Analysis of a gigantic jet in southern China: morphology, meteorology, storm evolution, lightning and narrow bipolar events

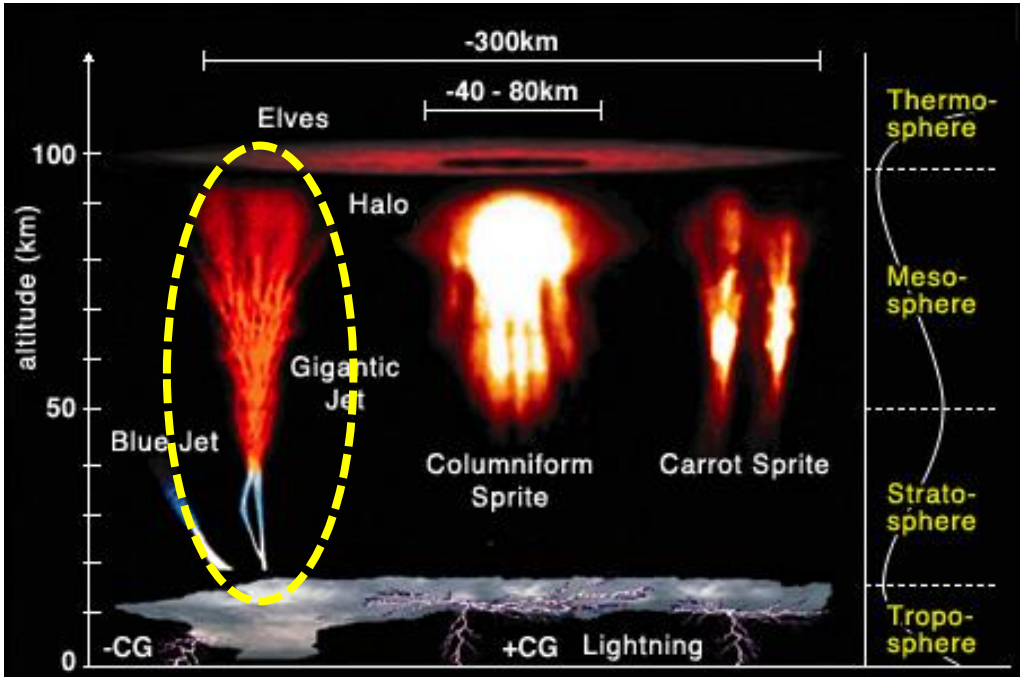
Jing Yang[1], Xiushu Qie[1*], Lihua Zhong[1,2], Qijia He[3], Gaopeng Lu[4], Zhichao Wang[5], Yu Wang[6], Ningyu Liu[7], Feifan Liu[4], Kang-Ming Peng[4], Baoyou Zhu[4], Anjin Huang[1], Mitsuteru Sato[8], Huien Pan[9], Hualong Li[10]

1. LAGEO, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, 100029, China
2. Chengdu University of Information Technology, Chengdu, 610225, China
3. Chongqing air traffic control branch of southwest regional air traffic administration of civil aviation of China, Chongqing, 401120, China
4. University of Science and Technology of China, School of Earth and Space Science, Hefei, 230026, China
5. China Meteorological Administration, Beijing, China
6. State Grid Electric Power Research Institute, Wuhan, China
7. Space Science Center, Department of Physics, University of New Hampshire, Durham, NH, USA
8. Department of Cosmosciences, Hokkaido University, Sapporo, Japan
9. Xinfeng county, Shaoguan city, Guangdong province, 511100, China
10. Jiahe county, Chenzhou city, Hunan province, 424500, China

Outline

1. Introduction
2. Analysis and results
3. Summary

1. Introduction



http://www.ep.sci.hokudai.ac.jp/~msato/GLIMS/science/TLEs.html

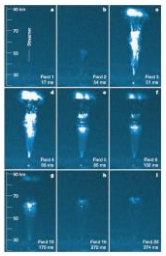
First discovery: Pasko et al. (2002)

Ground-based observations: Su et al., 2003; van der Velde et al., 2007; Cummer et al., 2009; van der Velde et al., 2010; van Velde et al ., 2010; Soula et al., 2011; Lu et al., 2011; Peng et al., 2018; He et al., 2019

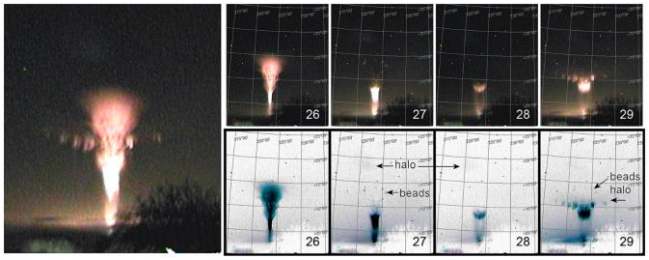
Satellite-based experiments: Chen et al., 2008; Kuo et al., 2009; Boggs et al., 2019.

