# CURRICULUM VITAE

Bhabani Sankar Das, PhD (USA)
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## Research Experience

Solute transport, water flow, diffuse reflectance spectroscopy, digital soil mapping, multispectral and hyperspectral remote sensing of land and water resources

## Education

1996 Ph.D., Soil Physics, Kansas State University, Manhattan, Kansas, USA
1991 M. Sc., Soil Science and Agricultural Chemistry, OUAT, Bhubaneswar, India
1988 B. Sc., Agriculture, OUAT, Bhubaneswar, India

## Professional Experience

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|---|---|---|
| 2014 - Present | Professor | IIT Kharagpur, INDIA |
| 2007 - 2014 | Associate Professor | IIT Kharagpur, INDIA |
| 2002 - 2003 | Visiting Professor | Purdue Univ., West Lafayette, USA |
| 1999 - 2007 | Assistant Professor (Soil Science) | IIT Kharagpur, INDIA |
| 1999 - 1999 | Post-Doctorate (Hydrology) | NMIMT, Socorro, New Mexico, USA |
| 1996 - 1999 | Post-Doctorate (Soil Physics) | MSU, Bozeman, Montana, USA |
| 1992 - 1996 | Research Assistant (Agronomy) | KSU, Manhattan, Kansas, USA |
| 1991 - 1992 | Extension Specialist (Soils) | OUAT, Keonjhar, Orissa, INDIA |

## Awards and Honors

Fellow, Department of Foreign Affairs and Trade, Australia, 2016
Delivered 9th Dr. T. D. Biswas Memorial Lecture, ICAR, 2015
Gamma Sigma Delta Outstanding Graduate Student Award, 1997
Irvin D. and Dora Mae Atkins Graduate Scholarship, 1996
Roscoe Ellis, Jr. Soil Science Graduate Scholarship, 1995
University Gold Medal for First Position in M. Sc. (Ag), 1991
Junior Research Fellowship, Indian Council of Agricultural Research, 1988-1990
National Scholarship, Govt. of Orissa, 1982-1988

## Professional Activities

Guest Editor, Ecotoxicology and Environmental Safety
Associate Editor, Agricultural Water Management
Guest Editor, Frontiers in Plant Science
Member, Editorial Board, Indian J. Agricultural Physics
Member, Soil Science Society of America
National Coordinator, Hyperspectral Remote Sensing in Water Resources, DST, New Delhi
Life Member, Indian Society of Soil Science
Member, PMKSY-Soil Health Mapping, ICRISAT, Patancheru, 2016.

## Teaching Experience

My primary teaching responsibility is in the area of flow and transport processes in soil, introductory soil science, soil-plant-water relationships, and modelling of agricultural systems.

