CIRRICULUM VITAE OF JAGADISH SHUKLA:

(1. Resume; 2. Service to Community; 3. Summary of Scientific Contributions; 4. Publications)

1. RESUME

ADDRESS:

Distinguished Professor, George Mason University (GMU)
President, Institute of Global Environment and Society, Inc. (IGES)
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Tel: (301) 595-7000; Fax: (301) 595-9793; E-mail: shukla@cola.iges.org

EDUCATION:

Primary School	(1953) – Under a banyan tree; village – Mirdha, Ballia, U.P., India
High School	(1958) – S.R.S. H.S. School, village – Sheopur, Ballia, U.P., India
B.Sc. (Honors)	(1962) – Banaras Hindu University (Physics, Math, Geology)
M.Sc.	(1964) – Banaras Hindu University (Geophysics), India
Ph.D.	(1971) – Banaras Hindu University (Geophysics), India
Sc.D.	(1976) – Massachusetts Institute of Technology (Meteorology), USA

PROFESSIONAL EXPERIENCE:

2003- present	Chairman, Climate Dynamics, George Mason University
1994 - present	Professor of Earth Sciences and Global Change, George Mason University
1991 - present	President, Institute of Global Environment and Society
1984 - 2004	Director, Center for Ocean-Land-Atmosphere Studies
1984 - 1993	Professor, Department of Meteorology, University of Maryland
1979 - 1983	Senior Scientist, NASA/Goddard Space Flight Center
1978 - 1979	Visiting Associate Professor, Massachusetts Institute of Technology
1976 - 1977	Research Associate, Princeton University
1971 - 1976	Research Assistant, Research staff (M.I.T., Princeton)
1965 - 1971	Junior Scientific Officer, Indian Inst. of Tropical Meteor., Pune, India

HONORS AND AWARDS

Rossby Research Medal (Amer. Met. Soc.), 2005
Scientist of the year, 2004, Association of Indians in America
Sir Gilbert Walker Gold Medal, 2001
Associate Fellow, Third World Academy of Sciences, 1996
Fellow, Indian Meteorological Society, 1996
Fellow, American Meteorological Society, 1986
Exceptional Scientific Achievement Medal, NASA, 1982
Exceptional Performance Award, Goddard Space Flight Center, NASA, 1981
Outstanding Contribution to First GARP Global Experiment, 1980
Fulbright Travel Grant, 1971
United National Fellowship, 1967

TEACHING:

As a faculty member at MIT, UMCP and GMU, advisor/co-advisor for Ph.D.thesis of 15 students.

SCIENTIFIC PUBLICATIONS AND LECTURES:

Author/coauthor of about 150 scientific papers and coauthor of about 20 reports
Editor/contributor for 5 books
About 300 seminars, invited lectures and conference presentations

SCIENTIFIC COLLABORATORS: Coauthors of Papers in Refereed Journals

J. Anderson, Atlas, Baker, Bamzai, Bangaru, Baumhefner, Bengtsson, Brankovic, Carton, Chang, Charney, Chen, Das, DeWitt, Dirmeyer, Doty, Estoque, Fennessy, Godbole, Goswami, Gutzler, Hahn, Halem, Herman, Huang, Jiing, , Kalnay, Kinter, Kirtman, Krishnamurhty, Marshall, Marx, Mintz, Misra, Mo, Mooley, Moura, Nigam, C. Nobre, P. Nobre, Palmer, Paolino, Phillips, Ploshay, Randall, K.R.Saha, Sajnani, Sanders, Sato, E.Schneider, Schubert, Sellers, Sethumadhavan, Suryanarayana, Straus, Sud, Suarez, Tribbia, Vernekar, Wallace, P.Webster, Wu, Xue, Yanai, Yang, Yasunari, Zhou, Zhu

