

## Curriculum Vitae

### **Dr. Manju G.**

Scientist/Engineer: 'SF'

SPL, VSSC, ISRO

Trivandrum: 695022

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### **Area of specialization:**

Ionosphere Thermosphere Physics Area

### **Research interests:**

- **Investigations on Equatorial Spread F /Scintillations and their day to day variability to facilitate prediction of navigation and communication outages.**
- **In-situ probing of terrestrial and planetary ionospheres**
- **Investigations on upper atmospheric response to diverse geophysical conditions**

### **Academic Qualification**

University of Kerala-Department of Physics, Ph.D., 1998

*Thesis: Studies on Equatorial Electrojet*

*Supervisor: Dr. K. S. Viswanathan*

University of Kerala-Department of Physics, M.Sc. (Physics), 1991

University of Kerala, Department of Physics, B.Sc. (Physics), 1989

### **Professional Background:**

Scientist/Engineer 'SE', SPL, VSSC, ISRO, Trivandrum (2015 onwards)

Scientist/Engineer 'SD', SPL, VSSC, ISRO, Trivandrum (2010 -2014)

Scientist/Engineer 'SC', SPL, VSSC, ISRO, Trivandrum (2006-2010)

Scientist/Engineer 'SB', SPL, VSSC, ISRO, Trivandrum (2003-2006)

Scientist/Engineer 'SB', RRSSC, ISRO, Kharagpur (2002-2003)

Scientific Assistant, RRSSC, ISRO, Kharagpur (1999-2002)

ISRO Visiting Fellow (1992-1997)

### **Fellowships, Honors and Awards**

ISRO team excellence award-2011 for Sooryagrahan Campaign

AGU Editor's Choice for paper (Manju et al., JGR, 2011)

Best paper award at National Space Science Symposium-2019 for co-authored paper

ISRO Visiting Fellowship (1992-1997)

Honorary mention for co-author paper presented at URSI RCRS-2014 conference in Pune

University Merit Scholarship (1985-1991)

### **Professional responsibilities**

- IDEA Payload on PS4 orbiting platform : **Principal Investigator**
- ENWI Rocket Payload : **Principal Investigator**
- RAMBHA-LP on Chandrayaan -2 : **Principal Investigator**
- SOUREX Experiment : **Co-Principal Investigator**
- INSWIM : **Project Manager**

### **Research Supervision**

**M.Phil** : 3

**Ph.D.** : 1 Awarded; 1 thesis submitted

**Publications in Peer reviewed journals** : 35

**Publications in Proceedings** : 1

**Symposium Presentations** : International - 18, National - 15

**No of journals for which reviews done** : 7

### **Publications in peer reviewed journals/proceedings**

1. N. Mridula, Tarun Kumar Pant, **G. Manju**, K.V. Subrahmanyam, K. Kishore Kumar, On the role of F3 layers as well as solar flux in modulating the topside ionization over Indian region: An analysis, Journal of Atmospheric and Solar-Terrestrial Physics, 189, 52-64, 2019.
2. **Manju G** and Aswathy R P., 'First time estimation of thermospheric neutral densities from threshold curves of ESF triggering: A novel evidence for ionosphere-thermosphere coupling', Journal of Geophysical Research: Space Physics, 123, doi:10.1029/2018JA025967, 2018.