1. Introduction

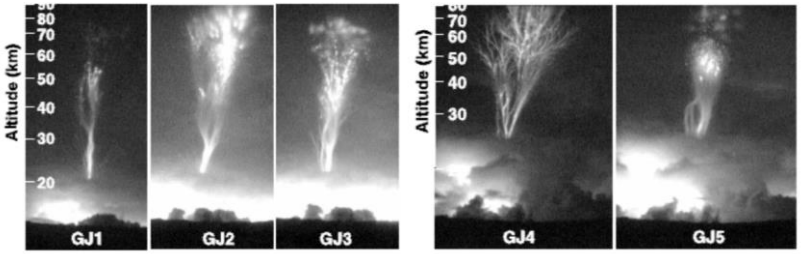
Pasko et al. (2002)



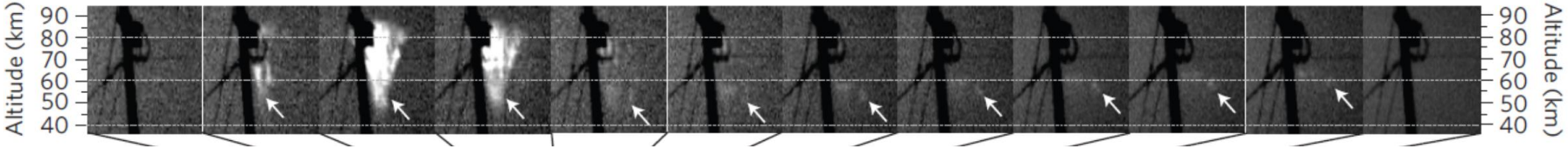
Su et al. 2003



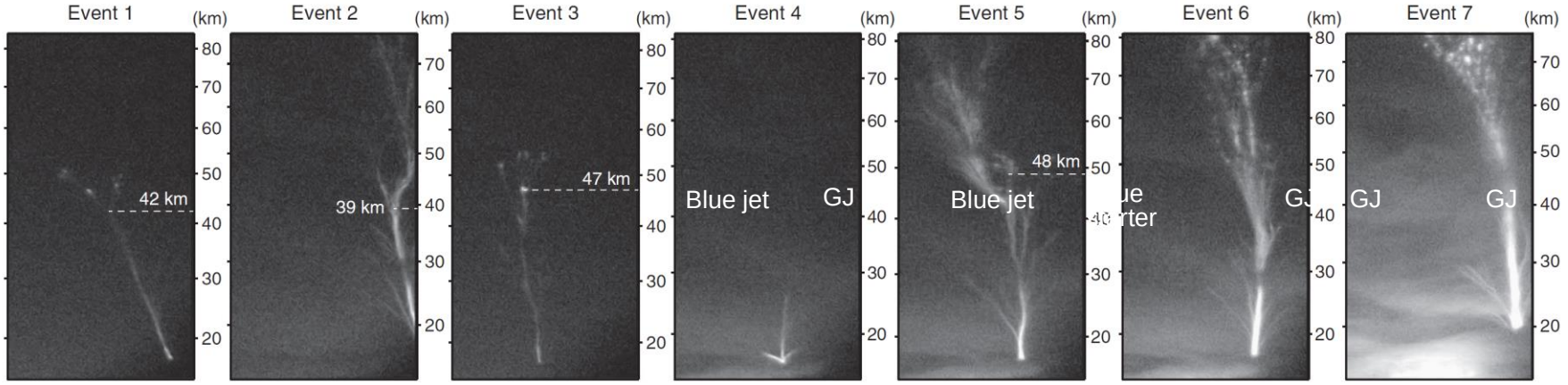
van der Velde et al. (2010)



Soula al. (2011)

