

## DR. RENJU R.

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### SCIENTIST/ENGINEER- SD

Microwave Remote Sensing/Microwave and Boundary Layer Physics

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### AREA OF RESEARCH INTEREST

#### MICROWAVE REMOTE SENSING OF PLANETARY ATMOSPHERE AND TERRAIN

- Ground-based microwave measurements of atmosphere and clouds
- GPS application for tropical water vapour & atmosphere studies
- Microwave propagation studies: Ka-band / GSAT-14 satellite attenuation studies
- Surface and subsurface exploration of planetary bodies using microwave remote sensing
- Thermophysical studies of the Moon and planets using In-situ measurements.
- Radiative Transfer model based analysis for simulation studies
- Satellite based microwave data utility for water vapour and convective studies

### PROFESSIONAL EXPERIENCE

**Research Associate:** (07/2016 - 03/2018)

Space Physics Laboratory

Vikram Sarabhai Space Centre, Thiruvananthapuram, India

**Research Fellow:** (03/2010 - 2015)

Space Physics Laboratory

Vikram Sarabhai Space Centre, Thiruvananthapuram, India

### ACADEMIC QUALIFICATIONS

**Ph.D. Physics (2016) Thesis Title:** ‘Tropical atmosphere studies using Multifrequency Ground Based Microwave Radiometer Profiler and ancillary sensors over a coastal station Trivandrum’, University of Kerala.

## AWARDS AND HONORS

- **Young Scientist Award** – International URSI, Atlantic Radio Science Meeting (AT- RASC) 2018, Gran Canaria, Spain.
- Research Fellowship of Indian Space Research Organization, 2012-2015
- Selected for best paper presentation in Kerala Science Congress, 2015
- **Best poster presentation award:** National Climate Science Conference, Divecha Centre for Climate Change, Indian Institute of Science, Bengaluru, 02-03 July, 2015.
- **Best paper Award:** Tropical Meteorology (TROPMET-2011), 14-16 December 2011, Hyderabad.
- **Best paper Award:** National Space Science Symposium (NSSS) 2016, VSSC, Trivandrum, Kerala.
- **Best paper Award:** International Tropical Meteorology (INTROMET-2014), 20-24 February, 2014, Chennai.

## PUBLICATIONS AND PROCEEDINGS

- Peer Reviewed International Journals :11
- Proceedings: 3
- Conferences/Symposia Presentations : 13

## IMPORTANT SCIENTIFIC CONTRIBUTIONS

Area of research includes the investigations of the energetics and dynamics of the tropical troposphere by making use of microwave remote sensing – an emerging field.

- Observations from ground-based passive hyperspectral microwave radiometer profiler (MRP); space borne microwave sounder (SAPHIR) aboard Megha-Tropiques satellite, a triple frequency GPS receiver, ancillary instruments such as disdrometers, LIDAR, radiosonde ascents along with microwave radiative transfer (RT) scheme have been utilized for scientific studies.
- Developed methods to infer precipitable water vapour content from the MRP and validated the retrieval technique using simultaneous estimates from GPS-wet delay ([Renju et.al, J. Geophys. Res., 2015](#)).
- Validation of the MRP derived vertical profiles of temperature and humidity has been carried out with concurrent radiosonde ascents, as well as those simulated using microwave radiative transfer scheme.
- Characterizing the coastal atmospheric boundary layer dynamics, its temporal features and also the thermal internal boundary layer characteristics ([Renju et.al, IEEE TGRS., 2017](#)).
- Using multi-year data on vertical profiles of water vapour content, she quantified the signatures of the active and break spells of the Indian summer monsoon in the humidity structure ([Renju et.al, J. Geophys. Res., 2015](#)).
- Investigated the genesis, thermodynamical and microphysical changes during evolution, propagation and dissipation of mesoscale convective systems.
- Development of a method based on brightness temperature difference between the 23 and 30 GHz observed using Microwave Radiometer Profiler to delineate the phase (vapour/liquid) of moisture in clouds and use this to characterize them and also to identify their cellular nature ([Renju et.al, IEEE TGRS., 2016](#)).

- **Atmospheric Radiative Transfer Simulator (ARTS)** simulation to determine millimeter and sub-millimeter wave frequencies to estimate the constituents in Venus atmosphere. ([Radio Science, 2019](#)).
- GSAT-14/ Ka-band signal propagation studies: Attenuation characteristics study over the tropical coastal region ([Radio Science, 2020](#)).

