
- Session Organizer for the American Geophysical Union Fall Meeting -2012, 2013, 2014, 2015, held in San Francisco CA.
- Participated in the organization of and attended first "Hydrologic modeling and Forecast" workshop at Instituto Mexicano De Tecnología Del Agua (IMTA), México. 12/01/2008-12/05/2008
- Facilitated the implementation of a mentorship program for the students at my department, as the secretary of the Chi Epsilon Honor Society. 2009-2011
- Volunteered at Engineering Open House, CEE career fair and graduate student orientation.

PUBLICATIONS

In Review

- McNally, A., **S. Shukla**, K. Arsenault, S. Wang, C. Peters-Lidard, and J. P Verdin: Evaluation of ESA C CI soil moisture in data sparse and food insecure East Africa. *Intl. J. App. Earth Obs. and Geo.*
- **Shukla, S.**, J. Roberts, A. Hoell, C. C. Funk, F. Robertson and B. Kirtman: Assessing North American Multimodel Ensemble (NMME) Seasonal Forecast Skill to Assist in the Early Warning of Hydrological Extremes over East Africa. *Bull. Am. Met. Soc.*

Published/In Press

2015

- **Shukla, S.**, A. Steinemann, S.F. Jacobellis and D.R. Cayan: Annual Drought in California: Association with Monthly Precipitation and Climate Phases. *Journal of Applied Meteorology and Climatology* 2015 ; e-View doi: <http://dx.doi.org/10.1175/JAMC-D-15-0167.1> (*in press*)
- C. Funk, P. Peterson, M. Landsfeld, D. Pedreros, J. Verdin, **S. Shukla**, G. Husak and L. Harrison: A new environmental record for monitoring hydrologic extremes. *Nat. Sci. Data.* (*accepted*)
- Hoell, A., **S. Shukla**, M. Barlow, F. Cannon, C. Kelley and C. Funk 2015: The Forcing of Monthly Precipitation Variability over Southwest Asia During the Boreal Cold Season. *J. Clim.* (*in press*)
- Safeeq, M., **S. Shukla**, I. Arismendi, G. Grant, S. Lewis, and A. Nolin: Influence of winter season climate variability on snow precipitation ratio in the Western U.S. *Intl. J. Clim.* (*in press*).
- Grace, K., F. Davenport, H. Hanson, C. Funk, and **S. Shukla**: Examining the Relationship between Temperature, Rainfall and Low Birth Weight in sub-Saharan Africa. *Glob. Env. Change.* (*in press*)
- Funk, C., **S. Shukla**, A. Hoell and B. Livneh: Assessing the contributions of East African and west Pacific warming to the 2014 boreal spring East African drought. *Bull. Am. Met. Soc. (Climate Attribution issue)* (*accepted*)

- **Shukla, S.****, M. Safeeq, A. AghaKouchak, K. Guan, and C. Funk, 2015: Temperature Impacts on the Water Year 2014 Drought in California. *Geophys. Res. Lett.*, 42, doi: 10.1002/2015GL063666.
<http://onlinelibrary.wiley.com/doi/10.1002/2015GL063666/abstract>
(* ** Ranked in the top 5% of all articles scored by Almetric <http://wiley.altmetric.com/details/3983651>)

2014

- **Shukla, S.**, McNally, A., Husak, G., and Funk, C. 2014: A seasonal agricultural drought forecast system for food-insecure regions of East Africa, *Hydrol. Earth Syst. Sci.*, 18, 3907-3921, doi:10.5194/hess-18-3907-2014.
<http://www.hydrol-earth-syst-sci-discuss.net/11/3049/2014/hessd-11-3049-2014.html>
- **Shukla S.**, Funk, C., and Hoell, A. 2014: Using constructed analogs to improve the skill of National Multi-Model Ensemble March-April-May precipitation forecasts in equatorial East Africa. *Environ. Res. Lett.* 9, 094009.
<http://iopscience.iop.org/1748-9326/9/9/094009>.
- Funk, C., Hoell, A., **Shukla, S.**, Bladé, I., Liebmann, B., Roberts, J. B., Robertson, F. R., and Husak, G. 2014: Predicting East African spring droughts using Pacific and Indian Ocean sea surface temperature indices, *Hydrol. Earth Syst. Sci.*, 18, 4965-4978, doi:10.5194/hess-18-4965-2014.
<http://www.hydrol-earth-syst-sci.net/18/4965/2014/hess-18-4965-2014.html>
- Nijssen, B., **S. Shukla**, C. Lin, H. Gao, T. Zhou, J. Sheffield, E. F. Wood, D. P. Lettenmaier, 2014: A prototype Global Drought Information System based on multiple land surface models, *J. Hydrometeorol.* doi:<http://dx.doi.org/10.1175/JHM-D-13-090.1>
<http://journals.ametsoc.org/doi/abs/10.1175/JHM-D-13-090.1>