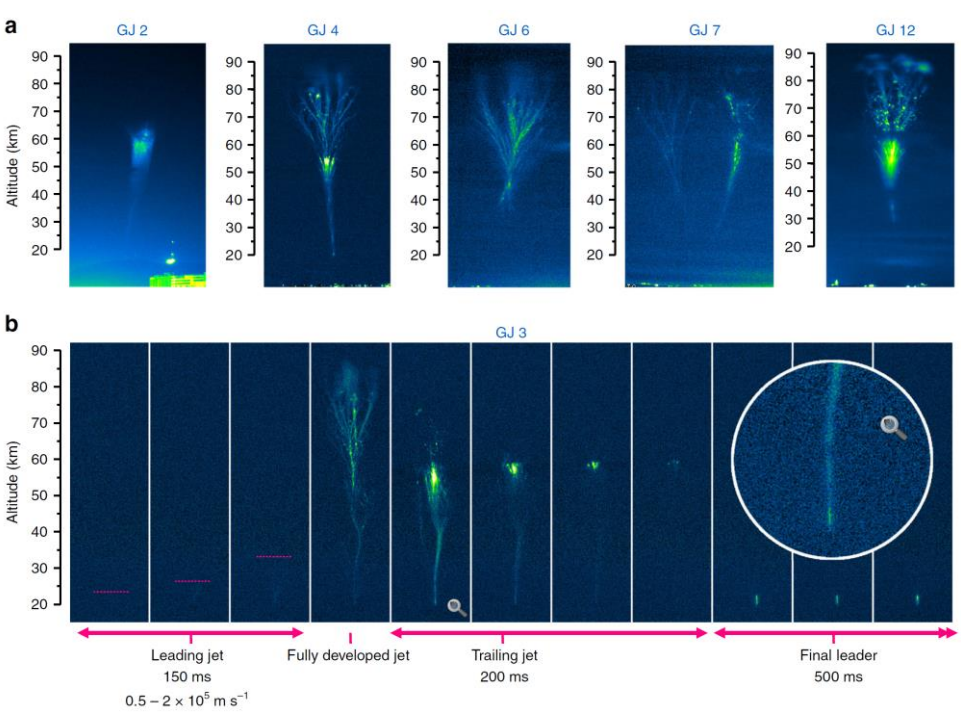


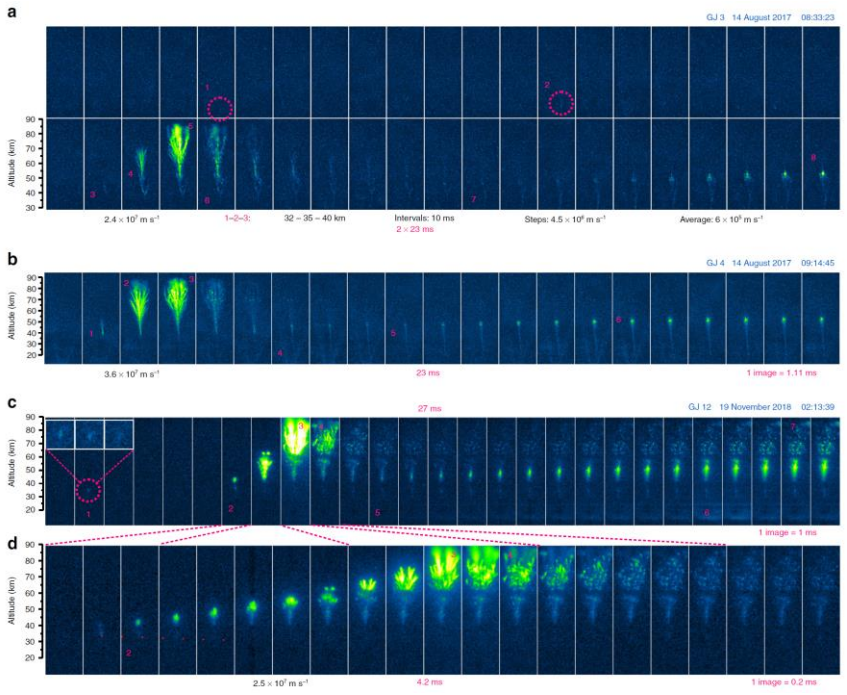
Cummer et al. (2009)



Liu et al. (2015)