SCIENTIFIC COLLABORATORS: Coauthors of Panel and Committee Reports

D. Anderson, Arkin, Austin, Baker, Barnett, Barber, Bengtsson, Blackmon,Boville, Branstator, Brown, F.Bryan, K. Bryan, Busalacchi, Cane, Charney, Chelton, Clark, Dahl, Duplessy, Elachi, Esbensen, Fuguno, Garstag, Gates, Gent, Ghil, Goodrich, Gordon, Halpern, Harrison, Houze, Hudlow, Kiehl, Krishnamurti, Lukas, Mahlman, Manton, Matsuno, McBean, Molinari, Moritz, Murakami, Neelin, Niiler, North, Randall, Rasmusson, Sarachik, Schott, Simpson, Solomon, Spencer, Stommel, Sumi, Suomi, Thiele, Trenberth, Wallace, F. Webster, P. Webster, Weinman, Weller, Wilheit, Young, Zipser

SCIENTIFIC WORKING GROUPS: Joint Modeling Experiments; Committees

AMIP, CLIVAR NEG-1, DSP, ECMWF-ERA, MONEG, NCEP-CDAS, NCAR-CSM, SMIP, TOGA-NEG, TPOP; MONEX, TRMM, TOGA, GOALS, CLIVAR, ACCP, JSC

INSTITUTION BUILDING:

Center for Ocean-Land-Atmosphere Studies (COLA), Calverton, Maryland, USA
National Center for Medium Range Weather Forecasting (NCMRWF), New Delhi, India
Physics of Weather and Climate, ICTP, Trieste, Italy
CPTEC, Brazil, Organizer training of Brazilian scientists at COLA
International Pacific Research Center (IPRC), U. Of Hawaii, Co-author, Initial Science Plan.
International Research Institute for Climate Prediction (IRIPC-IRI), Co-author, Initial Proposal
Gandhi Degree College, Village - Mirdha, Ballia, UP, India
Climate Dynamics Ph.D. Program, George Mason University

NATIONAL/INTERNATIONAL COMMITTEE, PANELS:

