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Introduction to the special issue on recent advances and developments in atmospheric electricity

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The special issue highlights the state of research efforts on the atmospheric electricity in Asia, particularly in Taiwan, China and Japan. In some ways, this can also be viewed as a commemorative issue for the ISUAL/FORMOSAT2 experiment, which officially ended its mission in July 2016. The first breakthrough on atmospheric electricity research in Taiwan was achieved through ground campaigns, including the investigations of transient luminous events (TLEs) near the vicinity of Taiwan (Su et al. 2002; Hsu et al. 2003) and gigantic jet (Su et al. 2003). From 2004 - 2016, the satellite mission of ISUAL (Imager of Sprite/Upper Atmospheric Lightning) onboard the FORMOSAT2 satellite was conducted, and a few important results are reported in (Hsu et al. 2017; this issue). The ISUAL mission is a successful international cooperation between Taiwan, USA and Japan (Chern et al. 2003; Su et al. 2005; Chen et al. 2008). The past and current TLE scientific missions include the Mediterranean Israeli Dust Experiment (MEIDEX) sprite campaign onboard the space shuttle Columbia in 2003 (Yair et al. 2003), a Japanese micro satellite SPRITE-SAT (2010-) (Takahashi et al. 2010), the Japan mission Global Lightning and Sprite Measurements on Japanese Experiment Module (JEM-GLIMS) on the International Space Station (ISS) from 2011 (Sato et al. 2015, 2017), NASA Crew Earth Observation program (2011 - 2012) (Jehl et al. 2013), and the Iriss mission by Denmark's first astronaut, Andreas Mogensen on the ISS (Chanrion et al. 2017). The upcoming orbit missions including ASIM (Atmosphere-Space Interaction Monitor) (Neubert 2009) and TARANIS (Tool for the Analysis of RAdiations from lightNIngs and Sprites) (Farges et al. 2017). The ISUAL mission besides being a pioneer atmospheric electricity program, also is a historic space platform dedicating to the study of TLEs in the middle atmosphere (Hsu et al. 2017; this issue).

In the special issues, papers are invited on the topics relevant to atmospheric electricity, especially for TLEs, thunderstorms, and lightning. In the special issue, Hsu et al. (2017) reviewed the important scientific results from the ISUAL mission, Chang et al. (2017) analyzed the sensitivity degradation of the Far Ultra-Violent (FUV) photometer, which affects the observed intensity of FUV emissions. Wu et al. (2017) revisited the occurrence rate of elves during El Niño and La Niña and extend the time series analysis to 25 November 2015. Lu et al. (2017a) examined the broadband (< 1 Hz to 30 kHz) lightning sferics associated with 395 sprites observed near North America by ISUAL in a 12-year period from 2004 - 2015. Sato et al. (2017) show the statistical results of TLEs in the JEM-GLIMS missions. Their innovative data analytical methods of nadir observation from ISS include: (1) extraction of relatively weak sprite emission from lightning emission, (2) a calculation of the intensity ratio between different photometer channels, and (3) an estimation of the charge moment change of the suspected sprite-producing CG discharge. For TLE ground campaign, Peng et al. (2017) showed the first coordinated observation on TLEs from space and ground, and Lu et al. (2017b) analyzed a recorded sprite spectrum by the slitless spectroimager in the 2016 Lulin Observatory ground campaign. Yang et al. (2017) showed TLEs ground observations in mainland China in 2012. This study found a very unusual and unique positive sprite event, which may be produced jointly by two distinct positive cloud-to-ground lightning flashes but separated by about 27 km.

Lastly, we hope that this special issue, in some way, can serve as a catalyst for the future communication and cooperation of the atmospheric electricity community in Asia.

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