1. Introduction

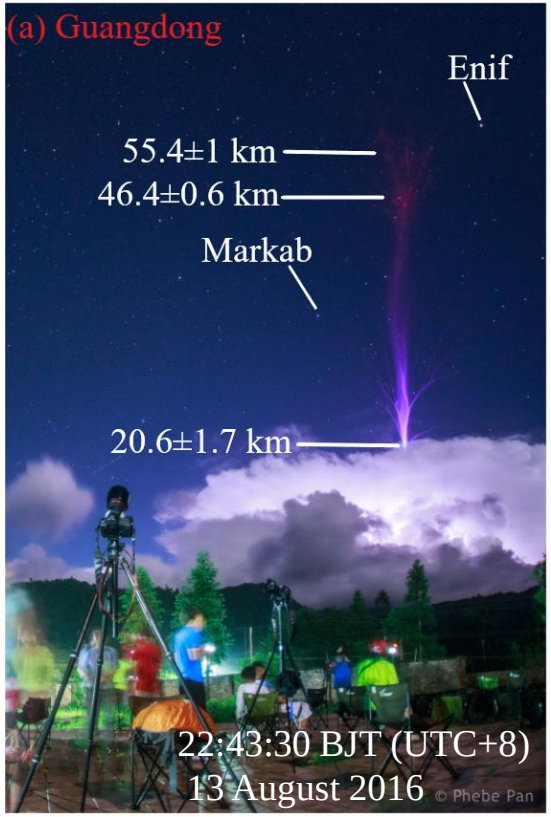




van der Velde et al. (2019)

- **rarity of GJs (global incidence of 0.01 jets per minute) (Chen et al., 2014)**
- **most observed GJs were recorded only by a single station**

2. Analysis and results



GJ captured by two sites 22:43:30 BJT

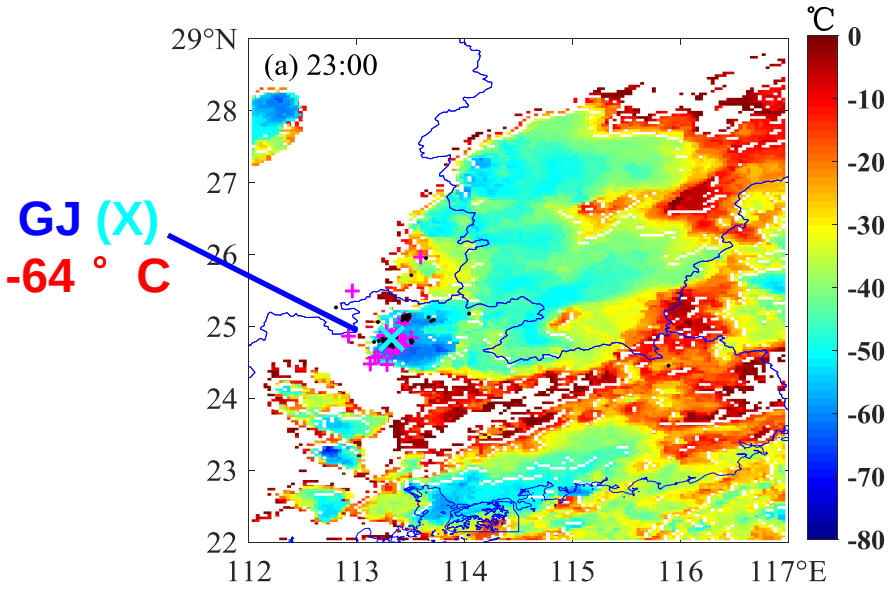
Observer location: Shikengkong, Qingyuan city, Guangdong province, China
Equipment: Canon EOS 6D, Sigma 15mm fisheye
Parameters: 10s, f/2.8, ISO1600

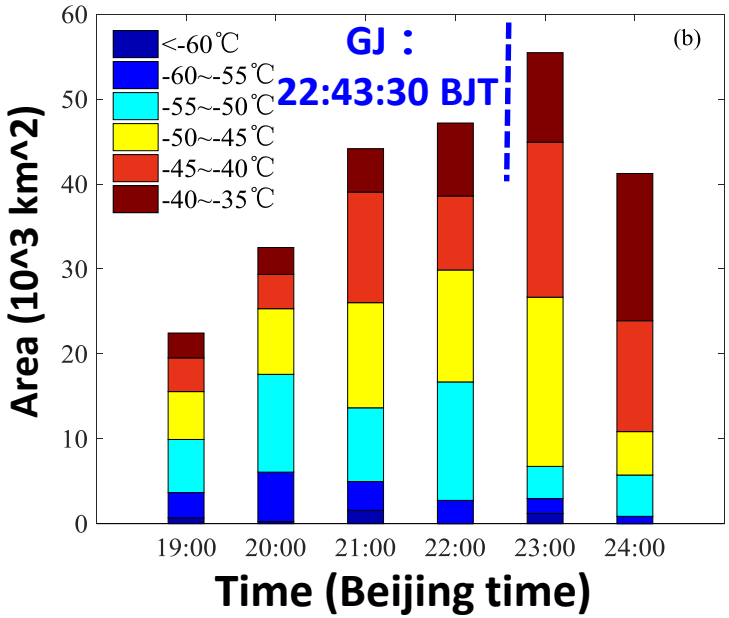
Observer location: Jiahe County, Chenzhou city, Hunan province, China
Equipment: Nikon D60, Nikon 18-55mm
Parameters: 15s, f/3.5, ISO1600