Member, 2001-, Joint Scientific Committee (JSC), World Climate Research Program (WCRP)
Member, 2000-2001, Asian Australian Monsoon Working Group, US CLIVAR
Chairman, 1999- 2001, Seasonal-Interannual Modeling Panel (SIMAP), US CLIVAR
Chairman, 2001, International Conference on Monsoons, New Delhi, India
Member, 2001-, Editorial Board, Earth & Planetary Sciences, Indian Academy of Sciences
Member, 1998-2000, Science Steering Committee, Climate Variability, US CLIVAR
Member, 1997-2000, Science Steering Committee, Climate System Modeling (CSM), UCAR
Member, 1995-2000, PAGES/CLIVAR Working Group, WCRP
Member, 1995-1998, TOGA Numerical Experimentation Group (TOGA-NEG), WCRP
Member, 1996-1998, CLIVAR Monsoon Panel, WCRP
Member, 1996-1997, Science Working Group, International Pacific Research Center (IPRC), Hawaii
Member, 1994-1997, U.S. Panel on GOALS, National Research Council (NRC), NAS
Member, 1993-1996, Climate Data Analysis (CDAS), Advisory Committee for NCEP, UCAR
Member, 1991-1995, International Scientific Steering Committee, (CLIVAR), WCRP
Co-chairman, 1994, International Conference on Monsoons, Trieste, Italy
Member, 1992-1994, Atlantic Climate Change Program (ACCP), OGP/NOAA
Chairman, 1992, Steering Committee for Study Conference on GOALS, NRC/NAS
Director, Workshop on Mediterranean Processes, August 1992, Venice, Italy
Scientific Coordinator, 1991-1994, International Institute for Earth, Environmental and Marine Sciences and Technologies (IIEM), Trieste, Italy
Member, 1991-1993, GEWEX Panel on Continental Scale Project (GCIP)
Member, 1991-1993, External Advisory Group, ECMWF Reanalysis (ERA)
Member, 1991-1998, Scientific Advisory Committee, Venice Center for Marine Sciences
Director, NATO Advanced Research Workshop (ARW) on Prediction of Interannual Climate Variations, International School for Advanced Studies (ISAS), July 1991, Trieste, Italy.
Chairman, 1989, Organizing Committee, TOGA Ad-hoc, panel meeting on Reanalysis
Chairman, 1989 - 1992, U.S. Panel on Tropical Ocean Global Atmosphere (TOGA), NRC/NAS
Member, 1989 - 1994, International Monsoon Numerical Experimentation Group (MONEG)
Member, 1989 - 2000, Editorial Board, Journal of Indian Meteorological Society, MAUSAM
Scientific Advisor, 1989-1990, National Center for Medium Range Weather Forecasting, India
Member, 1983-1988, U.S. Panel on TOGA (NRC/NAS)
Member, 1984 - 1989, International Scientific Steering Group on TOGA,WCRP
Member, 1987 - 1991, Panel on Dynamical Extended Range Forecasting (DERF), NRC/NAS
Member, 1987 - 1990, Air-Sea Fluxes Working Group, WCRP
Director, Summer school on physical climatology, May-June, 1988, ICTP, Trieste, Italy
Member, 1988 - 1991, Scientific Steering Committee (and co-project leader) for International Center for Earth Sciences (ICE), Trieste, Italy
Member, 1986 - 1990, Computer Steering Committee, Goddard Space Flight Center, NASA
Member, 1986 - 1989, Science Steering Committee for TRMM, NASA
Chairman, 1985, Organizing Committee, Meeting on Interannual Variations of Monsoon (US TOGA)
Member, 1984-1987, Indian Ocean Panel, Committee on Climate Change and Ocean (CCCO)
Program Leader, 1984 - 1990, U.S.-India Science and Technology Initiative (STI) on Monsoon
Member, 1982 - 1985, Climate Research Committee, NRC/NAS
Member, 1982 - 1984, Advisory Board, Equatorial Pacific Ocean Climate Studies, (EPOCS)
Member, 1983 - 1986, Committee on Climate Variations, American Meteor. Soc., (AMS)
Lead Scientist, 1983 - 1983, Global Habitability Program, GSFC/NASA
Member, 1975 - 1983, Panel on Monsoon Experiment (MONEX), NRC/NAS
Chief Scientist, 1977 - 1979, Monsoon Experiment (FGGE/GWE) in Bay of Bengal (NSF)

2. SERVICE TO COMMUNITY:

a. Scientific Programs

He has been chairman/member of numerous national and international panels and committees concerned with the advancement of the atmospheric and oceanic sciences including the monsoon climate program of the World Meteorological Organization. He was the **founding member/chair** of the scientific steering group of the following national and international programs:

- MONEX – Monsoon Experiment (US and WCRP)
- STI – Science and Technology Inititative (US – India)
- TRMM – Tropical Rain Measurement Mission (NASA)
- DERF – Dynamical Extended Range Forecasting (NAS/NRC)
- TOGA – Tropical Ocean Global Atmosphere (US and WCRP)
- GOALS – Global Ocean Atmosphere Land Systems (NAS/NRC)
- CLIVAR – Climate Variability (International SSG)
- ERA – External Advisory Committee on ECMWF Reanalysis
- GCIP – GEWEX Continental Scale Project (CLIVAR)
- ACCP – Atlantic Climate Change Program (NOAA)
- SIMAP – Seasonal-Interannual Modeling & Prediction (US CLIVAR)
- AAMWG – Asian Australian Monsoon Working Group (US CLIVAR)
- COPES- Coordinated Obs. and Prediction of the Earth System (WCRP)
- JSCMP- Joint Scientific Committee Modeling Panel (WCRP)

b. Institution Building

i. COLA and IGES, USA

He is the founder of the Institute of Global Environment and Society (a non-profit institute registered in Maryland) and the Center for Ocean-Land-Atmosphere Studies (COLA). IGES and COLA freely provide models, data, and data analysis and display software (GrADS) to the research community. COLA has also developed a desktop weather forecast system that can be used for research and operational forecasts.