**Student Supervision:** PhD Students: 14; B. Tech. and M. Tech. Student: 45+

**Sponsored Research and Consultancy:** ~2 Crore INR (Last 5 years)

**Publications**

**A. Peer-Reviewed Journal Papers:**


1. Reddy, N.N. and Das, B.S., 2023. Digital soil mapping of key secondary soil properties using pedotransfer functions and Indian legacy soil data. **Geoderma**, 429, p.116265.
2. Roy, S. and Das, B.S., 2022. Estimation of Euphotic Zone Depth in Shallow Inland Water using Inherent Optical Properties and Multispectral Remote Sensing Imagery. **Journal of Hydrology**, p.128293.
3. Roy, S., Ojha, S. R., Reddy, N. N., Samal, R. N. and Das, B. S., 2022. Suspended Particulate Matter and Secchi Disk Depth in the Chilika Lagoon from In Situ and Remote Sensing Data: A Modified Semi-Analytical Approach. **International J. Remote Sensing**. 43:10, 3628-3654, DOI: 10.1080/01431161.2022.2102953.
4. Das, B.S., Wani, S.P., Benbi, D.K., Muddu, S., Bhattacharyya, T., Mandal, B., Santra, P., Chakraborty, D., Bhattacharyya, R., Basak, N. and Reddy, N.N., 2022. Soil Health and its Relationship with Food Security and Human Health to Meet the Sustainable Development Goals in India. **Soil Security**, p.100071.
5. Purushothaman, N. K., Reddy, N. N., and Das, B.S., 2022. National-scale maps for soil aggregate size distribution parameters using pedotransfer functions and digital soil mapping data products. **Geoderma**, 424, 116006.
6. Ganguli, P., Singh, B., Reddy, N.N., Raut, A., Mishra, D. and Das, B.S., 2022. Climate-catchment-soil control on hydrological droughts in peninsular India. **Nature Scientific Reports**, 12(1), pp.1-14.
7. Vasava, H.B. and Das, B.S., 2022. Assessment of Soil Properties using Spectral Signatures of Bulk Soils and Their Aggregate Size Fractions. **Geoderma**, 417, p.115837.
8. Shekhar, S., Mailapalli, D.R., Das, B.S., Mishra, A. and Raghuwanshi, N.S., 2021. Hydrus-1D for Simulating Potassium Transport in Flooded Paddy Soils. **Communications in Soil Science and Plant Analysis**, 52(22), pp.2803-2820.
9. Swain, S.R., Chakraborty, P., Panigrahi, N., Vasava, H.B., Reddy, N.N., Roy, S., Majeed, I. and Das, B.S., 2021. Estimation of soil texture using Sentinel-2 multispectral imaging data: An ensemble modeling approach. **Soil and Tillage Res.**, 213, p.105134.
10. Mishra, D., Das, B. S., Sinha, T., Hoque, J. M., Reynolds, C., Islam, M. R., Hossain, M., Sar, P, and Menon, M. 2021. Living with arsenic in the environment: An examination of current awareness of farmers in the Bengal basin using hybrid feature selection and machine learning, **Environment International**, 153: 106529.
11. Begum, N., Maiti, A., Chakravarty, D. and Das, B.S., 2021. Diffuse Reflectance Spectroscopy based Rapid Coal Rank Estimation: A Machine Learning Enabled Framework. **Spectrochimica Acta** Part A: Molecular and Biomolecular Spectroscopy, p.120150.
12. Reddy, N.N., Chakraborty, P., Roy, S., Singh, K., Minasny, B., McBratney, A.B., Biswas, A. and Das, B.S., 2021. Legacy data-based national-scale digital mapping of key soil properties in India. **Geoderma**, 381:114684.
13. Panigrahi, N. and Das, B.S., 2021. Evaluation of regression algorithms for estimating leaf area index and canopy water content from water stressed rice canopy reflectance. **Information Processing in Agriculture**, 8(2), pp.284-298.
14. Seema, C., Ghosh, A.K., Das, B.S. and Reddy, N., 2020. Application of VIS-NIR spectroscopy for estimation of soil organic carbon using different spectral