2. Analysis and results

The Meteorological parameters of the background environment of the GJ parent thunderstorm (20:00 BJT=UTC+8)

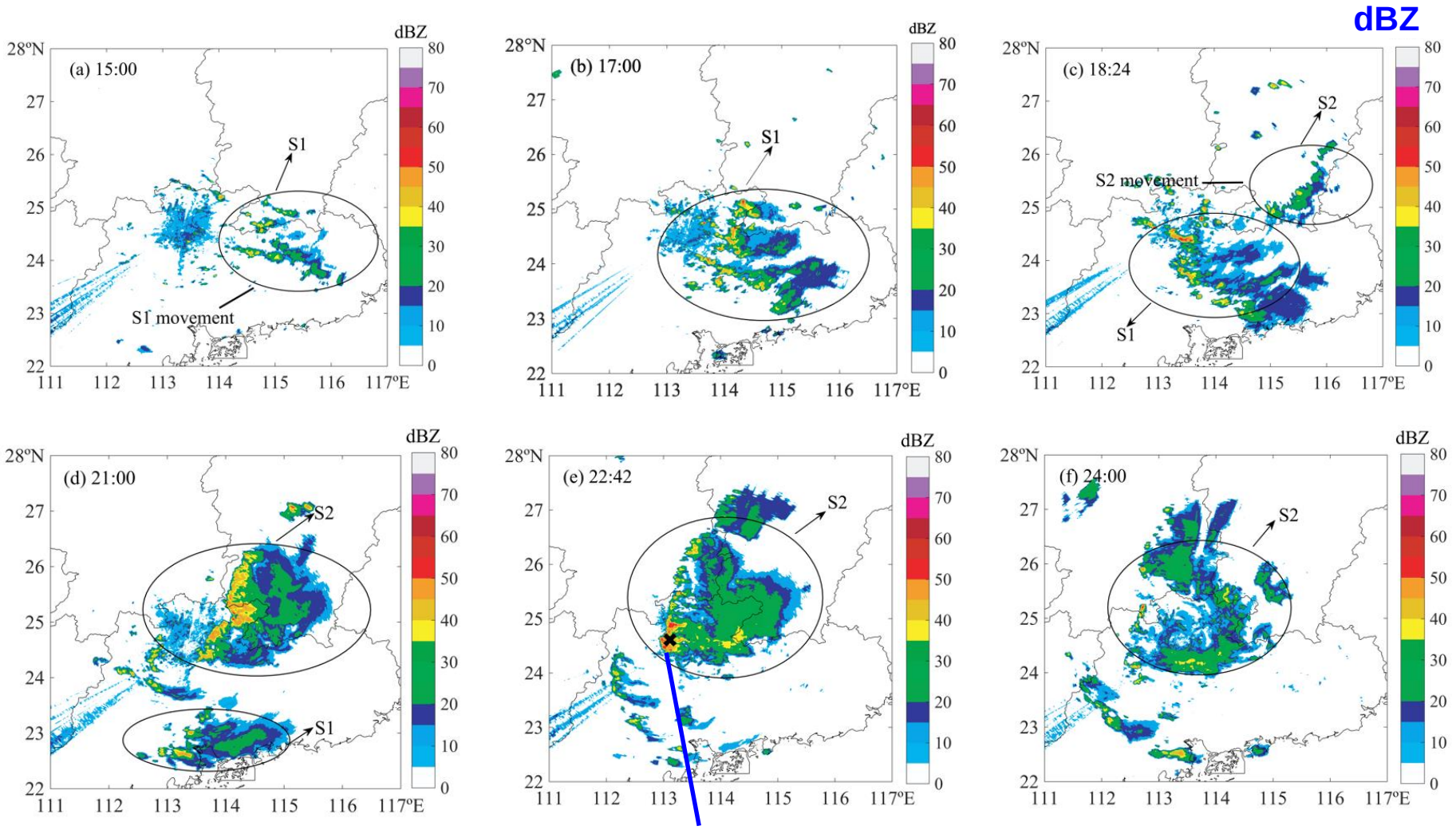
Station	LI (°C)	CAPE (J/kg)	PWAT (mm)	0°C height (km)	0-6 km Shear (m/s)	K index (°C)
Qingyuan	-5.78	2428.94	66.27	5.3	4.6	42.5