3. Aswathy, R. P., **Manju, G.**, & Sunda, S., The response time of equatorial ionization anomaly crest: A unique precursor to the time of equatorial spread F initiation. *Journal of Geophysical Research: Space Physics*, 123 , doi.org/10.1029/2018JA025469, 2018
4. Aswathy R. P. and **G. Manju**, Hind-casting of Equatorial Spread F (ESF) using seasonal empirical models *Journal of Geophysical Research: Space Physics*, 123, 1515–1524, doi.org/10.1002/2017JA025036, 2018.
5. Madhav Haridas M. K., **G. Manju** and T. Aruznamani, Solar activity variations of Equatorial Spread F occurrence and sustenance time during different seasons over Indian longitudes: Empirical model and causative mechanisms, *Adv. Space Res.*, 10.1016/j.asr.2018.02.040, 61(10), 2585-2592, 2018.
6. **Manju G.** and R.P. Aswathy, Climatology of GW-TIDs in the magnetic equatorial upper thermosphere over India,, *J. Atmos. Terr. Phys*, 164, 142–148, doi.org/10.1016/j.jastp.2017.08.015. 2017.
7. Aswathy R. P. and **G. Manju**, Gravity wave control on ESF day to day variability: an empirical approach, *Journal of Geophysical Research (Space Physics)*, doi:10.1002/2017JA023983, 2017.
8. Madhav Haridas, M. K., **G. Manju**, and T. Arunamani, Solar activity variations of nocturnal thermospheric meridional winds over Indian longitude sector, *Journal of Atmospheric and Solar Terrestrial Physics*, 147, 21–27, doi:10.1016/j.jastp.2016.06.010 ,2016.
9. **Manju G.**, On the unique divergent response of the equatorial electrojet vertical polarization electric field to different solar flare events, *Journal of Geophysical Research: Space Physics*, 121, doi:10.1002/2015JA021588, 2016.
10. **Manju G.**, Madhav Haridas M. K. and Aswathy R. P., “Role of gravity wave seed perturbations in ESF day-to-day variability: a quantitative approach”, *Adv. in Space Res.*, *Advances in Space Research* 57, 1021–1028, doi:10.1016/j.asr.2015.12.019, 2016.
11. Madhav Haridas, M. K., **G. Manju**, and T. K. Pant , On the solar activity variations of nocturnal F region vertical drifts covering two solar cycles in the Indian longitude sector, *Journal of Geophysical Research: Space Physics*, doi:10.1002/ 2014JA020561, 2015.

12. **Manju G.** and M. K. Madhav Haridas, On the equinoctial asymmetry in the threshold height for the occurrence of equatorial spread F, *Journal of Atmospheric and Solar Terrestrial Physics*, 124, 59-62, DOI:10.1016/j.jastp.2015J.01.008), 2015.
13. **Manju G.**, Madhav Haridas M. K., G. Ramkumar, Tarun K. Pant, R. Sridharan and Sreelatha P, Gravity wave signatures in the dip equatorial ionosphere–thermosphere system during the annular solar eclipse of 15 January 2010, *J Journal of Geophysical Research: Space Physics*, (<http://dx.doi.org/http://dx.doi.org/10.1002/2014JA019865>), 2014.
14. Madhav Haridas, M. K., **G. Manju**, and T. K., First observational evidence of the modulation of the threshold height  $h'F_c$  for the occurrence of equatorial spread F by neutral composition changes *Journal of Geophysical Research: Space Physics*, 118, doi:10.1002/jgra.50331, 2013.
15. Simi. K. G, **G. Manju**, Madhav Haridas, M. K., S. R. Prabhakaran Nayar, Tarun Kumar Pant, S.Alex Ionospheric response to a geomagnetic storm during november 08-10, 2004, *Earth Planets Space*, 65, 343–350, 2013.
16. **Manju, G.**, R. Sridharan, Sudha Ravindran, M.K. Madhav Haridas, T.K. Pant, P. Sreelatha and S.V. Mohan Kumar, "Rocket borne in-situ Electron density and Neutral Wind measurements in the equatorial ionosphere Results from the January 2010 annular solar eclipse campaign from India", *Journal of Atmospheric and Solar-Terrestrial Physics*, 86, 56-64, 2012.
17. **Manju, G.**, R. Sridharan, P. Sreelatha, Sudha Ravindran, M.K. Madhav Haridas, Tarun K. Pant, P. Pradeep Kumar, R. Satheesh Thampi, Neha Naik, N. Mridula, Lijo Jose, S.G. Sumod, A Novel probe for in-situ Electron density and Neutral Wind (ENWi) measurements in the near Earth space, *J. Atmos. & Sol. Terr. Phys.*, 74, 81–86, 2012.
18. Madhav Haridas, M. K., and **G. Manju** , On the response of the ionospheric  $F$  region over Indian low-latitude station Gadanki to the annular solar eclipse of 15 January 2010, *Journal of Geophysical Research: Space Physics*, 117, A01302, doi:10.1029/2011JA016695, 2012.
19. **Manju, G.**, M. K. Madhav Haridas., Sudha Ravindran, Tarun Kumar Pant and S. Tulasi Ram, Equinoctial asymmetry in the occurrence of Equatorial Spread F over Indian longitudes during the moderate to low solar activity period 2004-2007, *Indian Journal of Radio & Space Physics*, Vol 41, pp 240-246, 2012.