preprocessing techniques and multivariate methods in the middle Indo-Gangetic plains of India. **Geoderma Regional**, 23, p.e00349.
15. Chakraborty, P., Das, B. S., Vasava, H. B., Panigrahi, N., and Santra, P. 2020. Spatial structure, parameter nonlinearity, and intelligent algorithms in constructing pedotransfer functions from large-scale soil legacy data. **Nature Scientific Report**s 10(1): 1-3
16. Begum, N., Maiti, A., Chakravarty, D. and Das, B.S., 2020. Reflectance spectroscopy based rapid determination of coal quality parameters. **Fuel**, *280*, p.118676.
17. Shekhar, S., Mailapalli, D.R., Raghuwanshi, N.S. and Das, B.S., 2020. Hydrus-1D model for simulating water flow through paddy soils under alternate wetting and drying irrigation practice. **Paddy and Water Environ.**, 18:73-85.
18. Joshi, D.C., Iden, S.C., Peters, A., Das, B.S. and Durner, W., 2019. Temperature Dependence of Soil Hydraulic Properties: Transient Measurements and Modeling. **Soil Sci. Soc. Am. J.,** 83:1628–1636, doi:10.2136/sssaj2019.04.012
19. Singh, K., Majeed, I., Panigrahi, N., Vasava, H.B., Fidelis, C., Karunaratne, S., Bapiwai, P., Yinil, D., Sanderson, T., Snoeck, D. and Das, B.S., 2019. Near infrared diffuse reflectance spectroscopy for rapid and comprehensive soil condition assessment in smallholder cacao farming systems of Papua New Guinea. **Catena**, *183*, p.104185.
20. Singh, K., Vasava, H. B., Snoeck, D., Das, B. S., Yinil, D., Field, D., Majid, I., Panigrahi, N. 2019. Assessment of cocoa fertiliser needs using soil types and soil spectral analysis. **Soil Use and Management**. 1-11.
21. Begum, N., Chakravarty, D., & Das, B. S. 2019. Estimation of Gross Calorific Value of Bituminous Coal using various Coal Properties and Reflectance Spectra. **Int. J. Coal Preparation and Utilization**, 1-7.
22. Kumar, A., Nayak, A.K., Das, B.S., Panigrahi, N., Dasgupta, P., Mohanty, S., Kumar, U., Panneerselvam, P. and Pathak, H., 2019. Effects of water deficit stress on agronomic and physiological responses of rice and greenhouse gas emission from rice soil under elevated atmospheric CO2. **Sci. of The Total Environ.**, *650*, 2032-2050.
23. Kumar, A., Nayak, A.K., Pani, D.R. and Das, B.S., 2019. Application of Phosphorus, Iron, and Silicon Reduces Yield Loss in Rice Exposed to Water Deficit Stress. **Agronomy J.**. 111 (3), 1488-1497.
24. Ng, W., Minasny, B., Malone, B.P., Sarathjith, M.C. and Das, B.S., 2019. Optimizing wavelength selection by using informative vectors for parsimonious infrared spectra modelling. **Computers and Electronics in Agril.**, 158, pp.201-210.
25. Vasava, H.B., Gupta, A., Arora, R. and Das, B.S., 2019. Assessment of soil texture from spectral reflectance data of bulk soil samples and their dry-sieved aggregate size fractions. **Geoderma**, 337, pp.914-926.
26. Panigrahi, N., B. S. Das. 2019. Data from: Canopy spectral reflectance as a predictor of soil water potential in rice, **Dryad, Dataset, https://doi.org/10.5061/dryad.2fq726m**
27. Chakraborty, P. and Das, B.S., 2018. Measurement and Modeling of Longitudinal Dispersivity in Undisturbed Saturated Soil: An Experimental Approach. **Soil Sci. Soc. Am. J.,** 82:1117–1123 doi:10.2136/sssaj2018.05.0176
28. Panigrahi, N. and Das, B. S. 2018. Canopy Spectral Reflectance as a Predictor of Soil Water Potential in Rice. **Water Resour. Res**., 54:1-17.
29. Gupta, A, Vasava, H. B., Das, B. S., and Choubey, A. K. 2018. Local modeling approaches for estimating soil properties in selected indian soils using diffuse reflectance data over visible to near-infrared region. **Geoderma**, 325, 59–71.
30. Raj, A., Chakraborty, S., Duda, B.M., Weindorf, D.C., Li, B., Roy, S., Sarathjith, M.C., Das, B.S. and Paulette, L., 2018. Soil mapping via diffuse reflectance spectroscopy