ii. NCMRWF, India

When India received the first supercomputer from the USA under a special (Ronald Reagan-Rajiv Gandhi) agreement for monsoon forecasting, he was invited by India to establish the scientific infrastructure of the monsoon forecast supercomputer center in New Delhi. He was the scientific leader in establishing the National Center for Medium Range Weather Forecasting (NCMRWF) in New Delhi, India. He helped recruit the scientific staff and implemented a global data analysis-assimilation-forecast system in India to make weather forecasts using a global model.

iii. Physics of Weather and Climate, Italy

He conducted regular workshops, symposia and training courses for the benefit of the scientists from developing countries at the International Center for Theoretical Physics (ICTP), Trieste, leading to the establishment of a permanent research group at ICTP.

iv. **CPTEC, Brazil**
He organized the training of researchers from Brazil at COLA to use and develop the COLA atmosphere model for routine weather predictions at CPTEC, Cachoeira Paulista, Brazil.

v. **IRI, USA**
He was one of the members of the group that proposed the scientific plan for the establishment of the International Research Institute for Climate Prediction at Columbia University, New York.

vi. **IPRC, USA**
He was one of the members of the Science Working Group that prepared the scientific plan for the establishment of the International Pacific Research Center at Univ. of Hawaii, Honolulu.

vii. **Gandhi College, India**
He has established a degree college for the education of students, especially women, in the rural village of Mirdha in the Ballia district of India.

viii. **Climate Dynamics, GMU, USA**
He is the founding chair of the Climate Dynamics Ph.D. program which he helped establish at George Mason University.

3. SCIENTIFIC CONTRIBUTIONS:

c. Scientific Basis for Dynamical Extended Range Forecasting (DERF)

One of his most significant contributions was the advancement of the hypothesis that the spatially and temporally averaged atmospheric circulation is dynamically predictable for periods beyond the limits of deterministic weather prediction. This work, in conjunction with Miyakoda's pioneering research on monthly forecast experiments, provided a scientific basis for Dynamic Extended Range Forecasting (DERF). His innovative GCM experiments on the predictability of monthly averages and his sensitivity experiments on the influence of boundary conditions were crucial in persuading an otherwise skeptical community that there is a physical basis in dynamically predicting monthly and seasonal averages. It is likely that, in the not too distant future, seasonal predictions of the atmospheric circulation and rainfall will be done routinely using dynamical models.

d. Boundary Forcings as a Mechanism for the Interannual Variability of the Atmospheric Circulation

He presented a simple paradigm for mechanisms that determine the interannual variability of the atmospheric circulation. He suggested that for conceptual simplicity it is useful to consider the total variability as consisting of that due to the internal dynamics and that due to variations in the boundary conditions. He carried out a large number of GCM sensitivity experiments and diagnostic studies to model the effects of variations in different boundary conditions. He was awarded the NASA Gold Medal for Exceptional Scientific Achievement with the following citation:

For distinguished scientific contributions to the physical understanding of the role of the earth surface boundary forcings on the predictability of the large scale climate fluctuations through observational analysis and numerical modeling experiments, and for management and leadership of an outstanding climate modeling group.

e. Predictability of the Tropical Atmosphere

He was the first to point out (Shukla 1981) that the theoretical limit of deterministic prediction for the tropics is considerably smaller (3-7 day) than that for the mid-latitudes (2-3 weeks). This is because the tropical errors, largely influenced by moist-convection, reach their climatological saturation values much more quickly than in mid-latitudes. The magnitudes of these saturation values are small compared to those for mid-latitudes. He also pointed out that, for the same reason, monthly and seasonal averages are potentially far more predictable in the tropics because they are primarily determined by variations in the boundary conditions.

