

# Curriculum Vitae: Medhavy Thankappan



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Associated with Earth observations (EO) from space for over 35 years. Experience in EO calibration and validation, including the application of Earth observation data straddles both optical and microwave domains. Work on the utilisation of Earth observation data includes terrestrial and marine environments. Authored scientific publications in several leading journals. Currently Director, Data Processing, Quality and Integrity at Geoscience Australia, based in Canberra.

## Qualifications

**Master of Management**, Australian National University

**Graduate Certificate in Management**, University of Western Sydney

**Master of Science**, University of Allahabad

**Bachelor of Science**, University of Allahabad

## Experience

**Director, Data Processing, Quality and Integrity** (since September 2024)

Satellite Land Imaging Collection Branch

Geoscience Australia

Responsible for EO data processing quality assurance and delivering a quality and integrity monitoring capability. Manage Work Plan for Third Party Missions under the Landsat Next Program. Collaborate with key Australian and international EO groups including CEOS-WGCV and, LSI-VC on calibration and validation initiatives to deliver on multi-sensor data interoperability and drive the uptake of CEOS Analysis Ready Data.

**Director, Operations Science and Quality** (April 2024 – August 2024)

Satellite Land Imaging Collection Branch

Geoscience Australia

Responsible for Alice Springs Satellite Ground Station and the Australasian Copernicus Data Hub operations, EO science outcomes, and EO data quality assurance. Collaborate with key Australian and international EO groups including CEOS-WGCV and, LSI-VC on

calibration and validation initiatives to deliver on multi-sensor data interoperability and drive the uptake of CEOS Analysis Ready Data.

**Director, Satellite Data Quality Assurance and Science** (March 2022 - March 2024)

Satellite Land Imaging Collection Branch

Geoscience Australia

Responsible for delivering Branch-wide EO data quality assurance and science outcomes, following the creation of a new Branch within the newly created Space Division.

Collaborate with key Australian and international EO groups including CEOS-WGCV and, LSI-VC on calibration and validation initiatives to deliver on multi-sensor data interoperability and drive the uptake of CEOS Analysis Ready Data.

**Director, Calibration and Validation** (July 2017 – February 2022)

Digital Earth Australia Program

Geoscience Australia

Responsible for driving the data quality agenda across the Digital Earth Australia (DEA) Program. Build, lead, manage and mentor a multidisciplinary team with skills in environmental remote sensing, statistics, EO validation and calibration, software engineering and spatial analysis. Deliver testing frameworks and ensure appropriate critical review of all EO products. Work with key Australian and international groups to leverage off other calibration and validation initiatives.

**Section Leader, Earth Observation Science** (March 2009 – June 2017)

National Earth and Marine Observations

Geoscience Australia

Provided science leadership and managed performance of the Earth Observation Science (EOS) Section. Developed and nurtured the Section's science capability to better exploit the GA EO data record for terrestrial and marine applications. Actively engaged with stakeholders to increase uptake of EO based information. Provided advice to the GA Senior Leadership Team on EO science matters. Developed and supported strategic initiatives to maximise EO outcomes for GA. Developed and maintained national and international linkages that underpin science excellence in EO.

**Remote Sensing Scientist** (August 2003 – February 2009)

National Mapping Division

Geoscience Australia

Delivered EO application development projects across GA including identification of offshore natural hydrocarbon seeps; extraction of building footprints from high resolution satellite imagery; a satellite-derived vegetation theme, and a National Image Layer for use in the Seamless Topographic Database. Evaluated, and supported implementation of the MODIS Cloud Mask for operational use. Supported application related outcomes for the ALOS mission.

**Remote Sensing Product Manager** (November 2002 - July 2003)

National Mapping Division  
Geoscience Australia

Managed life cycle of the EO products portfolio from development of product strategies through to implementing product plans. Reported on monthly sales for all ACRES products and services. Conducted market research and analysed trends for EO products. Managed new EO product development projects through close liaison with product marketing. Attended EO conferences and analysed potential partner relationships for Australian Centre for Remote Sensing (ACRES) products.

**Remote Sensing Account Manager** (January 1999 - October 2002)

National Mapping Division  
Geoscience Australia

Business development of EO products from the Australian Centre for Remote Sensing (ACRES), management of the EO product distribution network. Monitored distributor performance, organised annual distributor meetings and training schedules. Provided feedback to distributors on annual sales performance. Evaluated distributor marketing plans and provided input to GA budget planning process. Supported EO product development and represented GA at EO fora.

