

# Curriculum Vitae

2017/11/06

**Name:** Liu, Jann-Yenq (Tiger)

**Date of Birth:** 27 February 1958

**Citizenship:** TAIWAN

**Position and Institution:** Chair Professor, Institute of Space Science, National Central University

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## Education

1988-1990	PhD	Physics	Utah State University USA
1983-1988	MS	Physics	Utah State University USA
1976-1980	BS	Atmospheric Physics	National Central University TAIWAN

## Specialized Field

1. Ionospheric Radio Sciences
2. GPS Geosciences Applications
3. Seismo-ionospheric Precursors and Disturbances
4. Ionospheric Space Weather and Climate

## Professional Background

1997/8-present	Professor	Institute of Space Science (ISS), National Central University (NCU)
2016/8-present	Senior Consultant	National Space Organization (NSPO)
2017/5-2017/6	Visiting Professor	Faculty of Sciences, Chiba University
2017/3-2017/4	Visiting Professor	Dept. of Civil & Enviro. Engineering, National Univ. of Singapore
2017/1	Visiting Professor	Institut de Physique du Globe de Paris (IPGP)
2011/1-2015/6	Chief Scientist	National Space Organization (NSPO)
2011/1-2011/12	Director	Earth Sci. Res. Promotion Center (ESRPC)
2009/7-2010/7	Visiting Scholar	National Center for Atmosphere Res. (NCAR)
2008/4-2009/5	Director	GPS Sci. Application Res. Center (GPSARC)
2006/2	Visiting Professor	Faculty of Sciences, Kyushu University
2002/8-2005/7	Director	Institute of Space Science, NCU/ISS
2001/6-2001/9	Visiting Professor	RASC, Kyoto University
2001/2-2001/5	Visiting Professor	Academia Sinica
1994/8-1995/2	Visiting Scientist	EISCAT, Tromsø, Norway
1990/8-1997/7	Associ. Professor	NCU/ISS
1992	Trainee	FAIS, Toulouse Center, France
1992	Trainee	JHU/APL
1988-1990	RA/TA	CASS/Phys. Dept., USU
1987-1988	Instructor	HAFB, Ogden Area Center, USU

1985-1986	RA	NASA, Marshall Space Flight Center
1983-1985	RA/TA	CASS/Phys. Dept., USU

### **Academic Awards or Honors**

International Space Science Institute (ISSI-Bern), Team Leader of Ionospheric Space Weather Studied by RO and Ground-based GPS TEC Observations: International Teams selected in 2016

National Taitung University Distinguish Chair Professor (2016/9-2019/7)

NCU Chair Professor (2015/8-2018/7)

Ministry of Science and Technology Outstanding Research Award (2014/8-2017/7)

NCU Distinguish Professor for Outstanding Research (2013/1-2015/12)

National Science Council Outstanding Research Award (2010/8-2013/7)

NCU Distinguish Professor for Outstanding Research (2010/1-2012/12)

NCAR Advanced Study Program- Faculty Fellowship Program (2009/8-2010/7)

National Science Council Outstanding Research Award (2006/8-2009/7)

NCU Distinguish Professor for Outstanding Research (2006/8-2009/7)

USU Presidential Fellowship (1989-1990)

### **Memberships**

1. American Geophysical Union (AGU)
2. Chinese Geoscience Union (CGU)
3. European Geosciences Union (EGU)
4. Asia Oceania Geosciences Society (AOGS)
5. Japanese Geoscience Union (JpGU)
6. American Metrology Society (AMS)

### **Academic Activity and Service**

AOGS ST (Solar Terr.) President (elected): 2017/8-2021/7

IAGA-Taiwan President: 2016/6-present

EMSEV- Bureau/IAGA Liaison: 2007-present

CGU Secretary in General: 2011/2-2014/2

COSPAR-Taiwan President: 2008/1-2012/7

AOGS STI (Solar Terr. Ionosphere) Secretary: 2003/7-2005/6

URSI (International Union of Radio Science)-SRS Secretary: 2002-2004

Invited Member of 2014 International Team: 298 Multi-instrument Space-Borne Observations and Validation of the Physical Model of the Lithosphere-Atmosphere-Ionosphere-Magnetosphere Coupling (team leader: Pulinets S. (RU) & D. Ouzounov (US)) granted by International Space Science Institute, ISSI-Bern.

Invited Member of 2015 International Team: 10 Validation of Lithosphere-Atmosphere- Ionosphere-Magnetosphere Coupling (LAIMC) (team leader: Ouzounov D. (US) & Zhang X. (CN)) granted by International Space Science Institute, ISSI-Beijing.