f. Monsoon Dynamics

In his Ph.D. thesis he proposed a theory for the formation of monsoon disturbances, locally referred to as monsoon depressions, that form over the Bay of Bengal and move over India. He showed that these disturbances represent on instability of the horizontally and vertically shearing monsoon winds modified by moist convection. This was the first attempt to carry out linear instability analysis with horizontal and vertical shear and moist convection as represented by the Arakawa and Schubert parameterization.

g. Monsoon predictability

Both his pioneering numerical experiment on the influence of Arabian Sea SST on the Indian monsoon using the GFDL model and diagnostic studies with D. Hahn at GFDL on the relationship between Eurasian snow cover and the Indian monsoon rainfall formed the basis for Charney and Shukla to suggest that monsoons have a degree of predictability due to the effects of the boundary conditions.

h. Long Range Forecasting of Monsoons

In a collaborative study with Paolino he showed that the summer monsoon rainfall over India is far more strongly correlated with the tendency of the Southern Oscillation in the preceding winter and spring season than the Southern Oscillation itself. This simple diagnostic result gave a clear explanation for the failure of Walker's attempt to forecast monsoon rainfall using the Southern Oscillation.

i. Land-Climate Interactions (deforestation, desertification)

An idealized study by Shukla and Mintz (1982) on the role of land surface evapotranspiration on climate combined with the earlier works of Charney on the influence of changes in albedo helped establish the importance of land surface processes in climate variability and predictability. He and his colleagues have shown that: Amazon deforestation can produce significant changes in temperature, evaporation and rainfall; the climatic effects of deforestation are largely determined by changes in albedo; although the Sahel drought was probably initiated by planetary scale atmosphere-ocean-land interactions, the local land-surface effects play an important role in perpetuating the drought; and initial values of soil wetness are important in determining seasonal mean temperature and rainfall.

j. Predictability of Weather and Climate

He has carried out a large number of predictability studies using atmospheric GCMs to investigate the predictability of weather, predictability of monthly and seasonal averages; predictability of tropical oceans; and predictability of the coupled ocean-atmosphere system.

k. Reanalysis

He is one of the pioneers of reanalysis. As a member of the US TOGA panel and the scientific steering group of the international TOGA, he put forward the idea of reanalysis. Bengtsson and Shukla published a paper in 1988 advancing the concept of reanalysis. To test the feasibility of reanalysis, COLA carried out a pilot reanalysis project. His suggestions on reanalysis to produce climate data sets, which were not well received in the beginning, have now been accepted by the entire community and several groups around the world are carrying out reanalysis to produce data for climate research.

l. Predictability in the midst of chaos

Synthesizing many years of research on climate predictability, he published a paper in *Science* in 1998 to confirm the scientific basis for climate prediction. This has clarified an apparent contradiction between the lack of weather predictability beyond two weeks and the very high predictability of seasonal means for periods well beyond the limit of weather predictability.

4. PUBLICATIONS

2006

DelSole, T., and J. Shukla, 2006: Specification of Wintertime North American Surface Temperature. *J. Climate* (in press).

Huang, B., and J. Shukla, 2006a: On the mechanisms of the interannual variability in the tropical Indian Ocean, Part I: The role of remote forcing from tropical Pacific. *J. Climate* (in press).

Huang, B., and J. Shukla, 2006b: On the mechanisms of the interannual variability in the tropical Indian Ocean, Part II: Regional processes. *J. Climate* (submitted).

Shukla, J., T. DelSole, M. Fennessy, J. Kinter, and D. Paolino, 2006: Climate Model Fidelity and Projections of Climate Change. *GRL* (submitted).

Shukla, J. and J. L. Kinter III, 2006: Predictability of seasonal climate variations: A pedagogical review. In Predictability of Weather and Climate, T. Palmer and R. Hagedorn, eds. (in press).