**Earth Observation Scientist** (March 1987 - December 1998)

Remote Sensing Applications Group  
Space Applications Centre, Indian Space Research Organisation

Developed methodologies for EO based natural resource management with special reference to, agriculture and environment. As team leader of a national project on Crop Production Forecasting using digital satellite data from optical and microwave sensors, designed national sampling plan for ground truth data collection through field surveys, analysed satellite data and assessed product accuracy. Transferred technology in EO applications to State Departments, and Regional Remote Sensing Centres.

**Professional Bodies**

GA Representative and Member, CEOS Working Group on Calibration and Validation PoC, ARD Evaluation, CEOS Land Surface Imaging - Virtual Constellation  
Member, AusCalVal Technical Advisory Group  
Member, Editorial Board, Journal of Geomatics  
Member, Editorial Advisory Board, Journal of the Indian Society of Remote Sensing  
Life Member, Indian Society of Remote Sensing  
Life Member, Indian Meteorological Society

## Scientific Publications

### 2024

Medhavy Thankappan, Jon Christopherson, Simon Cantrell, Robert Ryan, Mary Pagnutti, Courtney Bright, Denis Naughton, Kathryn Ruslander, Lan-Wei Wang, David Hudson, Jerad Shaw, Shankar Nag Ramaseri Chandra, Cody Anderson. Concept of a Satellite Cross-Calibration Radiometer for in-orbit Calibration of Commercial Optical Satellites. *Remote Sens.* 2024, *16*, 1333. <https://doi.org/10.3390/rs16081333>

Guy Byrne, Mark Broomhall, Andrew Walsh, Medhavy Thankappan, Eric Hay, Fuqin Li, Brendon McAtee, Rodrigo Alejandro Garcia, Janet Anstee, Gemma Kerrisk, Nathan Drayson, Jason Barnettson, Ian Samford, Robert Denham. Validating Digital Earth Australia NBART for the Landsat 9 underfly of Landsat 8. *Remote Sens.* 2024, *16*, 1233. <https://doi.org/10.3390/rs16071233>

### 2023

Fuqin Li, David LB Jupp, Brian L Markham, Ian C Lau, Cindy Ong, Guy Byrne, Medhavy Thankappan, Simon Oliver, Tim Malthus, Peter Fearn (2023). Choice of Solar Spectral Irradiance Model for Current and Future Remote Sensing Satellite Missions. *Remote Sens.* 2023, *15*, 3391. <https://doi.org/10.3390/rs15133391>

### 2022

Mark Broomhall, Guy Byrne, Eric Hay, Medhavy Thankappan, Andrew Walsh (2022). Validating Landsat and Sentinel-2 Analysis Ready Data with Uav-Mounted Spectrometers. *IGARSS 2022-2022 IEEE International Geoscience and Remote Sensing Symposium 7775-7778*

### 2020

Andreas Hueni, Laurie A Chisholm, Cindy Ong, Tim J Malthus, Mathew Wyatt, Simon A Trim, Michael E Schaeppman, Medhavy Thankappan (2020). The SPECCHIO spectral information system. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, *13* 5789-5799

Andreia Siqueira, Adam Lewis, Medhavy Thankappan, Zoltan Szantoi, Brian Killough, Philippe Goryl, Steven Labahn, Jonathon Ross, Takeo Tadono, Ake Rosenqvist, Jennifer Lacey, Matthew Steventon (2020). CEOS Analysis Ready Data for Land: Implementation phase and next steps. *IGARSS 2020-2020 IEEE International Geoscience and Remote Sensing Symposium 3376-3378*

### 2019

Catherine Ticehurst, Zheng-Shu Zhou, Eric Lehmann, Fang Yuan, Medhavy Thankappan, Ake Rosenqvist, Ben Lewis, Matt Paget (2019). Building a SAR-Enabled Data Cube Capability in Australia Using SAR Analysis Ready Data. *Data* (4) 3 100

TJ Malthus, C Ong, I Lau, P Fearn, G Byrne, M Thankappan, L Chisholm, M Suarez, K Clarke, P Scarth, S Phinn (2019). A community approach to the standardised validation of surface reflectance data. A technical handbook to support the collection of field reflectance data. Release version 1.0 CSIRO. Australia. ISBN