Invited Member of 2015 International Team: 345 Understanding Solid Earth/Ocean-Ionosphere Coupling: Improving Models and Observational Capabilities for Monitoring Tsunamis from Space (2016-2017, (team leader: Makela J. (US) & Rolland L. (FR)) granted by International Space Science Institute, ISSI-Bern.

Terrestrial, Atmospheric and Oceanic Sciences (TAO) special issue: FORMOSAT-5, Guest Editor 2016

Journal of Asian Earth Sciences (JAES) special issue: iSTEP, Guest Editor: 2014-2015

Atmospheric Measurement Techniques (AMT) special issue Observing Atmosphere and Climate with Occultation Techniques - Results from the OPAC-IROWG 2013 Workshop, Guest Editor: 2014-2015

Physics and Chemistry of the Earth (PCE) special issue: Electromagnetic phenomena associated with Earthquakes and Volcanoes, Guest Editor 2009

Journal of Asian Earth Sciences (JAES) special issue: Validation of earthquake precursors-VESTO, Guest Editor 2009

Terrestrial, Atmospheric and Oceanic Sciences (TAO) special issue: FORMOSAT-3/COSMIC, Guest Editor 2007

Terrestrial, Atmospheric and Oceanic Sciences (TAO) special issue: Earthquake precursor, Guest Editor 2005

Journal Referee: JGR, GRL, JAES, JASTP, EPS, AG, EPS, PCE, TAO, ASR

## LIU, JANN-YENQ (TIGER)

Professor, Institute of Space Science, National Central University

### Research Track

- 1983-1990 Ph.D. study at the Department of Physics, and thesis research work on airglow and Dynasonde at the Center for Atmospheric and Space Science, Utah State University.
- 1990- Started the faculty appointment at the Institute of Space Science, National Central University, Taiwan.
- 1994 Set up the first advanced ionospheric sounder of digisonde portable sounder (DPS) in Taiwan.
- 1994- Conducted seismo-ionospheric precursor study by comparing the ionospheric electron density at the F2-peak and earthquakes in Taiwan.
- 1994 Established a routine procedure to derive the ionospheric total electron content (TEC) from measurements of ground-based GPS receivers.
- 1996- Applied the set-up DPS and the developed GPS TEC routine to investigate the ionospheric signatures of solar flare, solar eclipse, magnetic storm, ionospheric storm, severe weather, etc. as well as equatorial ionization anomaly region.
- 1999 Developed statistical analyses for detecting temporal and spatial seismo-ionospheric anomalies of the GPS TEC before large earthquakes.
- 2000- Engaged the pre-launch study of FORMOSAT-3/COSMIC ionospheric observations.
- 2002- Enhanced the theoretical study of the ionospheric physics by sending five Ph.D. students to NCAR (National Center for Atmospheric Research) to learn about ionospheric modeling and simulations.
- 2002-2006 Awarded an Excellence Project from the Ministry of Education: “A study of earthquake electromagnetic precursors” (or integrated Search for Taiwan Earthquake; iSTEP). Set up the most comprehensive ground-based observation system of the world for earthquake precursor monitoring, including eight networks of electrodes, magnetometers, atmospheric electric field sensors, FM tuners, HF Doppler sounding systems, all sky cameras, and GPS receivers, with 52 instruments in total. This can be used to simultaneously monitor and detect earthquake precursors in the lithosphere, atmosphere and ionosphere as well as their coupling processes in Taiwan.
- 2006- Conducted projects of Tiny Ionospheric Photometer (TIP) and Gps Occultation eXperiment (GOX) onboard FORMOSAT-3/COSMIC. Integrated observations of TIP, GOX, ground-based ionospheric radars, GPS TEC and cross compared with ionospheric simulations to study the global 3D ionospheric structure and dynamics.
- 2008-2009 Became Director of GPS Science Application Research Center making a comprehensive plan on weather forecast and ionospheric monitoring for FORMISAT- 3/COSMIC.
- 2008-2011 Awarded an Outstanding Project granted by National Science Council: “Integrated Study and Taiwan Earth Precursor (iSTEP-2)”. Developed a seismo-ionospheric spatial study by the global ionosphere map and FORMOSAT-3/COSMIC ionospheric observations.
- 2009-2010 Sabbatical year supported by Advanced Fellowship Program-Faculty Fellowship Program at NCAR. Promoted and initiated the development of an assimilation model by using FORMISAT-3/COSMIC ionospheric data and TIEGCM model with neutral composition for ionospheric space weather
- 2011-2015 Became Chief Scientist of the National Space Origination (NSPO), National Apply Research Laboratories to plan satellite science missions and promote international collaborations. Have been Carrying out the international collaboration on FORMOSAT-3/COSMIC weather forecast and