2005

Huang, B., and J. Shukla, 2005: The ocean-atmosphere interactions in the tropical and subtropical Atlantic Ocean. *J. Climate*, 18, 1652-1672.

Kang, I.-S. and J. Shukla, 2005: Dynamical seasonal prediction and predictability of monsoon. In *The Asian Monsoon* (B. Wang, ed.), Praxis Pub. Ltd., Chichester, UK., 585-612

Wang, B., Q. Ding, X. Fu, I.-S. Kang, K. Jin, J. Shukla and F. Doblas-Reyes, 2005: Fundamental challenge in simulation and prediction of summer monsoon rainfall. *Geophys. Res. Lett*., **32**, L15711, doi: 10.1029/2005GL022734.

2003

Straus D., D. Paolini, J. Shukla, S. Schubert, M. Suarez, P. Pegion, and A. Kumar, 2003: Predictability of the Seasonal Mean Atmospheric Circulation During Autumn, Winter and Spring. *J. climate*, **16**, No. 22, 3629-3649.

2002

Del Sole, T., and J. Shukla, 2002: Linear prediction of Indian monsoon rainfall. *J. Climate,* **15,** 3645-3658.

Kang, I.-S., K. Jin, K.-M. Lau, J. Shukla, V. Krishnamurthy, and coauthors, 2002a: Intercomparison of atmospheric GCM simulated anomalies associated with the 1997-98 El Niño event. *J. Climate,* **15,** 2791-2805.

Kang, I.-S., K. Jin, B. Wang, K.-M. Lau, J. Shukla, V. Krishnamurthy, and coauthors, 2002b: Intercomparison of the climatological variations of Asian summer monsson precipitation simulated by 10 GCMs. *Climate Dyn*., **19,** 383-395.

Kirtman, B. P., and J. Shukla, 2002: Interactive coupled ensemble: A new coupling strategy for CGCMs. *Geophys. Res. Lett.*, **29**, 1367, doi:10.1029/2002GLO14834.

Straus, D. M., and J. Shukla, 2002: Does ENSO force the PNA? *J. Climate*, **15**, 2340 - 2358.

2001

Blackmon, M., …, J. Shukla, …, E. K. Schneider, and coauthors, 2001: The Community Climate System Model. *Bull. Amer. Meteor. Soc*., **82**, 2357-2376.

Kirtman, B. P., J. Shukla, M. Balmaseda, N. Graham, C. Penland, Y. Xue, S. Zebiak, 2001c: Current status of ENSO forecast skill. *World Climate Research Program (WRCP) Report,* 23/01, 26 pp.

Krishnamurthy, V., and J. Shukla, 2001: Observed and model simulated interannual variability of the Indian monsoon. *Mausam*, **52**, 133-150.

Shukla, J. (ed.), 2001: *Dynamics of Large-Scale Atmospheric and Oceanic Processes: Selected Papers of Jule Gregory Charney*. A. Deepak Publ. (Hampton, VA, 611 pp).

2000

Kirtman, B. P., and J. Shukla, 2000: Influence of the Indian Summer Monsoon on ENSO. *Quart. J. Royal Meteor. Soc.*, **126**, 213-239.

Krishnamurthy, V. and J. Shukla, 2000: Intraseasonal and interannual variability of rainfall over India. *J. Climate*, **13**, 4366-4377.

Reale, O. and J. Shukla, 2000: Modeling the effects of vegetation on Mediterranean climate during the Roman classical period. Part II: Model simulation. *Global and Planetary Change,***25**, 185-214.

Shukla, J., D. A. Paolino, D. M. Straus, D. DeWitt, M. Fennessy, J. L. Kinter, L. Marx and R. Mo, 2000: Dynamical Seasonal Predictions with the COLA Atmospheric Model. *Quart. J. Royal. Meteor. Soc.,***126**, 2265-2291.