20. **Manju G.**, Simi K. G. and S. R. Prabhakaran Nair , Analysis of solar EUV and X- ray flux enhancements during intense solar flare events and the concomitant response of equatorial and low latitude upper atmosphere, J. Atmos. & Sol. Terr. Phys.,86,1-5, 2012.
21. N. Mridula, **G. Manju**, Tarun Kumar Pant, Sudha Ravindran, Lijo Jose, and Shobana Alex, On the significant impact of the moderate geomagnetic disturbance of March 2008 on the equatorial ionization anomaly region over Indian longitudes, Journal of Geophysical Research: Space Physics, 116, A07312, doi:10.1029/2011JA016615, 2011.
22. **Manju G.**, V. Sreeja, S. Ravindran and S. V. Thampi, Towards Prediction of L band scintillations in the Equatorial Ionization Anomaly (EIA) Region, Journal of Geophysical Research: Space Physics, 116, A02307, 8 PP., doi: 10.1029/2010JA015893, 2011.
23. John S. R., Karanam Kishore Kumar, K. V. Subrahmanyam, **G. Manju**, and Q. Wu, Meteor radar measurements of MLT winds near the equatorial electro jet region over Thumba (8.5° N, 77° E): comparison with TIDI observations, Ann. Geophys., 29, 1209– 1214, 2011.
24. **Manju G.**, C. V. Devasia and Sudha Ravindran, The seasonal and solar cycle variations of electron density gradient scale length during magnetically disturbed days: Its implications for Spread F, Earth Planets and Space, 61, 913-917, 2009.
25. **Manju G.**, Tarun Kumar Pant, Sudha Ravindran and R. Sridharan, On the response of the equatorial and low latitude ionospheric regions in the Indian Sector to the large magnetic disturbance of 29 October 2003, Ann. Geophys. 27, 2539-2544, 2009.
26. **Manju G.**, C. V. Devasia and Sudha Ravindran, The seasonal and solar cycle variations of electron density gradient scale length, vertical drift and layer height during magnetically quiet days: Implications for Spread *F* over Trivandrum, India, Earth Planets and Space, 61, 1339-1343, 2009.
27. **Manju G.**, T. K. Pant, C. V. Devasia, S. Ravindran, and R. Sridharan, electrodynamical response of the Indian low-mid latitude ionosphere to the very large solar flare of 28 October 2003 – a case study, Ann. Geophys., 27, 3853-3860, 2009.
28. **Manju G.**, Sudha Ravindran, C. V. Devasia, Smitha V. Thampi and R. Sridharan, Plasmaspheric electron content (PEC) over low latitude regions around the magnetic equator in the Indian sector during different geophysical conditions, J. Atmos. Terr. Phys., 70, 1066-1073, 2008.

29. **Manju G.** and K. S. Viswanathan, VHF radar studies of counter electrojet events during the northern winter solstice period of 1992, *Earth Planets Space*, 59, 259, 2007.
30. **Manju G.**, C. V. Devasia and R. Sridharan, On the seasonal variations of the threshold height for the occurrence of equatorial spread F during solar minimum and maximum years, *Ann. Geophys.*, 25, 1, 2007.
31. **Manju G.**, K.S. Viswanathan, Sudha Ravindran, Spatial and temporal variations of small scale plasma turbulence parameters in the equatorial electrojet: HF and VHF radar observational results, *Ann. Geophys.*, 23, 1165-1173, 2005.
32. **Manju G.** and K.S. Viswanathan, Response of the equatorial electrojet to solar flare related X-ray flux enhancements, *Earth Planets Space* , 57, 231, 2005.
33. **Manju G.** and K.S. Viswanathan, Short period fluctuations in the equatorial electrojet electric fields, *Indian Journal of Radio and Space Physics*, 35, 90-97, 2005.
34. G. K. Mukherjee, Navin Parihar, K. Niranjana and **G. Manju**, Signature of Midnight Temperature Maximum (MTM) using OI 630 nm Airglow. *Indian J. Rad. & Space Phys.*, 35, 14, 2005.
35. **Manju G.**, V. M. Chowdary, Y.K. Srivastava , A. Jeyaram and S. Adiga, Mapping and characterization of wetlands of East Champaran district, Bihar using Remote Sensing and GIS, *Journal of Indian Society of Remote Sensing*, 33, 1, 2005.
36. **Manju G.**, Sudha Ravindran, Smitha V. Thampi and R. Sridharan, Study on ESF duration and strength at the magnetic equator in association with the duration and strength of L band scintillations in the EIA region *Proc. ECAR* (2008), 2009.