Andreia Siqueira, Adam Lewis, Medhavy Thankappan, Zoltan Szantoi, Philippe Goryl, Steven Labahn, Jonathon Ross, Steven Hosford, Susanne Mecklenburg, Takeo Tadono, Ake Rosenqvist, Jennifer Lacey (2019). CEOS analysis ready data for land—an overview on the current and future work. *IGARSS 2019-2019 IEEE International Geoscience and Remote Sensing Symposium 5536-5537*

Cindy Ong, T Malthus, Ian C Lau, Medhavy Thankappan, Guy Byrne (2019). The development of a standardised validation approach for surface reflectance data. IGARSS 2018-2018 IEEE International Geoscience and Remote Sensing Symposium 6456-6459

Medhavy Thankappan, Guy Byrne, Andrew Walsh, Fuqin Li, Tim Malthus, Cindy Ong, Ian Lau (2019). Continental Scale Validation Of Analysis Ready Data In Australia: Experience With Satellite Derived Surface Reflectance. IGARSS 2019-2019 IEEE International Geoscience and Remote Sensing Symposium 5638-5641

## **2018**

David Gavin, Trevor Dhu, Stephen Sagar, Norman Mueller, Bex Dunn, Adam Lewis, Leo Lymburner, Stuart Minchin, Simon Oliver, Jonathon Ross, Medhavy Thankappan (2018) Digital Earth Australia-From Satellite Data to Better Decisions. IGARSS 2018-2018 IEEE International Geoscience and Remote Sensing Symposium 8633-8635

## **2017**

Li, F., Jupp, D.L.B., Paget, M., Briggs, P.R., Thankappan, M., Lewis, A., Held, A. (2017). Improving BRDF normalisation for Landsat data using statistical relationships between MODIS BRDF shape and vegetation structure in the Australian continent. Remote Sensing of Environment 195, 275-296

## **2016**

Oliver, S., Wu, W., Ip, A., Woodcock, R., Wang, P., Paget, M., Evans, B., Lewis, A., Dekker, A., Thankappan, M. and Held, A. (2016). Evolution of the Australian Geoscience Data Cube. Proceedings ESA Living Planet Symposium, Prague 9-13 May

Thankappan, M., Garthwaite, M., Meadows, P., Miranda, N., Schubert, A., and Small, D. (2016). Results for calibration of Sentinel-1A using the Australian corner reflector array. Proceedings ESA Living Planet Symposium, Prague 9-13 May

Purss, M.B.J., Gibb, R., Samavati, F., Peterson, P., Percivall, G., Lewis, A. and Thankappan, M. (2016). Discrete Global Grid Systems and the Living Planet. Proceedings ESA Living Planet Symposium, Prague 9-13 May

Lymburner, L., Fyfe, S., Nicholas, T., Thankappan, M., Sagar, S., Mueller, N., Lewis, A. and Brooke, B. (2016). Monitoring coastal change dynamics using multi-decadal moderate resolution Earth observation data. Proceedings ESA Living Planet Symposium, Prague 9-13 May

Garthwaite, M., Lawrie, S., Lewis, B., Moghaddam, N.F. and Thankappan, M. (2016). Using InSAR to measure and model the impacts CSG extraction in Australia. Proceedings ESA Living Planet Symposium, Prague 9-13 May

Li, F., Jupp, D.L.B., Thankappan, M., Wang, L.W., Lewis, A. & Held, A. 2016. Evaluation of the TanDEM-X Intermediate DEM for Terrain Illumination Correction in Landsat Data. Record 2016/10. Geoscience Australia, Canberra. <http://dx.doi.org/10.11636/Record.2016.010>

Li, F., Jupp, D.L.B., Thankappan, M., Wang, L-W., Lewis, A. and Held, A. (2016). Evaluation of the Tandem-X intermediate DEM for terrain illumination correction in Landsat data. Proceedings IEEE International Geoscience and Remote Sensing Symposium, Beijing, China.