- space weather prediction. Set up the science payload Advanced Ionospheric Probe being ready to be onboard FORMOSAT-5. Planned science payloads of FORMOSAT-7/COSMIC-2.
- 2012-2016 Obtained a grant on “Science Vanguard Research Program-integrated Study and Test Earth Precursor (iSTEP-3)” from the Ministry of Science and Technology. Developed and established monitoring systems for detecting seismo-ionospheric temporal and spatial precursors in Taiwan and the globe.
- 2014-2015 Being invited to join 2014 International Team: 298 Multi-instrument Space-Borne Observations and Validation of the Physical Model of the Lithosphere-Atmosphere-Ionosphere-Magnetosphere Coupling (team leader: Pulinet S. (RU) & D. Ouzounov (US)) granted by International Space Science Institute, ISSI-Bern. (<http://www.issibern.ch/teams/spaceborneobserve/>)
- 2015-2017 Being invited to join 2015 International Team: 10 Validation of Lithosphere-Atmosphere-Ionosphere- Magnetosphere Coupling (LAIMC) (team leader: Ouzounov D. (US) & Zhang X. (CN)) granted by International Space Science Institute, ISSI-Beijing. ([http://www.issibj.ac.cn/Program/I T/201304/t20130424\\_101265.html](http://www.issibj.ac.cn/Program/I T/201304/t20130424_101265.html))
- 2015-2017 Being invited to join 2015 International Team: 345 Understanding Solid Earth/Ocean-Ionosphere Coupling: Improving Models and Observational Capabilities for Monitoring Tsunamis from Space (2016-2017, (team leader: Makela J. (US) & Rolland L. (FR)) granted by International Space Science Institute, ISSI-Bern. (<http://www.issibern.ch/program/teams.html>)
- 2016-2018 Invite scientists from Taiwan, Japan, China, USA, Canada, France, Poland to form 2016 International Team: 375 Ionospheric Space Weather Studied by RO and Ground-based GPS TEC Observations, (team leader: Liu J.Y. (TW)) granted by International Space Science Institute, ISSI-Bern. (<http://www.issibern.ch/program/teams.html>)
- 2016-2020 Obtained a new grant on “Science Vanguard Research Program-integrated Study and Test Earth Precursor (iSTEP-4)” from the Ministry of Science and Technology. Study characteristics of seismo-ionospheric precursors in the total electron content (TEC) and develop lithosphere-atmosphere-ionosphere coupling models finding possible causal mechanisms for the large earthquake prediction and forecast of the globe.

In summary, Dr. J.Y. (Tiger) Liu’s research areas are

- (1) Ionospheric plasma structures and dynamics
- (2) Ionospheric space weather
- (3) Seismo-traveling ionospheric disturbances induced by earthquakes and tsunamis.
- (4) Seismo-ionospheric precursor

He has utilized ionospheric radars and ground-based GPS total electron content to study the ionospheric structure and dynamics of diurnal, seasonal, solar activity, and geographical variations as well as transit vents of solar flare, magnetic storm, solar eclipse, atmospheric wave and tide. He has been developing an assimilation model by inserting FORMISAT-3/COSMIC ionospheric data into the TIEGCM model with neutral composition for ionospheric space weather monitoring and prediction. Meanwhile, he has also constructed the most comprehensive ground-based observation system of the world to search for earthquake precursors in the lithosphere, atmosphere, and ionosphere, as well as the coupling processes between them. In fact, he is a pioneering and leading scientist in the seismo-ionospheric precursor study.

## Major research achievements and contributions

Dr. J. Y. (Tiger) Liu has been an academic faculty member at the Institute of Space Science of National Central University for more than 27 years, ever since he received his PhD degree from Utah State University in 1990. In total, 63 MS and 24 PhD students have graduated under his supervision. He has published 246 journal papers (98% with SCI), mostly in top ranking journals (such as the Journal of Geophysical Research (JGR), Geophysical Research Letters (GRL)), H-index 33. Currently, he is working with 4 postdoctoral research fellows, and supervising 3 PhD and 4 MS students. There are 82 published journal papers; he is either the first author or the correspondence author in 32 (39%=32/82) of them, 45% (=37/82) of them are published in GRL and JGR in the past five years (2012/1-2016/12).