### **Invited talks**

1. **Manju G.**, Near surface lunar plasma environment, Lunar science meet, 27 September 2018, Bangalore, India.
2. **Manju G.**, Tarun Kumar Pant, Sreelatha P, Rosmy John, N. Mridula, Aswathy R. P., Satheesh Thampi J.K. Abhishek and A. N. Aneesh, IDEA payload observations of electron density and electric fields in the Near Earth Space Environment on board PS4 orbiting platform, APRSAF-24, Nov.13-18, 2017, Bangalore, India
3. **Manju G.**, Invited talk on 'Solar terrestrial relations' given at Calicut University, Department of Physics in April 2012.

## Symposium Presentations

### *International Symoposia*

1. Aswathy R P, **Manju G**, S.Sunda, The response time of Equatorial Ionization Anomaly: A unique precursor to Equatorial Spread F initiation', **15<sup>th</sup>International Symposium on Equatorial Aeronomy**, 22- 26 October 2018, PRL,Ahmedabad
2. **Manju G**, M. K. Madhav Haridas, Tarun Kumar Pant, R.Sridharan† and P. Sreelatha, The response of the equatorial and low latitude E and F regions of the ionosphere to the annular solar eclipse of January 15, 2010 using GPS beacon, in-situ and ground based data, International Beacon Symposium, July 2013, University of Bath, Bath, UK.
3. **Manju, G.**, V. Sreeja, Sudha Ravindran, Smitha V. Thampi and Tarun Kumar Pant, Towards prediction of L band scintillations in the equatorial ionization anomaly (EIA) region, International Beacon Symposium, July 2013, University of Bath, Bath, UK.
4. M.K. Madhav Haridas and **G. Manju**, On the seasonal and solar activity variability of threshold height for the occurrence of Equatorial Spread F during magnetically disturbed periods, at ISEA 13, March, 2012, Peru.
5. **Manju G.**, Sreelatha P., Sudha Ravindran, Rosmy John, Neha Naik, Satheesh Thampi, Pradeep Kumar P, S. V. Mohan Kumar and R. Sridharan, A new Ionospheric Probe for insitu measurements of neutral wind and electron density, AOGS, July 2010, Hyderabad, India.
6. Sudha Ravidran, N Mridula, R Sridharan, R S Dabas, A D Sarma, Rajnish Sarma, **G Manju** and Tarun Kumar Pant, Spatio-temporal variability of the equatorial and low latitude Ionosphere-Results from the Indian Ionospheric tomography experiment, AOGS, July 2010, Hyderabad, India.
7. Mala S. Bagiya, Smitha V.Thampi, Malini Aggarwal, Sudha Ravindran, H. P. Joshi, K. N. Iyer, **G. Manju**, R.Sridharan, Geomagnetic storm effect on low-latitude Total Electron Content (TEC) COSPAR, July 2008, Montreal, Canada.
8. **Manju G.**, Tarun Kumar Pant, Sudha Ravindran and R. Sridharan, On the response of the Indian low latitude ionospheric regions to the magnetic disturbances of October 2003, COSPAR, July 2008, Montreal, Canada.
9. Smitha V. Thampi, Sudha Ravindran, Tarun Kumar Pant , C. V. Devasia , P. Sreelatha, **G. Manju**, R. Sridharan, and K. Niranjana, The Role of Background Ionospheric-

Thermospheric Conditions in the initiation of Equatorial Spread F (ESF) and the forecasting of ESF on a day-to-day basis, CPEA Symposium, March, 2007, Kyoto University, Kyoto, Japan.