## **2015**

Lewis, A., Lyburner, L., Purss, M.B.J., Brooke, B., Evans, B., Ip, A., Dekker, A.G., Irons, J.R., Minchin, S., Mueller, N., Oliver, S., Roberts, D., Ryan, B., Thankappan, M., Woodcock, R., and Wyborn, L. (2015). Rapid, high-resolution detection of environmental change over continental scales from satellite data – the Earth Observation Data Cube, *International Journal of Digital Earth*. <http://dx.doi.org/10.1080/17538947.2015.1111952>

Garthwaite, M.C., Lawrie, S., Dawson, J. and Thankappan, M. (2015). Corner Reflectors as the tie between InSAR and GNSS measurements: Case Study of Resource Extraction in Australia. *Proceedings FRINGE 2015, ESA-ESRIN, Frascati, Italy, March 2015* <http://dx.doi.org/10.5270/Fringe2015.pp60>

Tan, P., Sagar, S., Mueller, N., Lyburner, L., Thankappan, M. and Lewis, A., (2015). A surface cover change detection method based on the Australian Geoscience Data Cube. *Proceedings 20th International Congress on Modelling and Simulation, November 29 to December 4, 2015, Gold Coast.*

Li, F., Jupp, D. L. B., Thankappan, M., Wang, L-W., Sixsmith, J., Lewis, A. and Held, A. (2015). Land surface brightness temperature retrieved from Landsat data. *Proceedings 20th International Congress on Modelling and Simulation, November 29 to December 4, 2015, Gold Coast.*

Mitchell, A., and Thankappan, M. (2015). Good practice guidelines for calibration and validation of SAR data and derived biophysical products. In A. Held, S. Phinn, M. Soto-Berelov, & S. Jones (Eds.), *AusCover Good Practice Guidelines: A technical handbook supporting calibration and validation activities of remotely sensed data product* (pp. 73-87). Version 1.1. TERN AusCover, ISBN 978-0-646-94137-0

## **2014**

Malthus, T.J., Karpouzli, E., Thankappan, M., Dekker, A., and Smith, C. (2014) An audit of satellite calibration and validation facilities and activities in Australia. Report prepared for the Department of Industry, Space Coordination Office. ISBN 978-1-4863-0490-5

## **2013**

Tan, P., Lyburner, L., Mueller, N., Li, F., Thankappan, M., and Lewis, A. (2013). Applying machine learning methods and time series analysis to create a National Dynamic Land Cover Dataset for Australia. *Proceedings IEEE International Geoscience and Remote Sensing Symposium-IGARSS* (pp. 4289-4292).

Lyburner, L., Tan, P., McIntyre, A., Lewis, A., and Thankappan, M. (2013). Dynamic Land Cover Dataset version 2: 2001-now... a land cover odyssey. *Proceedings IEEE International Geoscience and Remote Sensing Symposium-IGARSS* (pp. 3297-3300). \*Reports involving significant Earth observation input from Geoscience Australia

Li, F., Jupp, DLB, Thankappan, M, Paget, M., Lewis, A. and Held, A. (2013). The Variability of Satellite Derived Surface BRDF Shape over Australia from 2001 to 2011. *Proceedings IEEE International Geoscience and Remote Sensing Symposium, Melbourne, Australia.*

Lyburner, L., McIntyre, A., Li, F., Ip, A., Thankappan, M. and Sixsmith, J. (2013). Creating Multi-Sensor Time Series using data from Landsat-5 TM and Landsat-7 ETM+ to Characterise Vegetation Dynamics. *Proceedings IEEE International Geoscience and Remote Sensing Symposium, Melbourne, Australia.*

Li, F., Jupp, DLB, Lymburner, L., Tan, P., McIntyre, A., Thankappan, M., Lewis, A. and Held, A. (2013). Characteristics of MODIS BRDF shape and its relationship with land cover classes in Australia. Proceedings 20th International Congress on Modelling and Simulation, December 1-6, 2013, Adelaide

Garthwaite, M.C., Thankappan, M., Williams, M.L., Nancarrow, S., Hislop, A. (2013). Corner reflectors for the Australian Geophysical Observing System and support for calibration of satellite-borne synthetic aperture radars. Proceedings IEEE International Geoscience and Remote Sensing Symposium-IGARSS, 266-269.

Thankappan, M., Garthwaite, M.C., Williams, M.L., Hislop, A., Nancarrow, S., and Dawson, J. (2013). Characterisation of Corner Reflectors for the Australian Geophysical Observing System to Support SAR Calibration. Proceedings ESA Living Planet Symposium. Edinburgh, UK.

## **2012**

Li, F., Jupp, D. L.B., Thankappan, M., Lymburner, L., Mueller, N., Lewis, A., and Held, A. (2012). A physics-based atmospheric and BRDF correction for Landsat data over mountainous terrain. Remote Sensing of Environment, 124, 756-770.