- 1996 Established a routine procedure for computing the ionospheric total electron content (TEC) from the measurements of ground-based GPS receivers [Liu et al., TAO 1994]. This opened a new chapter for studying ionospheric signatures caused by solar flare, solar eclipse, magnetic storm, severe weather, earthquake, tsunami, etc. and ionospheric structure and dynamics (see 100+ papers on the list).
- 2000- Found seismo-ionospheric precursors (SIPs) of the 1999 Mw7.6 Chi-Chi earthquake and confirmed with statistical results of magnitude  $M \geq 6.0$  earthquakes. Initiated temporal and spatial SIP studies by using ground-based GPS TEC [Liu et al., GRL 2001, AG 2004, JGR 2010]. In fact, this established the leading position of his research team and significantly impacted earthquake precursory studies in the world.
- 2003 Set up the most comprehensive ground-based observation system of the world for simultaneously monitoring earthquake precursors in the lithosphere, atmosphere, and ionosphere, as well as the coupling between them. This system is the most important reference for satellites observing earthquake precursors (see 50+ papers on the list).
- 2004 Developed the theory and the observation technique for monitoring ionospheric solar flare effects by means of the TEC recorded by ground-based GPS receivers [Liu et al., GJR 2004; the 1<sup>st</sup> place of the most popular articles in year 2011 in JGR-Space Physics]. The development resulted in the finding that the ionospheric solar flare effect is a function the cosine of the great circle angle between the center and flare locations on the solar disc [Liu et al., JGR 2006; the 16<sup>th</sup> place of the most popular articles in year 2011 in JGR-Space Physics].
- 2006 Conducted a statistical analysis on the temporal seismo-ionospheric precursors of 184  $M \geq 5.0$  earthquakes in Taiwan during 1994-1999. Found characteristics of the precursor being the ionospheric electron density significantly decrease in the afternoon period 1-5 days before the earthquake, and the chance of observing the precursor is proportional to the earthquake magnitude.
- 2006 Pioneered the observation of tsunami waves by ground-based GPS TEC and applied the beam forming and ray tracing techniques to locate the tsunami origin [Liu et al. JGR 2006; the 2<sup>nd</sup> place of the most popular articles in year 2011 in JGR-Space Physics.] This should help developing a complementary system for the early warning of tsunamis (see, Lovett [Nature News 2010]).
- 2010 Found the solid evidence that Moon's shadow of the solar eclipse can trigger the atmospheric gravity waves, which in turn form the bow wave, the stern wave, and the stern wake in the atmosphere and

- ionosphere since the bow wave was predicted in 1970 [Liu et al., GRL highlight, alternatively reported by the other journals 2011].
- 2010 Predicted plasma caves underlying the crests of equatorial ionization anomaly which were observed in 1938 [Liu et al., JGR 2010]. Lee et al. [JGR 2012] confirmed the plasma caves with in situ measurements of Dynamic Explorer DE-2 and proposed the vertical plasma drift being important. Chen et al. [JGR 2014] found the atmospheric tides being essential by ionospheric model simulations.
- 2011 For the first time observed the tsunami origin and propagations from space [Liu et al., JGR 2011; the 15<sup>th</sup> place of the most popular articles in year 2011 of JGR-Space Physics].
- 2012- Accomplished the first ionospheric weather monitoring and forecast model with the neutral atmosphere [Lee et al., JGR 2012] assimilating ionospheric FORMOSAT-3/COSMIC observations into the TIEGCM model. Lee et al. [JGR 2013] conducted observing system simulation experiments by inserting FORMOSAT-7/COSMIC-2 data into the assimilation model and found that the error could be significantly reduced to 1/4 of that of FORMOSAT-3/COSMIC. Hsu et al. [JGR 2014] showed that the assimilation model yields the more accurate longer prediction, if the neutral parameters are updated in each step.
- 2013 Combined satellite in situ measurements and ground-based GPS TEC observations detecting temporal and spatial SIPs (seismo-ionospheric precursors) [Ho et al., ASR 2013; Ho et al., NHESS 2013; Liu et al., JAES 2015] ◦
- 2015 Analyzed lightning activities and 395  $M \geq 5.0$  earthquakes during 1993-2004 and found that the lightning activities significantly enhance over the epicenter 17-19 days before the earthquakes [Liu et al., GEOP 2015], which shows the first statistical evidence of seismo-atmospheric electricity precursors.
- 2015 Evaluated the global L-band scintillation by using FORMOSAT-3/COSMIC observations by studying the quality of satellite communication, positioning, and navigation for diurnal, seasonal, solar activity, and geographical variations [Liu et al., GEOP 2016].
- 2016 Applied co-located seismometer, infrasonic system, magnetometer, HF Doppler sounding system, and ground-based GPS TEC studying the vertical propagation of seismo-atmospheric traveling disturbances (STADs) induced by the Relight waves traveling into the upper atmosphere, and then the ionosphere. For the first time, study the vertical propagation of STADs or the lithosphere-atmosphere-ionosphere in detail [Liu et al., GRL 2016].
- 2017 Pioneered using ion velocity probed by satellite to derive the seismo electric field, which penetrating from the ground and generated during the earthquake preparation period [Liu and Chao, TAO 2017].
- 2017 Accomplished a rapid and accurate ionospheric monitoring model of TIGER GIM by using total electron content from ground-based GNSS receiver and FORMOSAT-3/COSMIC GPS occultation experiment [Sun, Liu et al., GPSSol, 2017].
- 2017 Accomplished the first empirical model for prediction of L-band scintillation S4 index by using FORMOSAT-3/COSMIC data [Chen, Bilitza, Chen et al., ASR, 2017].