based on variable indicators: An ordered predictor selection approach. **Geoderma,** 314, pp.146-159.
31. Minasny, B., Arrouays, D., McBratney, A.B., Angers, D.A., Chambers, A., Chaplot, V., Chen, Z.S., Cheng, K., Das, B.S., Field, D.J. and Gimona, A., 2018. Rejoinder to Comments on Minasny et al., 2017 Soil carbon 4 per mille Geoderma 292, 59--86. **Geofisica Internacional**, 309, pp.124-129.
32. Haritha, D, Chakraborty, S., & Das, B. S. Mallick, N., Kotamreddy, N. 2017.Rapid Assessment of Algal Biomass and Pigment Contents Using Diffuse Reflectance Spectroscopy and Chemometrics. **Algal Res.**, 27, 274-285
33. Chakraborty, S., Li, B., Deb, S., Paul, S., Weindorf, D. C., & Das, B. S. 2017. Predicting soil arsenic pools by visible near infrared diffuse reflectance spectroscopy. **Geoderma**, 296, 30-37.
34. Kumar, A., Nayak, A. K., Pani, D. R., & Das, B. S. 2017. Physiological and morphological responses of four different rice cultivars to soil water potential based deficit irrigation management strategies. **Field Crops Research**, 205, 78-94.
35. Minasny, B., Malone, B. P., McBratney, A. B., Angers, D. A., Arrouays, D., Chambers, A., Chaplot, V., Chen Z. S., Cheng K., Das B.S., Field D. J., Gimona A., Hedley C.B., Hong S.Y., Mandal B., Marchant B.P., Martin M., Mcconkey B.G., Mulder V.L., O'Rourke S., Richer-de-Forges A.C., Odeh I., Padarian J., Paustian K., Pan G., Poggio L., Savin I., Stolbovoy V., Stockmann U., Sulaeman Y., Tsui C.C., Vågen T.G., Wesemael B.V., & Winowiecki L. 2017. Soil carbon 4 per mille. **Geoderma**, 292, 59-86.
36. Chakraborty, P., Das, B. S., & Singh, R. 2017. An Ensemble Modeling Approach for Estimating Diffusive Tortuosity for Saturated Soils From Porosity. **Soil Sci.**, 182(2), 45-51.
37. Sarathjith, M. C., B. S. Das, S. P. Wani, and K. L. Sahrawat, A. Gupta. 2016. Assessment of nutrient contents of Indian soils using diffuse reflectance spectroscopy. **Curr. Sci.** 110(6):1031-1037.
38. Gupta, A, B. S. Das, A. Kumar, P. Chakraborty, B. Mohanty. 2016. Rapid assessment of Atterberg limits using diffuse reflectance spectroscopy. **Soil Sci. Soc. Am. J.**, 80(5): 1283:1295.
39. Panigrahi, N., C. S. Bhol, B. S. Das. 2016. Rapid assessment of black tea quality using diffuse reflectance spectroscopy. **J. Food Engg.**, 190:101-108.
40. Kumar, A., A. K. Nayak, S. Mohanty, B. S. Das. 2016. Greenhouse gas emission from direct seeded paddy fields under different soil water potentials in Eastern India. **Agril., Ecosystems and Environ.**, 228:111-123.
41. Sahadevan, A. S., Routray, A., Das, B. S., & Ahmad, S. (2016). Hyperspectral image preprocessing with bilateral filter for improving the classification accuracy of support vector machines. **J. Applied Remote Sensing**, 10(2), 025004-025004.
42. Sarathjith , M. C., B. S. Das, S. P. Wani, and K. L. Sahrawat. 2016. Variable indicators for optimum wavelength selection in diffuse reflectance spectroscopy of soils. **Geoderma**. 267:1-9.
43. Mohanty, B., A. Gupta, B. S. Das. 2016. Estimation of weathering indices using spectral reflectance over visible to mid-infrared region. **Geoderma**. 266:111-119.
44. Das, B. S., Vasava, H. B., Sarathjith, M. C., & Mohanty, B. (2015). Variance of Aggregate Size Distribution as a Criterion for Soil Similarity. **Vadose Zone J.**, 14(10).
45. Das, B. S., M. C. Sarathjith, P. Santra, R. N. Sahoo, R. Srivastava, A. Routray, S. S. Ray. 2015. Hyperspectral Remote Sensing: Opportunities, Status and Challenges for Rapid Soil Assessment in India. **Curr. Sci.** 108(5):860-868.