featured very moist and tropical characteristics

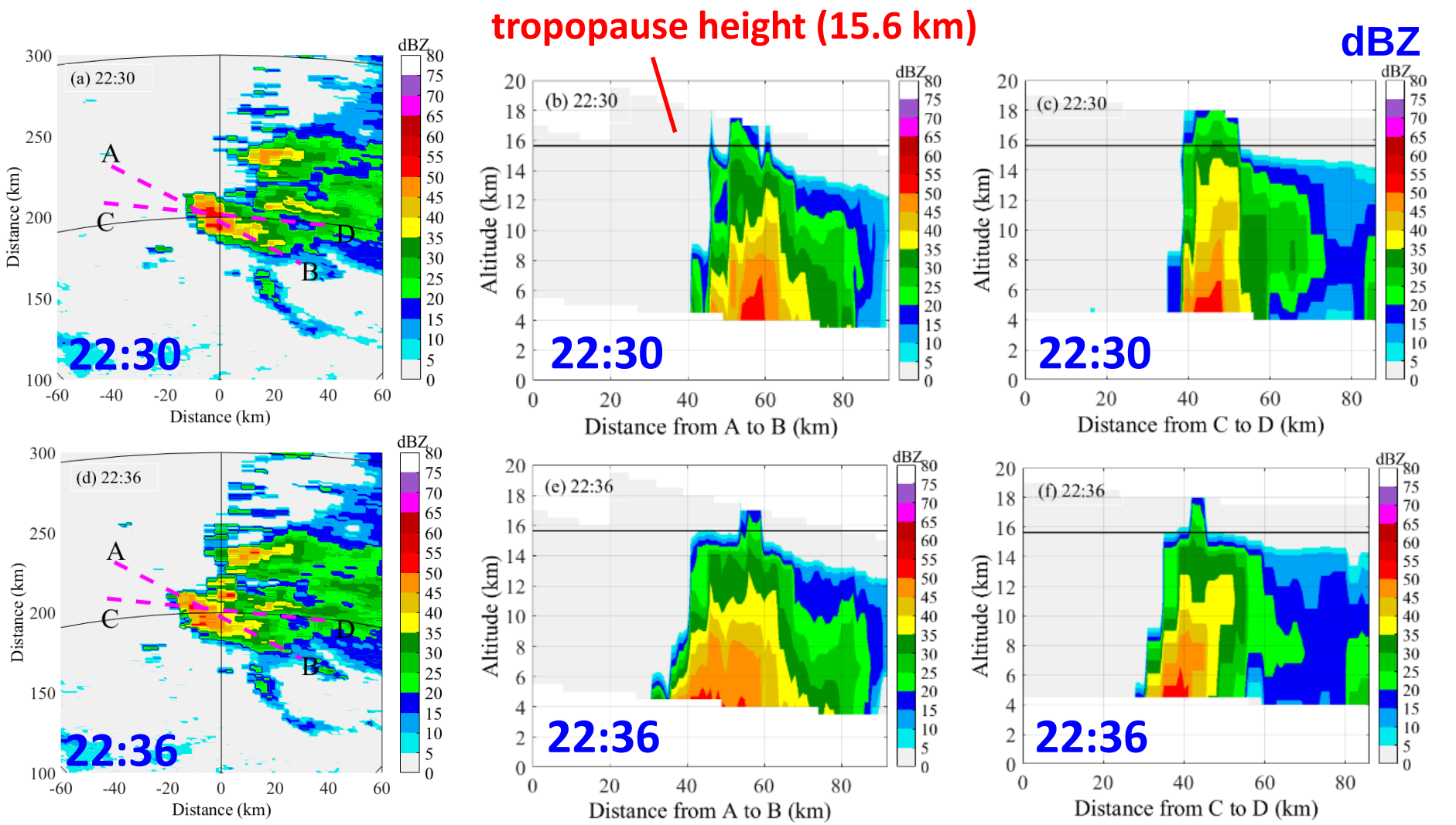
2. Analysis and results



GJ (X) 40~45 dBZ

GJ : 22:43:30 BJT