In summary, Dr. J. Y. Liu has been teaching ionospheric/space physics and conducting research with radar and satellite experiments for more than 27 years. These allow him to carry out scientific research with theoretical developments, simulations, and data analyses. His research can generally be divided into the following three areas: (1) ionospheric 3D structure and dynamics, (2) ionospheric space weather, and (3) earthquake precursors, and (4) coseismic disturbances. The study of ionospheric structure and dynamics covers various topics and broad areas. The important contributions are: develop the theory and observation for studying ionospheric solar flare effects; find the evidence of Moon's shadow of the solar eclipse triggering the bow wave, the stern wave, and the stern wake; and discover the ionospheric plasma caves. For the second area he has established the first assimilation model with the neutral/atmospheric composition for the ionospheric space weather monitoring and prediction. This results in significantly improving the accuracy and the period of the prediction. The most important contribution to the third area is the development of processes for detecting the temporal and spatial seismo-ionospheric precursors. It requires reliable precursors to carry out the earthquake forecast/prediction. Currently, statistical analyses in Taiwan, China, Japan, and Indonesia, as well as corresponding event studies on the 1999 M7.6 Chi-Chi earthquake, 2004 M9.3 Sumatra earthquake, 2008 M8.0 Wenchuan earthquake, 2010 M7.0 Haiti earthquake, and 2011 Tohoku earthquake show that the seismo-ionospheric precursor is the most reliable, useful, and credible one. Moreover, the applicant has also found the ionospheric tsunami signature and for the first time derived the tsunami origin. Dr. Liu has been leading the study of ionospheric earthquake precursors and earthquake/tsunami disturbances.