## LIST OF SCIENTIFIC PUBLICATIONS

1. **Renju, R.**, C. Suresh Raju, N. Mathew, T. Antony, and K. Krishna Moorthy (2015), “Microwave radiometer observations of inter-annual water vapor variability and vertical structure over a tropical station”, **J. Geophys. Res. Atmos.**, 120, 4585-4599. doi. 10.1002/2014JD022838.
2. **Renju, R.**, C. Suresh Raju, N. Mathew, N.V.P. Kiran Kumar, and K. Krishna Moorthy (2016), “Tropical Convective Cloud Characterization Using Ground-Based Microwave Radiometric Observations”, **IEEE Trans. Geoscience and Remote Sensing (TGRS)**, Vol. 54, No. 7, 3774-3779, doi.10.1109/TGRS.2016.2527099.
3. **Renju, R.**, M. K. Mishra, Suresh Raju C., K. Rajeev and K. Krishna Moorthy (2017), “Atmospheric boundary layer characterization using ground-based microwave radiometric observations over a tropical coastal station”, **IEEE Trans. Geoscience and Remote Sensing (TGRS)**, Vol.55, No.12, 6877-8682, doi.10.1109/TGRS.2017.2735626.
4. Suresh Raju C., **R. Renju**, Tinu Antony, Nizy Mathew and K. Krishna Moorthy (2013), “Microwave radiometric observation of an intense convective system that formed waterspout over the coastal Arabian Sea”, **IEEE Geoscience and Remote Sensing Letter (GRSL)**, No.10, 1075-1079, doi: 10.1109/LGRS.2012.2229960.
5. Nizy Mathew, C. Suresh Raju, **R. Renju** and Tinu Antony (2016), “Distribution of Tropical Deep Convective Clouds from Megha-Tropiques SAPHIR Data”, **IEEE Trans. Geoscience and Remote Sensing (TGRS)**, Vol. 54, No. 11, 6409-6414 doi.10.1109/TGRS.2016.2584540.
6. Yan Feng, M. Cadeddu, V. R. Kotamarthi, **R. Renju** and C. Suresh Raju (2016) “Humidity bias and effect on simulated aerosol optical properties during the Ganges Valley Experiment”, **Current Science**, Vol. 111, No. 1, 93-100.
7. Tinu Antony, Suresh Raju C., **R. Renju**, Nizy Mathew and K. Krishna Moorthy (2018), “Microwave emissivity over arid regions at 10 GHz- Potential for subsurface studies”, **International Journal of Rem. Sens.**
8. Kavitha M, Prabha R. Nair, I. A. Girach, S. Aneesh, S. Sijikumar and **R. Renju** (2018), “Diurnal and seasonal variations in surface methane at a tropical coastal station: Role of boundary layer meteorology”, **Science of Total Environment**, 631:1472-1485.
9. Kavitha M, Prabha R. Nair and **R. Renju** (2018), “Thunderstorm induced changes in near-surface O<sub>3</sub>, NO<sub>x</sub> and CH<sub>4</sub> and associated boundary layer meteorology over a tropical coastal station”, **Journal of Atmospheric and Solar-Terrestrial Physics**, 179, 261-272.
10. N. Mathew, S. Sahoo, **R. Renju** and C. S. Raju, “Millimetre-Wave Radiometric Information Content Analysis for Venus Atmospheric Constituents Studies”, *Radio Science*, 2019, doi:10.1029/2019RS006913.

11. M. K. Mishra, **R. Renju**, N. Mathew, C. Suresh Raju, M. R. Sujimol and K. Shahana, "Characterization of GSAT-14 satellite Ka-band microwave signal attenuation due to precipitation over a Tropical Coastal station over the southern peninsular region of the Indian subcontinent", *Radio Science*, 2019, Accepted (in press).
12. **R. Renju**, Suresh Raju C., Manoj Kumar Mishra, Nizy Mathew and N. V. P. Kiran Kumar, "Attenuation characteristics of Ka-band signals over the tropical coastal station". [IEEE, Transactions on Antennas and Propagation 2019, Under Revision]

#### Publications in Proceedings/Report/Book

1. **R. Renju**, C. Suresh Raju C., E. V. Davis, N. Mathew and K. K. Moorthy, "Validation of ground-based microwave radiometer measurements over a tropical coastal station," *2019 URSI Asia-Pacific Radio Science Conference (AP-RASC)*, New Delhi, India, 2019, pp. 1-5, doi: 10.23919/URSIAP-RASC.2019.8738615.
2. Mishra, M. K., **R. Renju**, N. Mathew, C. Suresh Raju, M. Sujimol and K. Shahana, "Rain attenuation of Ka-band signal over a Tropical station," *2019 URSI Asia-Pacific Radio Science Conference (AP-RASC)*, New Delhi, India, 2019, pp. 1-3. doi: 10.23919/URSIAP-RASC.2019.8738301.

