

July 22, 2026

ISEE Award in 2026

Award Winner: Dr. Natchimuthuk Gopalswamy (Staff Scientist, NASA Goddard Space Flight Center)

Title: Outstanding contribution to space-earth environmental research through international collaborative research on solar-terrestrial physics

Dr. Natchimuthuk (Nat) Gopalswamy is an internationally renowned researcher in the fields of coronal mass ejections (CMEs), high-energy solar particles, and space weather, and has long been a leading figure in research on the interaction between solar activity and the Earth's environment. At the Institute for Space-Earth Environmental Research (ISEE), Nagoya University, understanding solar activity and advancing space weather forecasting are among the priority research areas, and the institute has been promoting ongoing international collaborative research with Dr. Gopalswamy.

In particular, Dr. Gopalswamy organized an ISEE International Workshop titled “Origin of High-Energy Protons Responsible for Late-Phase Pion-Decay Gamma-Ray Continuum from the Sun” in 2023. In this Workshop, researchers in the fields of solar flares, high-energy solar particles, gamma-ray observations, and CME/shock wave physics gathered to address the critical scientific challenge of determining the origin of the high-energy protons responsible for sustained gamma-ray emission events. This workshop successfully fostered active international collaboration and yielded significant scientific results. As a direct outcome of the international collaborative research initiated through the workshop, five scientific papers have been published [1]–[5]. These studies have contributed to a deeper understanding of particle acceleration associated with solar eruptions and sustained gamma-ray emission.

In addition, as the President (2011–2019) and Past President (2019–2027) of the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) under the International Science Council (ISC), Dr. Gopalswamy has strongly supported SCOSTEP-related activities carried out by ISEE. SCOSTEP's recent programs and the ISEE-related activities in which Dr. Gopalswamy has been involved since 2015 can be summarized as follows.

- A) CAWSES-II Program (2009–2013): Guest Editor of the special issue summarizing the CAWSES-II Symposium held at Nagoya University in 2013 [9]
- B) VarSITI Program (2014–2018): Guest Editor of the special issue summarizing the 2019 ISEE International Workshop “VarSITI Program Summary Workshop” and co-author of a review paper [7]
- C) PRESTO Program (2020–2024): Co-author of the program definition paper [8], Guest Editor of the special issue related to the 2025 ISEE International Workshop “PRESTO Program Summary Workshop”
- D) COURSE Program (2026–2030): Co-author of the COURSE program definition paper [6], developed at the 2024 ISEE International Workshop “SCOSTEP Next Scientific Program Committee”

Furthermore, Dr. Gopalswamy made an important contribution to ISEE's joint-use and joint-research activities through the international continued operation of the Nobeyama Radioheliograph. The Nobeyama Radioheliograph is a globally important solar radio instrument that images the full solar disk at 17 GHz and 34 GHz with high temporal and spatial resolution.

After its operation by the National Astronomical Observatory of Japan ended, the instrument was continuously operated for five years, from April 2015 to March 2020, by ICCON, the International Consortium for the Continued Operation of the Nobeyama Radioheliograph, whose lead institution was Nagoya University's Solar-Terrestrial Environment Laboratory, later ISEE, and which consisted of research institutions in Japan, the United States, China, and Korea. Dr. Gopalswamy, as a core member of ICCON, played a central role in establishing and sustaining the international operational framework centered on ISEE. Through this continued operation, the Nobeyama Radioheliograph was made available to researchers in Japan and abroad as an ISEE joint-use facility. As one example of the resulting scientific achievements, Dr. Gopalswamy and his collaborators used 17 GHz microwave imaging observations from the Nobeyama Radioheliograph to show that the enhancement of the polar microwave brightness temperature is correlated with the polar magnetic field strength, and further applied the polar microwave brightness temperature to the prediction of the activity level of solar cycle 25. This study demonstrated the high scientific value of the long-term continuous observations by the Nobeyama Radioheliograph for studies of solar-cycle variability, solar polar magnetic fields, and space-weather prediction. This contribution is highly regarded not merely as international cooperation, but as a significant contribution to the maintenance and development of the observational infrastructure supporting ISEE's international joint-use and joint-research activities, as well as to the creation of scientific achievements using those observational data.

In addition, Dr. Gopalswamy served as one of five international external evaluators of ISEE in the international external evaluations conducted by ISEE in June 2018 and March 2026. During these evaluations, he assessed ISEE's activities from an international perspective and consistently provided constructive feedback and insights, thereby contributing to the expansion of ISEE's international activities.

As described above, Dr. Gopalswamy is an internationally renowned researcher in solar-terrestrial physics and has made outstanding contributions to space-earth environmental research through ISEE's international collaborative research programs. For this reason, we have decided to award the 2026 ISEE Award (Institute for Space-Earth Environmental Research Award) to Dr. Gopalswamy.