## Publication List

\* Corresponding author

### [2017] 09

- 246 · Lin, C. Y., Matsuo, T., Liu, J. Y., Lin, C. H., Huba, J. D., Tsai, H. F., & Chen, C. Y. (2017). Data assimilation of ground-based GPS and radio occultation total electron content for global ionospheric specification. *Journal of Geophysical Research: Space Physics*, 122. <https://doi.org/10.1002/2017JA024185>
- 245 · Chen, S. P., D. Bilitza, J. Y. Liu\*, R. G. Caton, L. C. Chang, and W. H. Yeh (2017), An empirical model of L-band scintillation S4 index constructed by using FORMOSAT-3/COSMIC data, *Advances in Space Research*, 60, 1015-1028, DOI: 10.1016/j.asr.2017.05.031.
- 244 · Sun, Y. Y., J. Y. Liu\*, H. F. Tsai, and A. Krankowski (2017), Global ionosphere map constructed by using total electron content from ground-based GNSS receiver and FORMOSAT-3/COSMIC GPS occultation experiment, *GPS Solutions*, 41, doi:10.1007/s10291-017-0635-4.
- 243 · Liu J. Y.\*, C. H. Chen, T. Y. Wu, H. C. Chen, K. Hattori, I. C. Yang, T. Bleier, K. Kappler, Y. Xia, W. Chen, and Z. Liu, Co-seismic signatures in magnetometer, geophone, and infrasound data during the Meinong Earthquake, *Terrestrial Atmospheric and Oceanic Sciences*, **28**, doi: 10.3319/TAO.2017.03.05.01.
- 242 · Chang, H. P., G. S. Chang, and J. Y. Liu (2017), Introduction to the Special Issue on “Earth Observation FORMOSAT-5”. *Terrestrial Atmospheric and Oceanic Sciences*, **28**, I-II, doi: 10.3319/TAO.2017.02.07.01(EOF5).
- 241 · Chen, C. H., C. C. H. Lin, J. Y. Liu, T. Matsuo, and W. H. Chen (2017), The impact of FORMOSAT-5/AIP observations on the ionospheric space weather, *Terrestrial Atmospheric and Oceanic Sciences*, **28**, 129-137, doi: 10.3319/TAO.2016.09.30.01(EOF5).
- 240 · Liu, J. Y.\*, and C. K. Chao, (2017). An observing system simulation experiment for FORMOSAT-5/AIP detecting seismo-ionospheric precursors, *Terrestrial Atmospheric and Oceanic Sciences*, **28**, 117-127, doi: 10.3319/TAO.2016.07.18.01(EOF5).
- 239 · Liu, J. Y.\*, Y. Y. Sun, C. K. Chao, S. P. Chen, and M. Parrot (2017), An observing system simulation experiment for FORMOSAT-5/AIP probing topside ionospheric plasma irregularities by using DEMETER/IAP, *Terrestrial Atmospheric and Oceanic Sciences*, **28**, 111-116, doi:10.3319/TAO.2016.08.18.01(EOF5).
- 238 · Lin, Z. W., C. K. Chao, J. Y. Liu, C. M. Huang, Y. H. Chu, C. L. Su, Y. C. Mao, and Y. S. Chang, (2017). Advanced Ionospheric Probe scientific mission onboard FORMOSAT-5 satellite. *Terrestrial Atmospheric and Oceanic Sciences*, **28**, 99-110, doi: 10.3319/TAO.2016.09.14.01(EOF5).
- 237 · Chou, M. Y., C. C. H. Lin, J. Yue, H. F. Tsai, Y. Y. Sun, J. Y. Liu, and C. H. Chen, Concentric traveling ionosphere disturbances triggered by Super Typhoon Meranti (2017), *Geophysical Research Letters*, **44**, Issue 3, 1219-1226, doi: 10.1002/2016GL072205.

### [2016] 16

- 240 · Kamogawa, M., Y. Orihara, C. Tsurudome, Y. Tomida, T. Kanaya, D. Ikeda, A. R. Gusman, Y. Kakinami, J. Y. Liu & A. Toyoda, A possible space-based tsunami early warning system using observations of the tsunami ionospheric hole, *Scientific Reports*, 6:37989, 1-7, doi:10.1038/srep 37989. DEC. 2016.
- 239 · Han, P., K. Hattori, J. Zhuang, C. H. Chen, J. Y. Liu, and S. Yoshida, Evaluation of ULF seismo-magnetic phenomena in Kakioka, Japan by using Molchan’s error diagram, *Geophysical Journal International*, **208**, 482-490, doi: 10.1093/gji/ggw404, NOV. 2016.