2013

- Funk, C., Husak, G., Michaelsen, J., **Shukla, S.**, Hoell, A., Lyon, B., Hoerling, M. P., Liebmann, B., Zhang, T., Verdin, J., Galu, G., Eilerts, G., and Rowland, J. 2013: Attribution of 2012 and 2003-12 rainfall deficits in eastern Kenya and southern Somalia, *B. Am. Meteorol. Soc.*, 95, S45-S48 .
<http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-13-00085.1>
- **Shukla, S.**, and D. P. Lettenmaier, 2013: Multi-RCM ensemble downscaling of NCEP CFS winter season forecasts: Implications for seasonal hydrologic forecast skill, *J. Geophys. Res. Atmos.*, 118, 10,770-10,790, doi:10.1002/jgrd.50628.
<http://onlinelibrary.wiley.com/doi/10.1002/jgrd.50628/abstract>
- **Shukla, S.**, Sheffield, J., Wood, E. F., and Lettenmaier, D. P., 2013: On the sources of global land surface hydrologic predictability, *Hydrol. Earth Syst. Sci.*, 17, 2781-2796, doi:10.5194/hess-17-2781-2013.
<http://www.hydrol-earth-syst-sci.net/17/2781/2013/hess-17-2781-2013.html>

2012

- Mo, K. C., **S. Shukla**, D. P. Lettenmaier, and L.-C. Chen. 2012. Do climate forecast system (CFSv2) forecasts improve seasonal soil moisture prediction?, *Geophys. Res. Lett.*, doi:10.1029/2012GL053598.
<http://onlinelibrary.wiley.com/doi/10.1029/2012GL053598/abstract>
- **Shukla, S.**, N. Voisin, and D. P. Lettenmaier, 2012: Value of medium range weather forecasts in the improvement of seasonal hydrologic prediction skill, *Hydrol. Earth Syst. Sci.*, 16, 2825-2838, doi:10.5194/hess-16-2825-2012.
<http://www.hydrol-earth-syst-sci.net/16/2825/2012/hess-16-2825-2012.html>
- Mo, K. C., L. Chen, **S. Shukla**, T. Bohn, and D. P. Lettenmaier. 2012: Uncertainties in North American Land Data Assimilation Systems over the Contiguous United States, *J. Hydrometeorol.*, 13(3), doi:10.1175/JHM-D-11-0132.1
<http://journals.ametsoc.org/doi/abs/10.1175/JHM-D-11-0132.1>

2011

- **Shukla, S.**, and D. P. Lettenmaier. 2011. Seasonal hydrologic prediction in the United States: understanding the role of initial hydrologic conditions and seasonal climate forecast skill. *Hydrol. Earth Syst. Sci.* 15, 3529-3538, doi:10.5194/hess-15-3529-2011.
<http://www.hydrol-earth-syst-sci.net/15/3529/2011/hess-15-3529-2011.html>
- Muñoz Arriola, F., S. Rabadán, J. Humberto, M. Rocchiccioli, Helène, **S. Shukla**, G. D. Reyes, A. L. Sánchez, and René. 2011. Surface hydrology in Grijalva river basin: Calibration of the Variable Infiltration Capacity model (VIC). *Aqua-LAC*. 3(1): 68 - 80.
<http://unesdoc.unesco.org/images/0021/002115/211509m.pdf#211530>
- **Shukla, S.**, A. C. Steinemann, and D. P. Lettenmaier. 2011. Drought monitoring for Washington state: Indicators and Applications. *J. Hydrometeor.* 12: 66–83, 10.1175/2010JHM1307.1.
<http://journals.ametsoc.org/doi/abs/10.1175/2010JHM1307.1>