46. Santra, P., R. Singh, M. C. Sarathjith, N. R. Panwar, P. Varghese, B. S. Das. 2015. Reflectance spectroscopic approach for estimation of soil properties in hot arid western Rajasthan, India. **Environ. Earth Sci.** DOI 10.1007/s12665-015-4383-x.
47. Dasgupta P., B. S. Das, S. K. Sen. 2015. Soil Water Potential and Recoverable Water Stress in Drought Tolerant and Susceptible Rice Varieties. **Agril. Water Manage**. 152: 110–118.
48. Chakraborty, P. and B. S. Das. 2014. Measurement and Modeling of Diffusive Tortuosity in Saturated Soils: A Pedotransfer Function Approach **Soil Sci. Soc. Am. J.** doi:10.2136/sssaj2014.04.0175
49. Sarathjith , M. C., B. S. Das, S. P. Wani, and K. L. Sahrawat. 2014. Dependency measures for assessing the covariation of spectrally active and inactive soil properties, **Soil Sci. Soc. Am. J.** doi:10.2136/sssaj2014.04.0173
50. Chakraborty, S., B. S. Das, Md. N. Ali, B. Li, M. C. Sarathjith, K. Majumdar, D.P. Ray. 2014. Rapid Estimation of Compost Enzymatic Activity by Combined Spectral and Machine Learning Approach. **Waste Management**. 34. 623-631.
51. Sarathjith , M. C., B. S. Das, H. V. Vasava, B. Mohanty, S. S. Anand, S. P. Wani, and K. L. Sahrawat. 2014. Diffuse Reflectance Spectroscopic Approach for the Characterization of Soil Aggregate Size Distribution, **Soil Sci. Soc. Am. J.** 78:369–376.
52. Anand, S. S., P. Shrivastava, B. S. Das, and M. C. Sarathjith. 2013. Discrete Wavelet Transform Approach for the Estimation of Crop Residue Content from Spectral Reflectance. **IEEE, J. Selected Topics in Applied Earth Observations and Remote Sensing**. DOI: 10.1109/JSTARS.2013.2280894
53. Patil, M. D. and B. S. Das. 2013. Assessing the effect of puddling on preferential flow processes through under bund area of lowland rice field. **Soil and Tillage Res.** 134: 61-71.
54. Santra, P. and B. S. Das. 2013. Modeling Runoff from an agricultural watershed of Western Catchment of Chilika Lake through ArcSWAT. **J. Hydro-Environ. Res**.:1-9.
55. Santra, P., B. S. Das, D. Chakravarty. 2012. Spatial prediction of soil properties in a watershed scale through maximum-likelihood approach. **Environ. Earth Sci.**, 56(7): 2051-2061
56. Patil, M. D., B. S. Das, P. B. S. Bhadoria. 2011. A simple bund plugging technique for improving water productivity in wetland rice. **Soil and Tillage Res**. 112: 66-75.
57. Santra,P., B. S. Das, D. Chakravarty. 2011. Delineation of hydrologically similar units in a watershed based on fuzzy classification of soil hydraulic properties. **Hydrologic Processes**, 25:64-79.
58. Kulluru, P. P., B. S. Das, and R. K. Panda. 2010. Evaluation of Sorption and Leaching Potential of Malathion and Atrazine in Agricultural Soils of India. **International J. Environ. Res.** 4:75-90.
**59.** Patil, M. D., B. S. Das, E. Barak, P. B. S. Bhadoria, A. Polak. 2010. Performance of polymer-coated urea in transplanted rice: effect of mixing ratio and water input on nitrogen use efficiency. **Paddy and Water Environ.** 8:189-198.
**60.** Ray, L. I. P., B. Mal, B. S. Das, S. P. Moulick, and N. Panigrahi, 2010. Aquaculture waste water as an irrigation source. Int. J. Sci. and Nat., (1), p.2.
**61.** Garg, K. K., B. S. Das, Md. Safeeq, and P. B. S. Bhadoria. 2009. Measurement and modeling of soil water regime in a lowland paddy field showing preferential transport. **Agril. Water Manage**. 96:1705-1714.
**62.** Santra, P., R. N. Sahoo, B. S. Das, R. N. Samal, A. K. Pattanaik, and V. K. Gupta. 2009. Estimation of Soil Hydraulic Properties using Spectral Reflectance in Visible and Near-Infrared Region. **Geoderma**. 152:338-349.

**63.** Santra, P. and B. S. Das. 2008. Pedotransfer Functions for Soil Hydraulic Properties Developed from a Hilly Watershed of Eastern India. **Geoderma**. 146: 439-448.

**64.** Perkins, D.B., N.W. Haws, J.W. Jawitz, B.S. Das, P.S.C. Rao. 2007. Soil hydraulic properties as ecological indicators in forested watersheds impacted by mechanized military training. **Ecological Indicator**. 7:589-597.

**65.** Das, B. **S.**, J. M. Wraith, G. J. Kluitenberg, H. M. Langner, P. J. Shouse, and W. P. Inskeep. 2005. Evaluation of mass recovery impacts on transport parameters using least-squares optimization and moment analysis. **Soil Sci. Soc. Am. J.** 69:1209-1216.