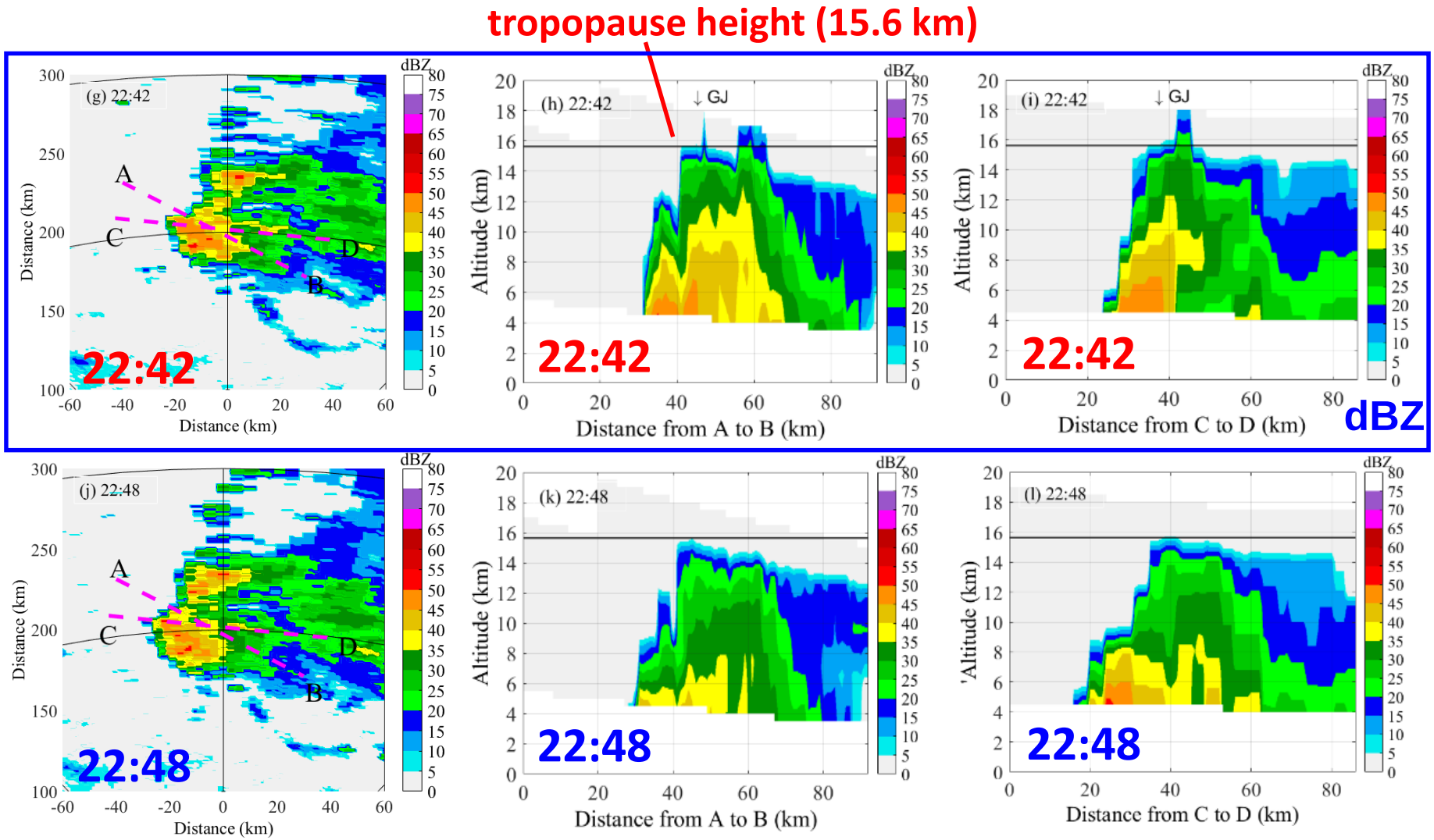
2. Analysis and results



Line AB, CD: line of sight of the observers at Jiahe and Shikengkong

GJ：22:43:30 BJT