2009

- Munoz-Arriola, F., **S. Shukla**, T. Bohn, C. Zhu, B. Livneh, D.P. Lettenmaier, R. Lobato-Sanchez and A. Wagner-Gomez. 2009: Forecasting Surface Hydrology in North America, *Border Climate Summary*, July 13th: 1-5.
<http://climas.arizona.edu/download/file/fid/1189>
- Mishra, V., K. Cherkauer, and **S. Shukla**. 2009. Assessment of drought due to historic climate variability and projected future climate change in the Midwestern United States. *J. Hydrometeor.* 11: 46-68, 10.1175/2009JHM1156.1.
<http://journals.ametsoc.org/doi/pdf/10.1175/2009JHM1156.1>

2008

- **Shukla, S.** and A.W. Wood. 2008. Use of a standardized runoff index for characterizing hydrologic drought. *Geophys. Res. Letters*. 35: L02405, doi:10.1029/2007GL032487.
<http://onlinelibrary.wiley.com/doi/10.1029/2007GL032487/abstract>

CONFERENCE PROCEEDINGS

- **Shukla, S.**, M. Damodhara Rao, N.S. Raghuwanshi, and R. Singh. 2006. A simple mathematical model for simulating water flow in furrow irrigation. International Conference in University of Agriculture, Faisalabad, Pakistan.
- Mishra, V., N.S. Raghuwanshi, **S. Shukla**, J. Cullmann, and G.H. Schmitz. 2006. Understanding runoff generation process through scaling of flood peaks. International Conference in University of Agriculture, Faisalabad, Pakistan.
- **Shukla, S.**, M. Damodhara Rao, R. Singh, N.S. Raghuwanshi, G.H. Schmitz, and F. Lennartz. 2005. Modeling temporal variation of soil erosion in furrow irrigation. Proceedings of International Symposium on Recent Advances in Water Resources Development and Management, IIT-Roorkee, India, 2005.
- Mishra, V., N. S. Raghuwanshi, **S. Shukla**, and G. H. Schmitz. 2005. Regional flood frequency analysis of Freiburger Mulde catchment by L-moments. Proceedings of International Symposium on Recent Advances in Water Resources Development and Management. IIT-Roorkee, India, 2005.

SELECTED PRESENTATIONS/POSTERS

- **American Geophysical Union (AGU) Fall Meeting**
 - **Shukla, S.**, J.B. Roberts, C. Funk, F.R. Robertson, A. Hoell: Seasonal Drought Prediction in East Africa: Can National Multi-Model Ensemble Forecasts Help? AGU Fall Meeting, San Francisco,