66. Das, B. S., N. W. Haws, and P. S. C. Rao. 2005. Defining geometric similarity in soils. **Vadose Zone J.** 4:264-270.

**67.** Haws, N. W., B. S. Das, and P. S. C. Rao. 2004. Dual-domain solute transfer and transport processes: Evaluation in batch and transport experiments. **J. Contam. Hydrol.** 75:257-280.

68. Das, B. S., L. S. Lee, P.S.C. Rao, and R. Hultgrens. 2004. Sorption and degradation of steroid hormones in soil during transport: Column studies and model evaluation. **Environ. Sci. and Technol.** 38:1460-1470.

**69.** Das, B. S., J. M. H. Hendrickx, and B. Borchers. 2001. Modeling transient water distributions around landmines in bare soils. **Soil Sci.** 166(3):163-173.

**70.** Das, B. S. and J. M. Wraith. 2000. Hydraulic property-based models to predict soil solution electrical conductivity under field conditions. **Water Resour. Res.** 36:3383-3387.

**71.** Das, B. S., J. M. Wraith, and W. P. Inskeep. 1999. Nitrate concentration in root zone estimated using time-domain reflectometry. **Soil Sci. Soc. Am. J.** 63(6):1561-1570.

**72.** Langner, H. W., W. P. Inskeep, H. M. Gaber, W. L. Jones**, B. S. Das**, J. M. Wraith. 1998. Pore water velocity and residence time effects on the degradation of 2,4-D during transport. **Environ. Sci. and Technol.** 32:1308-1315.

**73.** Wraith J. M. and B. S. Das. 1998. Monitoring water and ionic solute distribution using time domain reflectometry. **Soil and Tillage Res.**, 47:145-150.

**74.** Das, B. S., and G. J. Kluitenberg. 1996. Moment analysis to estimate degradation rate constants from leaching experiments. **Soil Sci. Soc. Am. J.**, 60:1724-1731.

**75.** Govindaraju, R. S., B. S. Das, and G. J. Kluitenberg. 1996. Cumulants-based analysis of input-output concentration data from soil column studies for system identification. American Society of Civil Engineering, **J. Hydrologic Eng**. 1:41-48.

**76.** Das, B. S**.**, G. J. Kluitenberg, and G. M. Pierzynski. 1995. Temperature dependence of nitrogen mineralization rate constant: A theoretical approach. **Soil Sci.** 159:294-300.

**77.** Kluitenberg, G. J., K. L. Bristow, and B. S.Das. 1995. Error analysis of the heat pulse method for measuring soil heat capacity, diffusivity, and conductivity. **Soil Sci. Soc. Am. J.**, 59(3):719-726.

**78.** Misra, C., B. C. Mohanty, B. S. Das, and N. K. Savant. 1995. Relationship between some selected soil properties and yield of transplanted rice fertilized with urea briquettes. **Oryza** 32:178–183.

**79.** Misra, C., P. K. Rath, D. Jena, and B. S. Das. 1994. Hydrological properties of a Typic Haplustult measured using a neutron hydroprobe and tensiometers. **J. Indian Soil Sci. Soc.** 42:172-177.