Thankappan, M., Lymburner, L., Tan, P., McIntyre, A., Curnow, S. and Lewis, A. (2012). Building a Continental Scale Land Cover Monitoring Framework for Australia. Proceedings First Sentinel-2 Preparatory Symposium, ESA-ESRIN, Frascati, Italy 23-27 April, 2012

## **2011**

Tan, P., Lymburner, L., Thankappan, M., and Lewis, A. (2011). Mapping Cropping Practices Using MODIS Time Series: Harnessing the Data Explosion. Journal of the Indian Society of Remote Sensing, 39(3), 365-372.

Lymburner, L., Tan, P., Mueller, N., Thackway, R., Lewis, A., Thankappan, M., Randall, L., Islam, A. and Senarath, U. (2011). The National Dynamic Land Cover Dataset. Geoscience Australia, Record Number 2011/31

Li, F., Jupp, D.L.B. and Thankappan, M. (2011). Using high resolution DSM data to correct terrain illumination effect for Landsat data. Proceedings 19th International Congress on Modelling and Simulation, 12-16 December 2011, Perth, Australia.

## **2009**

Wettle, M., Daniel, P.J., Logan, G.A. and Thankappan, M. (2009). Assessing the effect of hydrocarbon oil type and thickness on a remote sensing signal: A sensitivity study based on the optical properties of two different oil types and the HYMAP and Quickbird sensors. Remote Sensing of Environment 113, 2000-2010.

Thankappan, M., Logan, G., Wettle, M., Reddy, S., and Jones, A. (2009). Evaluation of TerraSAR-X for Natural Oil Seep Studies, Proceedings 4th International Workshop on Science and Applications of SAR Polarimetry and Polarimetric Interferometry, PolInSAR 2009, Frascati, Italy, 26-30 January, 2009

Thankappan, M. and Smith, C.J.H. (2009). A comparison of bathymetric signatures observed on ERS SAR and Landsat TM images over the Timor Sea. In Innovations in Remote Sensing and Photogrammetry, Simon Jones and Karin Reinke (Eds), pp 417-431

## **2008**

Logan, G.A., Jones, A.T., Ryan, G.J., Wettle, M., Thankappan, M., Groesjean, E., Rollet, N., and Kennard, J.M. (2008). Review of Australian Offshore Natural Hydrocarbon Seepage Studies. Geoscience Australia Record: 2008/17.

Chan, T., Beverly, C., Ebert, S., Garnett, N., Lewis, A., Pettit, C., Thankappan, M. and Williams, S. (2008). Platform for Environmental Modelling Support: a Grid Cell Data Infrastructure for Modellers. In Landscape Analysis and Visualisation, Christopher Pettit, William Cartwright, Ian Bishop, Kim Lowell, David Pullar, David Duncan (Eds) pp 97-117

Sagar, S., Thankappan, M., Cechet, B., Nidumolu, U., Hayman, P. (2008). Exploring the use of satellite derived Land Surface Temperature (LST) data to map the spatial and temporal coherence of frost for grain and grape industries in the South Australian Murray Darling Basin (SAMDB). Proceedings Australian Meteorological and Oceanographic Society Congress, Geelong, Victoria. 28th Jan –2nd Feb 2008

## **2006**

Jones, A.T., Thankappan, M., Logan, G.A., Kennard, J.M., Smith, C.J. and Williams, A.K. (2006). Coral spawn and bathymetric slicks in Synthetic Aperture Radar (SAR) data from the Timor Sea, north-west Australia. International Journal of Remote Sensing 27, 2063-2069.

Thankappan, M., Coghlan, R.A., Meakin, C.F., and Oliver, S. (2006). Synthetic Aperture Radar based assessment of damage to banana plantations following Cyclone Larry, Proceedings of the 13th Australasian Remote Sensing and Photogrammetry Conference, Canberra 20-24 November 2006.