Shukla, J., J. Anderson, D. Baumhefner, C. Brankovic, Y. Chang, E. Kalnay, L. Marx, T. Palmer, D. A. Paolino, J. Ploshay, S. Schubert, D. M. Straus, M. Suarez, J. Tribbia, 2000: Dynamical Seasonal Prediction, *Bull. Amer. Meteor. Soc.*, **81**, 2593-2606.

Straus, D. M. and J. Shukla, 2000: Distinguishing between the SST-forced variability and internal variability in mid-latitudes: Analysis of observations and GCM simulations. *Quart. J. Royal Meteor. Soc,***126**, 2323-2350.

1999

Bamzai, A. S., and J. Shukla, 1999: Relation between Eurasian Snow Cover, Snow Depth, and the Indian Summer Monsoon: An Observational Study. *J. Climate*, **12**, 3117-3132.

Fennessy, M. J., and J. Shukla, 1999: Impact of Initial Soil Wetness on Seasonal Atmospheric Prediction. *J. Climate*, **12,** 3167-3180.

Schneider, E. K., B. Huang, D. G. DeWitt, J. L. Kinter, B. P. Kirtman, and J. Shukla, 1999: Ocean Data Assimilation Initialization and Prediction of ENSO with a Coupled GCM. *Mon. Wea. Rev*., **127**, 1187-1207.

Shukla, J., J. L. Kinter, E. K. Schneider, D. M. Straus, 1999: Chapter 3: Modeling of the Climate System. Climate Change: an integrated perspective. Kluwer Academic Publishers, Editors: P. Mertens and J. Rotmans, 51-104.

1998

Shukla, J., 1998: Predictability in the Midst of Chaos: A Scientific Basis for Climate Forecasting. *Science*, **282**, 728-731.

Webster, P.J., V.O. Magana, T.N. Palmer, J. Shukla, R.A. Tomas, M. Yanai, and T. Yasunari, 1998: The monsoon: Processes, predictability, and prediction. *J. Geophys. Res*., **103**, 14451-14510.

Xue, Y. and J. Shukla, 1998: Model Simulation of the Influence of Global SST Anomalies on the Sahel Rainfall. *J. Climate*, **126**, 2782-2792.

1997

Huang, B., and J. Shukla, 1997a: An examinationof AGCM simulated surface wind stress and low level winds over the tropical Pacific Ocean. *Mon. Wea. Rev.*, **125**, 985-998.

Huang, B., and J. Shukla, 1997b: Characteristics of interannual and decadal variability in a general circulation model of the tropical Atlantic Ocean. *J. Phys. Oceanogr*., **27**, 1693-1712.

Kirtman, B.P., J. Shukla, B. Huang, Z. Zhu and E.K. Schneider, 1997: Multiseasonal predictions with a coupled tropical ocean global atmosphere system. *Mon. Wea. Rev.*, **125**, 789-808.

Schneider, E.K., Z. Zhu, B. Huang, B. Giese, B.P. Kirtman, J. Shukla, and J. Carton, 1997: ENSO variability in a coupled general circulation model. *Mon. Wea. Rev.*, **125**, 680-702.

Straus, D.M., and J. Shukla, 1997: Variations of mid-latitude transient dynamics associated with ENSO. *J. Atmos. Sci.*, **54**, 777-790.

1996

Dirmeyer, P.A., and J. Shukla, 1996: The effect on regional and global climate of expansion of the World's deserts. *Quart. J. Roy. Meteor. Soc.*, **122**, 530, 451-482.

Huang, B. and J. Shukla, 1996: A comparison of two surface wind analyses over the tropical Atlantic during 1980-87. *J. Climate*, **9**, 906-927.

Nobre. P. and J. Shukla, 1996: Variations of sea surface temperature, wind stress and rainfall over the tropical Atlantic and South America. *J. Climate*, **9**, 2464-2479.

Xue, Y. and J. Shukla, 1996: The influence of land surface properties on Sahel climate. PART II: Afforestation. *J. Climate*, **9**, 3260-3275.