**B. Book**

80. Govindaraju, R. S. and **B. S. Das**. 2007. Moment analysis for subsurface hydrologic applications. Springer.

**C. Book Chapters and Proceeding Papers:**

81. Das B.S., Santra P., Ranjan R., Vasava H.B., Samal R.N., Pattnaik A.K. (2020) Assessment of Runoff and Sediment Yield from Selected Watersheds in the Western Catchment of the Chilika Lagoon. In: Finlayson C., Rastogi G., Mishra D., Pattnaik A. (eds) Ecology, Conservation, and Restoration of Chilika Lagoon, India. Wetlands: Ecology, Conservation and Management, vol 6. Springer, Cham. https://doi.org/10.1007/978-3-030-33424-6_7.
82. Menon, M., Casson, S.A., Warren, J.M., Das, B.S. and Mickelbart, M.V. eds., 2019. Water-Use Efficiency: Advances and Challenges in a Changing Climate.
83. Santra, P., Kumar, M., Panwar, N.R. and Das, B.S., 2017. Digital Soil Mapping and Best Management of Soil Resources: A Brief Discussion with Few Case Studies. In: Rakshit A., Abhilash P., Singh H., Ghosh S. (eds) Adaptive Soil Management: From Theory to Practices. Springer, Singapore. https://doi.org/10.1007/978-981-10-3638-5_1
84. Minasny, B., McBratney, A.B., Malone, B.P., Angers, D.A., Arrouays, D., Chambers, A., Chaplot, V., Chen, Z., Cheng, K., Das, B.S. and Field, D.J., 2017. Per 1000 soil carbon sequestration. In Proceedings of the Global Symposium on Soil Organic Carbon 2017, Rome, Italy, 21-23 March, 2017 (pp. 135-137). Food and Agriculture Organization of the United Nations (FAO).
85. Das, B. S. 2011. Recent developments in vadose zone hydrology: Opportunities and challenges for sustainable utilization of water and nutrients for enhancing productivity. In: Wani S. P., K. L. Sahrawat, and K. K. Garg (ed.) Use of high science tools in integrated watershed management. Proc. National Symposium, New Delhi, 127:144.
86. Hendrickx, J. M. H, B. S. Das, D.L. Corwin, J.M. Wraith, and R.G. Kachanoski. 2002. Relationship between solute concentration and apparent soil electrical conductivity. In: Hendrickx, J.M.H, J.M. Wraith, R.G. Kachanoski, and D.L. Corwin. Solute content and concentration. J.H. Dane and G.C. Topp (ed.). Methods of Soil Analysis. Part 4-Physical Methods. ASA, Madison, WI.
87. Das, B. S., R. S. Govindaraju, G. J. Kluitenberg, A. Valocchi, and J. M. Wraith. 2002. Time moment analysis and solute transport studies in soil. In Govindaraju, R. S. (Ed.) Stochastic Methods in Subsurface Contaminant Hydrology, American Society of Civil Engineers Special Publication.
88. Borchers, B., J. M. H., Hendrickx, B. S. Das, and Sung--Ho Hong. 2000. Enhancing dielectric contrast between land mines and the soil environment by watering: modeling, design, and experimental results. In Detection and Remediation Technologies for Mines and Mine-like Targets V, SPIE Vol. 4038, 993-1000. https://doi.org/10.1117/12.396183
89. Hendrickx, J. M. H., B. S. Das, and B. Borchers. 1999. Modeling distributions of water and dielectric constants around landmines in homogenous soils. In Detection and Remediation Technologies for Mines and Mine-like Targets IV, SPIE Vol. 3710, 728-738.
90. S. Kar and B. S. Das. 2000. Soil water dynamics in rice eco-systems during rainy season. In Proc. National Workshop on Rainwater and Groundwater Management for Sustainable Rice Ecosystem, Agril. and Food Engg. Dept., IIT, Kharagpur.
91. Das, B. S., and G. J. Kluitenberg. 1995. Using pore size distribution to model the unsaturated hydraulic conductivity of soil. Kearney Foundation of Soil Science Vadose Zone Hydrology Conference, Kearney Foundation of Soil Science, University of California, Davis.

**D. Abstracts:**

92. Begum, N., D. Chakravarty, and B. S. Das. 2019. Study of spectral properties of coal and other coal measure rocks in VNIR band: A case study of Jharia coal mines, India, AGU Fall Meeting Abstracts, GC31N-1405
93. Panigrahi, N. and B. S. Das. 2018. Comparison of Different Chemometric Approaches for Estimation of Rice Leaf Aea Index and Canopy Water Content Using Diffuse Reflectance Spectroscopy; AGU Fall Meeting Abstracts 2018, H11W-1778
94. Santra, P., Das, B.S., Garg, K.K., Ahmed, N., Heuvelink, G., 2018. Soil organic stock estimation through digital soil mapping approach: How many soil samples are required at different scales? In: 21st World Congress on Soil Science (21st WCSS), held at Rio de Janeiro, Brazil during 12-17 August 2018. Abstract No. C1.5.1/1802
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