## **1999**

Discovering Remote Sensing – an introduction. Creasey, J., Gunther, J.M., Lewis, G.B., Mackey, S.J., Smith, C., and Thankappan, Medhavy, 1999, Australian Geological Survey Organisation (Record 1999/30B)

## **1996**

Comparative performance of Thematic Mapper middle-infrared bands in crop discrimination. Dadhwal, V.K., Parihar, J.S., Medhavy, T.T., Ruhel, D.S., Jarwal, S.D. and Khera, A.P., 1996, International Journal of Remote Sensing, 17(9) 1727-1734

Remote sensing data acquisition, platforms and sensor requirements. Navalgund, R.R., Jayaraman, V., Kiran Kumar, A.S., Tara Sharma, Kurien Mathews, Mohanty, K.K., Dadhwal, V.K., Potdar, M.B., Singh, T.P., Ghosh, R., Tamilarasan, V., and Medhavy, T.T., 1996, Journal of the Indian Society of Remote Sensing. 24(4) 207-242

## **1995**

Multi-temporal ERS-1 SAR data for identification of rice crop. Patel N.K., Medhavy, T.T., Patnaik, C. and Hussain, A., 1995, Journal of the Indian Society of Remote Sensing. 23(2) 33-40

Development of a wheat yield model for Punjab using remotely sensed data and historical yield trends. Medhavy, T.T., Tara Sharma, Dubey, R.P., Mahey, R.K. and Sharma, P.K., 1995 Journal of the Indian Society of Remote Sensing. 23(1) 23-30



An evaluation of speckle removal filters for ERS-1 SAR data. Medhavy, T.T., Patnaik, C. and Patel, N.K., 1995, Proceedings of Symposium on Remote Sensing for Environmental Monitoring and Management with special emphasis on Hill regions. Dehradun, Feb. 22-25, 1995. pp 91-97.

#### **1994**

Procedures for computation of saturation radiances: a case study for proposed sensors onboard Indian Remote Sensing Satellite 1 C. Tara Sharma and Medhavy, T.T., 1994 Journal of the Indian Society of Remote Sensing. 22(1) 9-20

#### **1993**

Wheat crop inventory for 1992-93 in northern plains of Bihar using satellite digital data. Medhavy, T.T., Patnaik, C., Patel, N.K., Srivastava, S.K., Mishra, N.K., Sanjay Kumar and Prasad Singh, K.R., 1993, Proceedings of Symposium on Remote Sensing Applications for Resource Management with special emphasis on N.E. region. Guwahati, Nov. 25-27, 1993. pp 335-341.

Classification of rice crop with ERS-1 SAR data. Patel, N.K., Medhavy, T.T., Patnaik, C., Hussain, A. and Das, A., 1993, Proceedings of Symposium on Remote Sensing Applications for Resource Management with special emphasis on N.E. region. Guwahati, Nov. 25-27, 1993. pp 347-352.

#### **1992**

Crop classification accuracies as influenced by training strategy, data transformation and spatial resolution of data. Medhavy, T.T., Tara Sharma, Dubey, R.P., Hooda, R.S., Mothikumar, K.E., Yadav, M., Manchanda, M.L., Ruhel, D.S., Khera, A.P. and Jarwal, S.D. 1992, Journal of the Indian Society of Remote Sensing. 21(1) 21-28.

#### **1991**

Wheat acreage estimation for Haryana using satellite digital data. Dadhwal, V.K., Ruhel, D.S., Medhavy, T.T., Jarwal, S.D., Khera, A.P., Singh, J., Tara Sharma and Parihar, J.S., 1991, Journal of the Indian Society of Remote Sensing. 19 (1): 1-16.

Rice acreage estimation for Orissa using remotely sensed data. Panigrahy, S., Parihar, J.S., Patel, N.K., Dadhwal, V.K., Medhavy, T.T., Ghose, B.K., Ravi, N., Pani, K.C., Panigrahy, B.K., Sridhar, V.N., Mohanty, R.R., Nanda, S.K., Tripathy, D.P., Mishra, P.K., Bhatt, H.P., Oza, S.R., Sudhakar, S., Sudha, K.S., Kumar, P. and Das, N.K., 1991, Journal of the Indian Society of Remote Sensing. 19 (1): 17-26

#### **1990**

District-level wheat acreage estimation in Haryana using IRS LISS I digital data. Ruhel, D.S., Medhavy, T.T., Jarwal, S.D., Dadhwal, V.K., Singh, J., Khera, A.P. and Parihar, J.S., 1990, Proceedings of National Symposium on Remote Sensing for Agricultural Applications, New Delhi, Dec. 6-8, 1990. pp. 250- 255

#### **1989**

Effect of acquisition date and TM spectral bands on wheat, mustard and gram classification accuracies. Dadhwal, V.K., Parihar, J.S., Ruhel, D.S., Jarwal, S.D., Medhavy, T.T., Khera, A.P. and Singh, J., 1989, Journal of the Indian Society of Remote Sensing. 17(4): 19-24