1995

Huang, B., J.A. Carton and J. Shukla, 1995: A numerical simulation of the variability in the tropical Atlantic Ocean, 1980-88. *J. Phys. Oceanog*., **25**, 835-854.

Paolino, D. A., Q. Yang, B. Doty, J. Kinter, J. Shukla, D. Straus, 1995: Results of a pilot reanalysis project at COLA. *Bulletin of the American Meterological Society*, **76**, 697-710.

Schneider, E.K., B. Huang, and J. Shukla, 1995: Ocean Wave Dynamics of El Niño. *J. Climate*, **8**, 2415-2439.

Shukla, J. 1995: On the initiation and persistence of the Sahel drought. *Natural Climate Variability on Decade-to-Century Time Scales*, National Academy Press, Washington, D.C., 44-48.

1994

Dirmeyer, P. A. and J. Shukla, 1994: Albedo as a modulator of climate response to tropical deforestation. *J. Geophys. Res.*, **99**, 923-935.

Fennessy, M. J. and J. Shukla, 1994: GCM Simulations of active and break monsoon periods. Proc. MONEG International Conference on Moonsoon Variability and Prediction, Trieste, Italy, 9-13 May, 1994.

Fennessy, M. J., J. L. Kinter III, B. Kirtman, L. Marx., S. Nigam, E. Schneider, J. Shukla., D. Straus. A. Vernekar, Y. Xue, and J. Zhou, 1994: The simulated Asian monsoon: A GCM sensitivity study. *J. Climate*, **7**, 33-43.

Vernekar, A., J. Zhou and J. Shukla, 1994: The effect of Eurasian snow cover on Indian monsoon. *J. of Climate*, **8**, 248-266.

Yang, R., M. J. Fennessy and J. Shukla, 1994: The influence of initial soil wetness on medium range surface weather forecasts, *Mon. Wea. Rev*., **122**, 471-485.

Yang, R., J. Shukla and P. J. Sellers, 1994: The influence of changes in vegetation type on the surface energy budget. Advances in Atmospheric Sciences, **11**, 139-161.

1993

Dirmeyer, P. A. and J. Shukla, 1993: Observational and Modeling Studies of the Influence of Soil Moisture Anomalies on Atmospheric Circulation (Review). *Prediction of Interannual Climate Variations*. NATO ASI Series I: Global Environmental Change, **Vol. 6**, Editor: J. Shukla, 1-24.

Fennessy, M.J., J.L. Kinter III, L. Marx, P. Sellers and J. Shukla, 1993: Influence of initial soil wetness on GCM simulation of th 1988 U.S. drought and heat wave. **Conference on Hydroclimatology** (Anaheim, CA, 17-22 January 1993).

Goswami, B. N. and J. Shukla, 1993: Aperiodic variability in the Cane-Zebick model: A diagnostic study. *J. Climate*, **5,** 628-638.

Robinson, A.R., C.J. Garrett, P. Malanotte-Rizzoli, S. Manage, S.G. Philander, N. Pinardi, W. Roether, F.A. Schott and J. Shukla, 1993: Mediterranean and Global Ocean and Climate Dynamics. *EOS Transactions*, American Geophysical Union, **Vol. 74**, No. 44, 506-507.

Shukla, J. 1993: Predictability of short-term climate variations. *Prediction of Interannual Climate Variations*. NATO ASI Series I: Global Environmental Change, **Vol. 6**, Editor: J. Shukla, 217-232.

Vernekar, A., J. Zhou and J. Shukla, 1993: The effect of Eurasian spring snow cover on Indian summer monsoon. *WCRP-80, WMO/TD-No. 546*, 69-73.

Xue, Y. and J. Shukla, 1993: The influence of land surface properties on Sahel climate. **PART I:** Desertification. *J. Climate,* **6**, 2232-2245.

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