10. **Manju G.**, Sudha Ravindran, C. V. Devasia, R. Sridharan , P. V. S. Ramarao , R. S. Dabas and M. R. Sivaraman, Longitudinal variability in the occurrence of Equatorial Spread F/scintillations at the crest and trough regions of the equatorial ionization anomaly, International Beacon Symposium, July 2007, Boston University, USA.
11. Tarun Kumar Pant, **G. Manju**, Smitha V. Thampi, C. Vineeth, Sudha Ravindran, C. V. Devasia and R. Sridharan, Response of the equatorial thermosphere-ionosphere system to the Halloween storm of October-November 2003, International Living With Star (ILWS) February 2006, Goa, India.
12. Sudha Ravindran, **G. Manju**, Tarun Kumar Pant, C. V. Devasia, Smitha V. Thampi, R. Sridharan and M. R. Sivaraman, Stormtime plasmaspheric electron content using GPS and CRABEX observations, ILWS, February 2006, Goa, India.
13. R. Sridharan, C.V. Devasia, Smitha Thampi, **G. Manju**, Sudha Ravindran and Tarun K. Pant, Solar influences on equatorial ionospheric irregularities, ILWS 2006, February 2006, Goa, India.
14. **Manju G.**, C. V. Devasia and R. Sridharan, A study on the solar activity dependence of the threshold height for the occurrence of spread F during summer and winter solstice periods, URSIGA 2005, New Delhi, India.
15. **Manju G.**, Sudha Ravindran, C. V. Devasia and R. Sridharan, The role of plasma turbulence in the E-W asymmetry of the experimentally observed electron drift velocities and altitude of occurrence of maximum electron drift velocity in the EEJ region, URSI General Assembly 2005, New Delhi, India.
16. C. V. Devasia, Smitha V Thampi, Sudha Ravindran, Diwakar Tiwari , **G. Manju** and R Sridharan, VHF radar studies of the daytime equatorial E and F region electrodynamic dynamics associated with Blanketing Es and Spread F occurrence, URSI-General Assembly A 2005, New Delhi, India
17. Smitha V Thampi, Sudha Ravindran, C V Devasia, Tarun K Pant, P Sreelatha, **G. Manju** and R Sridharan, The role of different electrodynamic conditions in the E and F regions



of the ionosphere for the generation of ESF: A study using radio beacon measurements, URSI-General Assembly, 2005, New Delhi, India.

18. Devasia C. V., **Manju G.**, Sudha Ravindran, Smitha V. Thampi, Tarun K. Pant, Diwakar Tiwari and R. Sridharan, On the Equatorial Ionospheric Response to the Severe Space Weather Event of October-November 2003, COSPAR, July 2004, Paris, France.

### *National Symposia*

1. Aswathy R. P. and **G. Manju**, Gravity wave control on ESF day to day variability, An empirical approach **29<sup>th</sup> Kerala Science Congress**, January 28-30, 2017, Pathanamthitta, Kerala
2. Aswathy R.P. and **G. Manju**, Gravity wave control on ESF day to day variability, **URSI-Regional conference on radio science**, March 1-4, 2017, Tirupathi, Andhra Pradesh
3. **Manju G.**, Sreelatha, P., Tarun Kumar Pant, Rosmy John, Aneesh A. N. and Satheesh Thampi, Design and development of Ionization Density and Electric field Analyzer (IDEA) Experiment for PSLV mission, Design and development of Ionization Density and Electric field Analyzer (IDEA) Experiment for PSLV mission, Hindi Seminar, **October 2017**, VSSC, Trivandrum, India
4. Aswathy R. P. and **G. Manju**, Gravity wave control on ESF day to day variability: An empirical approach, 32nd National Symposium on Plasma Science & Technology', 07-10 November 2017, Institute for Plasma Research, Gandhinagar, Gujarat, India.
5. Aswathy R.P. and **G. Manju**, Role of planetary wave activity in the seasonal/ day to day variability of the time of peak post sunset vertical drift over Indian longitudes, National Space Science Symposium (NSSS -2016), Trivandrum, India, February 9-12, 2016.
6. Madhav Haridas M. K, **G. Manju** and Tarun Kumar Pant, On the solar activity variations of nocturnal F region vertical drifts covering two solar cycles in the Indian longitude sector, National Space Science Symposium (NSSS -2016), Trivandrum, India, February 9-12, 2016.
7. Aswathy R.P. and **G. Manju**, Role of planetary wave activity in the seasonal/ day to day variability of the time of peak post sunset vertical drift over Indian longitudes, URSI-Regional conference on radioscience, New Delhi, India, November, 2015.