Related ISEE Joint Usage/Research Programs

2025 ISEE International Workshop "PRESTO Summarizing Workshop" (participant and guest editor of related special issue)

2024 ISEE International Workshop "Next Scientific Program (NSP) Committee meeting of the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP)" (participant and a co-author of related journal paper)

2023 ISEE International Workshop "Origin of High-Energy Protons Responsible for Late-Phase Pion-Decay Gamma-Ray Continuum from the Sun" (Workshop Convener Representative)

2019 ISEE International Workshop "VarSITI Summarizing Workshop" (participant, guest editor of related special issue, and a coauthor of related journal paper)

Publications of the awarded research

- I. Results related to the ISEE International Workshop “Origin of High-Energy Protons Responsible for Late-Phase Pion-Decay Gamma-Ray Continuum from the Sun”
- [1] **Gopalswamy, N.**, Makela, P., Akiyama, S. et al. “Multispacecraft Observations of the 2024 September 9 Backside Solar Eruption That Resulted in a Sustained Gamma Ray Emission Event.” *Solar Physics*, 300, 120 (2025). <https://doi.org/10.1007/s11207-025-02526-9>
 - [2] Mohan, A., Makela, P., **Gopalswamy, N.** et al. “Role of CME Clusters and CME-CME Interactions in Producing Sustained Gamma-Ray Emission Events.” *Solar Physics*, 300, 133 (2025). <https://doi.org/10.1007/s11207-025-02535-8>
 - [3] Vainio, R., Afanasiev, A., **Gopalswamy, N.** et al. “Long Duration Gamma-Ray Flares: The Number Problem.” *Solar Physics*, 301, 6 (2026). <https://doi.org/10.1007/s11207-025-02600-2>
 - [4] Warmuth, A., Pesce-Rollins, M., Omodei, N. et al. “Ion Acceleration in Fermi-LAT Behind-the-Limb Solar Flares: The Role of Coronal Shock Waves.” *Solar Physics*, 300, 114 (2025). <https://doi.org/10.1007/s11207-025-02522-z>
 - [5] **Gopalswamy, N.**, Makela, P., Yashiro, S., Akiyama, S., Xie, H., and Sindhuja, G. “Solar Cycle Variation of Sustained Gamma Ray Emission from the Sun.” *Solar Physics*, in press.
- II. Results from three SCOSTEP-related ISEE international workshops
- [6] Laurenza, Monica; Kazuo Shiokawa; Maria Graciela Molina; Hanli L. Liu; Natalie Krivova; Bernd Funke; Kanya Kusano; John Bosco Habarulema; Dalia Buresova; Matthew John West; Jorge Chau; Jie Zhang; Hilde Nesse; Ilya Usoskin; Tommaso Alberti; Lucilla Alfonsi; Odele Coddington; Sergio Dasso; Shing F. Fung; Hisashi Hayakawa; Yoshizumi Miyoshi; Rumi Nakamura; Manuela Temmer; Claudia Stolle; Quiang-G. Zong; Carine Briand; **Natchimuthuk Gopalswamy**; and Jana Safranov (2025), COURSE: Cross-scale cOUpling pRocesses in the Solar-tErrestrial system - SCOSTEP's new program for 2026-2030, *Earth, Planets, and Space*, 77:180. <https://doi.org/10.1186/s40623-025-02283-w>
 - [7] Zhang, J., Temmer, M., **Gopalswamy, N.** et al. Earth-affecting solar transients: a review of progresses in solar cycle 24. *Prog Earth Planet Sci* 8, 56 (2021). <https://doi.org/10.1186/s40645-021-00426-7>
 - [8] Daglis, I. A., Chang, L. C., Dasso, S., **Gopalswamy, N.**, Khabarova, O. V., Kilpua, E., Lopez, R., Marsh, D., Matthes, K., Nandy, D., Seppälä, A., Shiokawa, K., Thiéblemont, R., and Zong, Q. (2021): Predictability of variable solar–terrestrial coupling, *Ann. Geophys.*, 39, 1013–1035. <https://doi.org/10.5194/angeo-39-1013-2021>
 - [9] Yamamoto, M., Shiokawa, K., Nakamura, T., and **Gopalswamy, N.** Special issue “International CAWSES-II Symposium”. *Earth, Planets and Space*, 68:26 (2016). <https://doi.org/10.1186/s40623-016-0392-6>

III. Results related to the Nobeyama Radio Heliograph

- [10] **Gopalswamy, N.**, Mäkelä, P., Yashiro, S., and Akiyama, S. “Long-term solar activity studies using microwave imaging observations and prediction for cycle 25.” *Journal of Atmospheric and Solar-Terrestrial Physics*, 176, 26–33 (2018). <https://doi.org/10.1016/j.jastp.2018.04.005>

Career summary of the award winner:

Dr. Natchimuthuk Gopalswamy (Staff Scientist, NASA Goddard Space Flight Center)

After earning his Ph.D. from the Indian Institute of Science in 1982, he joined NASA following stints at the University of Maryland Research Institute and other institutions. He is internationally renowned for his research on solar activity, coronal mass ejections (CMEs), high-energy solar particle phenomena, and space weather, and has participated in international collaborative observation projects such as SOHO and STEREO. He has published numerous peer-reviewed papers and has made significant contributions to the advancement of space weather forecasting and solar physics.