- 238 ․ Liu, J. Y.\*, and C. K. Chao, An observing system simulation experiment for FORMOSAT-5/AIP detecting seismo-ionospheric precursors, *Terrestrial Atmospheric and Oceanic Sciences*, 1-28. doi:10.3319/TAO.2016.07.18.01(EOF5). NOV. 2016.
- 237 ․ Chen, C. H., C. H. Lin, J. Y. Liu, T. Matsuo and W. H. Chen, The impact of FORMOSAT-5/AIP on the ionospheric space weather, *Terrestrial Atmospheric and Oceanic Sciences*, 1-21. doi: 10.3319/TAO.2016.09.30.01(EOF5), NOV. 2016.
- 236 ․ Lin, Z. W., C. K. Chao, J. Y. Liu, C. M. Huang, Y. H. Chu, C. L. Su, Y. C. Mao, and Y. S. Chang, Scientific Mission of Advanced Ionospheric Probe Onboard FORMOSAT-5 Satellite, *Terrestrial Atmospheric and Oceanic Sciences*, 1-40. doi:10.3319/TAO.2016.09.14.01(EOF5). NOV. 2016.
- 235 ․ Liu, J. Y.\*, Y. Y. Sun, C. K. Chao, S. P. Chen, and Michel Parrot, An observing system simulation experiment for FORMOSAT-5/AIP probing topside ionospheric plasma irregularities by using DEMETER/IAP, *Terrestrial Atmospheric and Oceanic Sciences*, 1-20. doi:10.3319/TAO.2016.08.18.01(EOF5). SEP. 2016.
- 234 ․ Sun, Y. Y., J. Y. Liu, C. Y. Lin, H. F. Tsai, Loren C. Chang, C. Y. Chen, and C. H. Chen, Ionospheric F2 region perturbed by the 25 April 2015 Nepal earthquake, *Journal of Geophysical Research: Space Physics*, **121**, 5778–5784, doi:10.1002/2015JA022280. JUN. 2016.
- 233 ․ Liu, J. Y.\*, Loren C. W. Chang, C. K. Chao, M. Q. Chen, Y. H. Chu, L. N. Hau, C. M. Huang, C. L. Kuo, L. C. Lee, L. H. Lyu, C. H. Lin, C. J. Pan, J. H. Shue, C. L. Su, L. C. Tsai, Y. H. Yang, C. H. Lin, R. R. Hsu and H. T. Su, The fast development of solar terrestrial sciences in Taiwan, *Geoscience Letters*, 1-11, doi: 10.1186/s40562-016-0049-0. JUN. 2016.
- 232 ․ Chen, C. H., C. H. Lin, T. Matsuo, W. H., Chen, I. T., Lee, J. Y., Liu, J. T. Lin, and C. T., Hsu, Ionospheric data assimilation with thermosphere-ionosphere-electrodynamics general circulation model and GPS-TEC during geomagnetic storm conditions, *Journal of Geophysical Research*, **121**, 5708-5722, doi:10.1002/2015JA021787, JUN. 2016.
- 231 ․ Rajesh, P. K., J. Y. Liu, C. H. Lin, A. B. Chen, R. R. Hsu, C. H. Chen, and J. D. Huba, Space-based imaging of nighttime medium-scale traveling ionospheric disturbances using FORMOSAT-2/ ISUAL 630.0nm airglow observations, *Journal of Geophysical Research: Space Physics*, **121**, 4769-4781, doi:10.1002/2015JA022334. MAY 2016.
- 230 ․ Chum Jaroslav, J. Y. Liu, S. P. Chen, M. A. Cabrera, J. Laštovička, J. Baše, D. Burešová, J. Fišer, F. Hruška and R. Ezquer, Spread F occurrence and drift under the crest of the equatorial ionization anomaly from continuous Doppler sounding and FORMOSAT-3/COSMIC scintillation data, *Earth, Planets and Space*, doi: 10.1186/s40623-016-0433-1, APR. 2016.
- 229 ․ Maruyama, N., Y. Y. Sun, P. G. Richards, J. Middlecoff, T. W. Fang, T. J. Fuller Rowell, R. A. Akmaev, J. Y. Liu, and C. Valladares, A new source of the midlatitude ionospheric peak density structure revealed by a new Ionosphere-Plasmasphere model, *Geophysical Research Letters*, **43**, 2429-2435, doi:10.1002/2015GL067312, MAR. 2016.
- 228 ․ Liu, J. Y.\*, S. P. Chen, W. H. Yeh, H. F. Tsai, and P. K. Rajesh, Worst-case GPS scintillations on the ground estimated from radio occultation observations of FORMOSAT-3/COSMIC during 2007-2014, *Surveys in Geophysics*, 1-19, doi:10.1007/s10712-015-9355-x, JAN. 2016.
- 227 ․ Liu, J. Y.\*, C. H. Chen, Y. Y. Sun, C. H. Chen, H. F. Tsai, H. Y. Yen, J. Chum, J. Lastovicka, Q. S. Yang, W. S. Chen, S. Wen, The vertical propagation of disturbances triggered by seismic waves of the 11

March 2011 M9.0 Tohoku Earthquake over Taiwan, *Geophysical Research Letters*, **43**, 1759-1765, doi:10.1002/2015GL067487. FEB. 2016.

- 226 · Rajesh, P. K., J. Y. Liu, N. Balan, C. H. Lin, Y. Y. Sun, and S. A. Pulinets, Morphology of midlatitude electron density enhancement using total electron content measurements, *Journal of Geophysical Research: Space Physics*, **121**, 1503-1517, doi:10.1002/2015JA022251. FEB. 2016.
- 225 · Liu, J. Y.\*, Y. B. Tsai, C. H. Chen, Y. I. Chen, H. Y. Yen, Integrated, Search for Taiwan Earthquake Precursors (iSTEP), *IEEJ Transactions on Fundamentals and Materials*, 136, No.5, 214-220, doi:10.1541/ieejfms.136.214. JAN. 2016.