#### CONFERENCE PRESENTATIONS

1. **Renju, R.**, Suresh Raju C., Uma, K. N., and K. Krishna Moorthy, "Thermodynamics of Convective Cloud System during a Waterspout studied using Microwave Radiometer observations at Thiruvananthapuram", *TROPMET 2011*, 14- 16 December 2011, Hyderabad. (**BEST PAPER AWARD**).
2. **Renju, R.**, Suresh Raju C., Uma, K. N., and K. Krishna Moorthy, "Thermodynamics of Convective Cloud System during a Waterspout studied using Microwave Radiometer observations at Thiruvananthapuram", *NSSS 2012*, 14- 16 February 2012, Tirupati.
3. Uma, K. N., Suresh Raju C., **R. Renju**, Tinu Antony and K. Krishna Moorthy, "Relative Humidity profiles retrieved from SAPHIR on board Megha-Tropiques: A quantitative evaluation against concurrent ground based microwave radiometer profiler over an equatorial station", *International Tropical Meteorology (INTROMET-2014)*, Chennai, 20-24 February, 2014. (**BEST PAPER AWARD**)
4. **R. Renju**, Suresh Raju C., Uma, K. N., Nizy Mathew and K. Krishna Moorthy, "Inter-annual variability of water vapor over an equatorial coastal station using microwave radiometric observations", *NSSS 2014*, Dibrugarh, 28 Jan - 01 Feb, 2014.
5. **R. Renju**, Suresh Raju C. and K. Krishnamoorthy, "Multi- Scale analysis of humidity over equatorial coastal station observed using ground based microwave radiometer profiler and GPS", *27<sup>th</sup> Kerala Science Congress- 2015*, Alappuzha, 27-29 Jan, 2015.
6. **R. Renju**, Suresh Raju C., Tinu Antony, Nizy Mathew, "Microwave Radiometer Observations of vertical structure of water vapor and tropical convections", *IAA-IISL-KSCSTE International Conference on Climate change and Disaster Management (i3cdm- 2015)*, Kovalam, 26-28 February, 2015.
7. **R. Renju**, Suresh Raju C., Tinu Antony, Nizy Mathew and K. Krishnamoorthy, "Microwave Radiometer Observations of vertical structure of water vapor", *National*

*Climate Science Conference*, Divecha Centre for Climate Change, Indian Institute of Science, Bengaluru, 02-03 July, 2015 (**BEST POSTER PRESENTATION AWARD**).

8. **R. Renju**, Suresh Raju C., Nizy Mathew and K. Krishnamoorthy, “Tropical convective cloud characterization using ground based microwave radiometric observations”, *NSSS 2016*, VSSC, Kerala, 09-12 February, 2016 (**BEST PAPER AWARD**).
9. **R. Renju** and C. Suresh Raju, “Application of Ground based microwave radiometry for characterizing tropical convection”, *International symposium on Antennas and Propagation (APSYM 2016)*, CUSAT, 15-17 December, 2016.
10. **R. Renju** and C. Suresh Raju, “Characterization of tropical convection using ground based Microwave Radiometric observations”, *URSI, RCRS-2017*, Tirupati, 01-04 March 2017.
11. **R. Renju**, C. Suresh Raju, Nizy Mathew and K. Krishnamoorthy, “Validation of ground based microwave radiometer measurements over a tropical coastal station”, *URSI-APRASC-2019*, 9-15 March, New Delhi, India.
12. **R. Renju**, Suresh Raju Chellappan Pillai, Manoj Kumar Mishra, Kiran Kumar N.P.V, Sisma Samuel, “Characterization of cloud micro-physics during rainy cases over the tropical coastal station”, *URSI Asia Pacific Radio Science conference*, 09-15 March 2019, India Habitat Centre, New Delhi.
13. Manoj Kumar Mishra, Nizy Mathew, **Renju R.**, Suresh Raju C., Sujimol M. R., Shahana K., “Rain Attenuation of Ka-band signal over a tropical station”, *URSI Asia Pacific Radio Science conference*, 09-15 March 2019, India Habitat Centre, New Delhi.

#### **REVIEWER FOR INTERNATIONAL JOURNALS**

IEEE Geoscience Remote Sensing Letters

#### **WORKSHOP ATTENDED**

SMART training programme on INSAT -3DR data utility at Space Application Centre, Ahmedabad, 2017