8. Madhav Haridas M.K., **G. Manju**, Tarun Kumar Pant, Solar activity variations of nocturnal thermospheric meridional winds over Indian longitude sector, Kerala Science Congress, Alappuzha, India, January 2015.
9. Aswathy R. P. and **G. Manju**, Role of planetary wave activity in the seasonal/ day to day variability of time of peak post sunset vertical drift over Indian longitudes, Regional Conference on Radio Science (RCRS), New Delhi, India, December 2015.
10. **Manju G.**, Sudha Ravindran, and Smitha V Thampi, Plasmaspheric electron content at magnetic equator and low latitudes during different geophysical conditions, National Space Science Symposium, February 2008, Ooty, India.
11. **Manju G.**, Tarun Kumar Pant, Sudha Ravindran and R. Sridharan On the response of the Indian low latitude ionospheric regions to the magnetic disturbances of October 2003, National Space Science Symposium, February 2008, Ooty, India.
12. **Manju G.**, Sudha Ravindran, Smitha V. Thampi and R. Sridharan, Study on ESF duration and strength at the magnetic equator in association with the duration and strength of L band scintillations in the EIA region, ENCAR workshop, November 2008, Mumbai, India.
13. **Manju G.**, C V Devasia and Sudha Ravindran, The seasonal and solar cycle variation of the electron density gradient scale length and its implications for ESF occurrence. incursi- Golden Jubilee Symposium on Radio Science (INCURSI 2007), 2007, New Delhi, India.
14. Tarun K. Pant, C. Vineeth, Smitha Thampi, V. Sreeja, **G. Manju**, Sudha Ravindran R. Sridharan and C. V. Devasia, Investigation of the Mesopause Lower Thermosphere Ionosphere (MLTI) Coupling:- First results from the CAWSES campaign, Golden Jubilee Symposium on Radio Science (INCURSI 2007), 2007, New Delhi, India.
15. Madhav Haridas and **G. Manju**, “On the response of the ionospheric F region over Indian low-latitude Station Gadanki to the annular solar eclipse of 15 January 2010” during NSSS – 2012, on February, 2012, Thirupati, India
16. **Manju G.**, Tarun K. Pant, C. V. Devasia, Sudha Ravindran and Smitha V. Thampi, Electrodynamic response of the low latitude ionosphere to the very large solar flare of 28 October 2003 – a case study, December 2006, MST11-2006, Tirupathi, India.
17. Sudha Ravindran, **G. Manju**, C. V. Devasia, Smitha V. Thampi and R. Sridharan, Comparison of TEC measurements using GPS and CRABEX receivers with IRI model values, NSSS-2006, February 2006, Vishkhapatnam, India,.

## **Workshops**

1. **Manju G.**, Aswathy R. P. and Madhav Haridas M. K., Gravity wave control on equatorial spread F day to day variability: an empirical model approach, UN/USA Workshop on the International Space Weather Initiative: The Decade after the International Heliophysical Year 2007, July 31-August 04, 2017, Boston, USA
2. **Manju G.**, Climate and Weather of Sun earth System –India (CAWSES-India) Workshop, May 2013, Gadanki, India
3. Sridharan R., **G. Manju**, P.Sreelatha, Sudha Ravindran, Neha Naik, P.Pradeep Kumar, Satheesh Thampi, Tarun K Pant, M.K. Madhav Haridas, M. Mridula and Lijo Jose, ‘In-situ Electron density and Neutral Wind (ENWi) measurements in the near earth space – Results from the solar eclipse campaign 2010’ at NaWRoSE 2011 (National Workshop on Results of Solar Eclipse 2011), Feb 2011, Trivandrum, India
4. **Manju G.**, Workshop on ionospheric correction for GPS Navigation: Its relevance for developing countries, ICTP, December 2006, Trieste, Italy.
5. **Manju G.**, Course on Global Navigation Satellite Systems (GNSS), Osmania University, November, 2006, Hyderabad, India.
6. **Manju G.**, GNSS Ionosphere Technical Workshop, December 2005, Bangalore, India

## **Memberships in professional bodies**

1. COSPAR Associate

## **Reviewer in Journals**

1. Journal of Geophysical Research-Space Physics, USA
2. Geophysical Research Letters, USA
3. Journal of Atmospheric and Solar Terrestrial Physics, Netherlands
4. Earth Planets and Space, Japan
5. Journal of Earth System Science, India
6. Advances in Space Research
7. Indian Journal of Radio and Space Physics, India