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18. Liu, J. Y., Seismo-ionospheric effects and Ionospheric Observation by Using FORMOSAT-3/COSMIC and FORMOSAT-7/COSMIC-2, International Space Weather Conference, Guilin, China 11-14 November 2013. (Keynote)
19. Liu, J. Y., S. P. Chen, C. H. Hsu, I. T. Lee, G. S. Chang, S. J. Yu, and T. Y. Liu, Storm Signatures and Irregularities in the Equatorial Ionosphere Observed by Using FORMOSAT-3/COSMIC, AGU Fall Meeting, San Francisco USA, 09-13 December 2013. (Invited)
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25. Liu, J. Y., Seismo-ionospheric precursors and ionospheric storm signatures in the total electron content during the 16 October 1999 Mw7.1 Hector Mine earthquake, International Workshop on Earthquake Preparation Process 2014 - Observation, Validation, Modeling, Forecasting - (IWEP2014), Hokkaido University, Sapporo, Japan, August 2, 2014. (Invited)
26. Liu, J. Y., Y. I. Chen, C. S. Huang, A statistical Study on GPS TEC variations associated with  $5.6M \geq 6.0$  earthquakes in China during 1998-2013, The XXXI General Assembly of the International Union of Radio Science, Beijing, China on August 16-23, 2014. (Invited)
27. Liu J. Y., Atmospheric and Ionospheric Volcanic Disturbances Probed by FORMOSAT-3/ COSMIC, Eighth FORMOSAT-3/COSMIC Data Users' Workshop, Boulder, Colorado U.S.A., 30 September - 2 October 2014. (Invited)
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36. Liu, J. Y., S. P. Chen, and W. H. Yeh, The space weather of the global ionosphere S4 scintillation, European Geosciences Union General Assembly 2016, Vienna Austria, 17-22 April 2016. (Solicited)
37. Liu, J. Y., Seismo-ionospheric precursors probed by global navigation satellite system during the 12 May 2008 M8.0 Wenchuan Earthquake, International Beacon Satellite Symposium Trieste, Italy, 25 June-2 July 2016. (Invited)
38. Liu, J. Y., S. P. Chen, W. H. Yeh, The global ionosphere S4 scintillation during the solar minimum and maximum of Cycle 24, AOGS 13th Annual Meeting, Beijing, 31 July-05 August 2016. (Invited)
39. Liu, J. Y., and C. T. Hsu., FORMISAT-3/COSMIC Observations on Stormed Traveling Ionospheric and Atmospheric Disturbances, AOGS 13th Annual Meeting, Beijing, 31 July-05 August 2016. (Invited)
40. Liu, J. Y., Seismo-ionospheric precursors [conjugate effects] and volcano-lightning signature, International 2016 EMSEV Workshop, Lanzhou, China, August 25 – 29, 2016. (Invited)
41. Liu, J. Y., Ionospheric weather and climate observed by FORMOSAT-3/COSMIC and FORMOSAT-7/COSMIC-2, The 12th Cross Straits Space Science Workshop, Kunming, China, 6-8 September 2016. (Keynote)
42. Liu, J. Y., Taiwan's past, present, and future space science program, the 1st Space Science School, Chonburi, Thailand, October 16-26, 2016. (Invited)
43. Liu, J. Y. Tiger, Ionospheric Climate and Weather Probed by GNSS Radio Occultation Soundings, Korean Space Science Society Meeting, Jeju, Korea, October 25-28, 2016. (Invited)
44. Liu, J. Y. Tiger et al., Global Three-Dimensional Ionospheric Data Assimilation Model Using Ground-based GPS and Radio Occultation Total Electron Content, European Geosciences Union General Assembly 2017, Vienna Austria, 23-28 April 2017. (Solicited)
45. Liu J. Y., Ionospheric Space Weather Probed by GNSS Radio Occultation Soundings, ICONSPACE (2017 International Conference on Space Science and Communication), Kuala Lumpur, Malaysia May 3-5, 2017. (Keynote)
46. Liu J. Y., Measuring the Seismo-Generated Electric Field in the Ionosphere before Large Earthquakes, 2017 URSI General Assembly and Scientific Symposium (GASS), Montreal, Canada, August 19-26, 2017. (Invited)
47. Liu J. Y., Ionospheric Weather Probed by Radio Occultation of FORMOSAT-3/COSMIC, 2017 URSI General Assembly and Scientific Symposium (GASS), Montreal, Canada, August 19-26, 2017. (Invited)



48. Liu J. Y., Seismo-ionospheric Precursors of the Total Electron Content Associated with Global Large Earthquakes Examined by Using Ground-based and Space-based Radio Occultation GNSS Observations, AGU Fall Meeting, New Orleans USA, 11-15 December 2017. (Invited)