- CA, Dec-2014.
- **Shukla S.**, C Funk, J.P. Verdin and C.D. Peters--Lidard 2013: Food and water security scenarios for East Africa over next 20 years. AGU Fall Meeting, San Francisco, CA, Dec-2013.
 - **Shukla S.**, C Funk, M. D. Dettinger, and F. R. Robertson 2012: Evaluation of CMIP5 models in the context of food security assessments in Sahel and Eastern Africa. AGU Fall Meeting, San Francisco, CA, Dec-2012.
 - **Shukla, S.**, J. Sheffield, E. Wood and D. P. Lettenmaier, 2011. Relative contributions of initial hydrologic state and climate forecast skill to seasonal hydrologic prediction globally. AGU Fall Meeting, San Francisco, CA, Dec-2011.
 - **Shukla, S.** and D. P. Lettenmaier, 2010. Relative contributions of initial hydrologic state and climate forecast skill to seasonal drought prediction. AGU Fall Meeting, San Francisco, CA, Dec-2010.
 - **Shukla, S.**, A. C. Steinemann, and D. P. Lettenmaier, 2009. A drought prediction and monitoring system to reduce drought vulnerability and improve water management in Washington State. AGU Fall Meeting, San Francisco, CA, Dec-2009.
 - **Shukla, S.** and A. W. Wood, 2007. Application of LDAS-era land surface models for drought characterization and prediction in Washington State. AGU Fall Meeting, San Francisco, CA, Dec-2007.
 - Wood, A., **S. Shukla**, J. Vano and A. Steinemann, 2007. Connecting climate, hydrologic and drought predictions to water resources management in Washington State. AGU Fall Meeting, San Francisco, CA, Dec-2007.
 - Wood, A., A. Steinemann, D. Alexander and **S. Shukla**, 2006. Applications of Medium Range To Seasonal/Interannual Climate Forecasts For Water Resources Management In the Yakima River Basin of Washington State. AGU Fall Meeting, San Francisco, CA, Dec-2006.
- **American Meteorological Society (AMS) Annual Meeting**
 - **Shukla, S.**, C. Funk and F. Robertson. 2014: Experimental seasonal hydrological forecast system for East Africa. 94th AMS Annual Meeting, Atlanta, GA, Feb. 2011.
 - **Shukla, S.** and D. P. Lettenmaier. 2011. Evaluating the role of weather forecast skill in seasonal drought prediction. 91st AMS Annual Meeting, Seattle, WA, Jan. 2011.
 - **Shukla, S.**, A. Steinemann and D. P. Lettenmaier. 2011. Drought characterization: Indicators and Decision-Making. 91st AMS Annual Meeting, Seattle, WA, Jan 2011.
 - Munoz-Arriola, F., **S. Shukla**, L. Luo, A. Munoz-Orozco, and D.P. Lettenmaier. 2009. Drought predictability in Mexico. 89th AMS Annual Meeting, Phoenix, AZ, Jan. 2009.
 - Wood, A., N. Voision, and **S. Shukla**. 2008. Medium-range ensemble hydrologic forecasting for western Washington State. 88th AMS Annual Meeting, New Orleans, LA, Jan. 2008.
 - **Association of American Geographers Annual Meeting**
 - Pricope, N., **S. Shukla** and C. Lidard 2014. Exploring changes in surface runoff in relation to precipitation and population density changes in the Lake Victoria Basin of Eastern Africa. Tampa Florida, April 2014.
 - **NOAA's Climate Diagnostics and Prediction Workshop (CDPW)**
 - **Shukla, S.**, N. Voision, and D. P. Lettenmaier. 2011. Worth of medium range weather forecast skill in Seasonal hydrologic and drought prediction. 36th Annual CDPW, Fort Worth, TX, Oct. 2011.
 - **Shukla, S.**, F. Munoz-Arriola, T. Bohn, A. C. Steinemann, and D.P. Lettenmaier. Assessment of ESP-based drought prediction skill. 33rd Annual CDPW, Lincoln, NE, Oct. 2008.
 - **World Climate Research Programme (WCRP) Open Science Conference**
 - **Shukla, S.**, and D. P Lettenmaier, 2011. Drought characterization using the University of

- Washington Surface Water Monitor. WCRP Open Science Conference. Denver, CO, Oct. 2011.
- **Shukla, S.**, K. C. Mo and D. P Lettenmaier, 2011. Uncertainties in the North American Land Data Assimilation Systems. WCRP Open Science Conference. Denver, CO, Oct. 2011.
- **Invited Presentation**
 - **Shukla, S.** 2015: Incorporating stakeholders' feedback in drought monitoring products. *Drought Monitoring Panel*, AGU Chapman Conference on California Drought, Irvine, California, April 2015.
 - **Shukla, S.** and A. W. Wood. 2008. Application of a land Surface model for drought monitoring and prediction in Washington State. The Water Center Annual Review of Research, Seattle, WA, Feb. 2008.
 - **Miscellaneous Conferences/Meetings**
 - **Shukla, S.**, and co-authors: Forecasting seasonal agricultural droughts in East Africa, 2015: NASA Interdisciplinary Research in Earth Science: Seasonal Prediction of Hydro-Climatic Extremes in the Greater Horn of Africa 2nd Workshop. Addis Ababa (Ethiopia), July 2015.
 - **Shukla, S.**, A. Steinemann and D. P. Lettenmaier. 2010. Evaluation of a NOAA climate forecasts based drought prediction system for Washington State. Hydrology in the 21st Century: Links to the past and a vision for the future, Seattle, WA, March 2010.
 - Munoz-Arriola, F., **S. Shukla**, A. Hamlet, and D.P. Lettenmaier. 2009. Idaho climate and water forecast for 2010. CIG Annual Fall Forecast Meeting, Boise, ID, Oct. 2009.
 - Munoz-Arriola, F., **S. Shukla**, and D.P. Lettenmaier. 2009. Global climate and hydrological predictability. Foro de Expectativas del Sector Agroalimentario y Pesquero, Mexico City, Mexico, March 2009.
 - **Shukla, S.**, D. Alexander, A. Steinemann, and A.W. Wood. 2007. Applications of medium range to seasonal/interannual climate forecasts for water resources management in the Yakima river basin of Washington State. NOAA- Climate Prediction Applications Science Workshop (CPASW), Seattle, WA, March 2007.