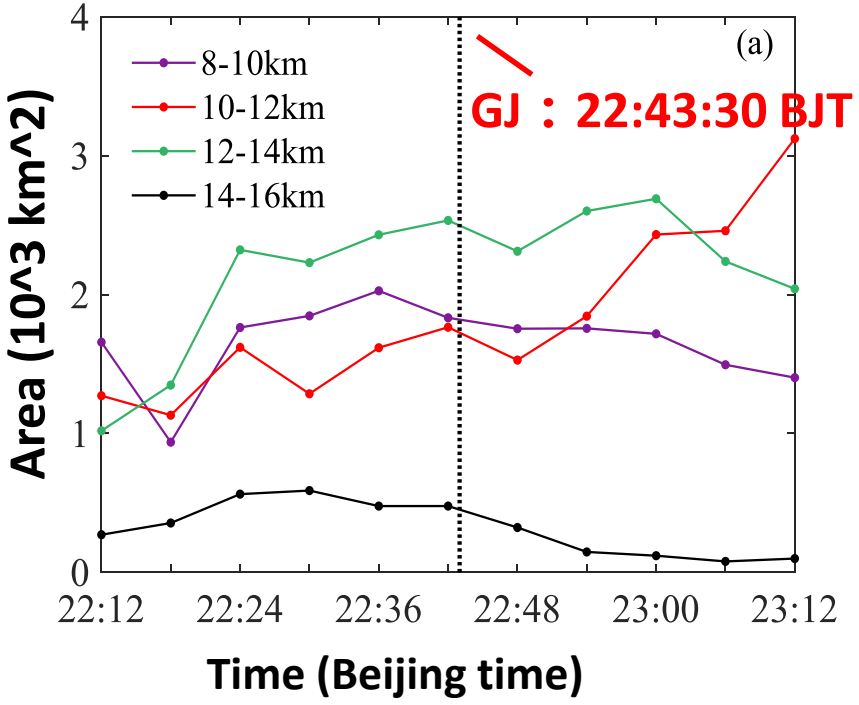
2. Analysis and results

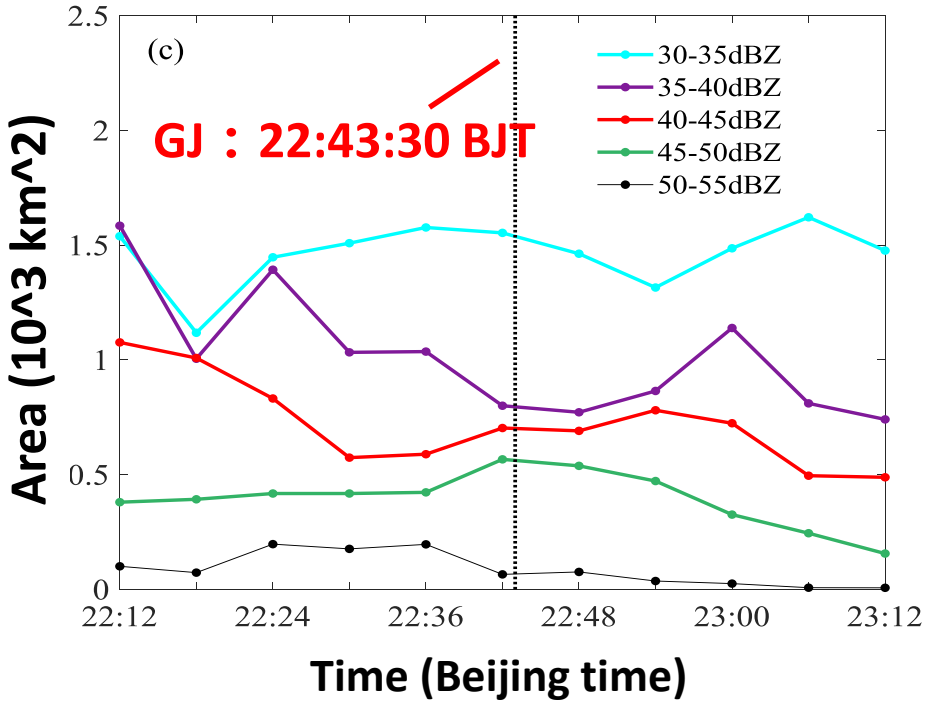


Line AB, CD: line of sight of the observers at Jiahe and Shikengkong

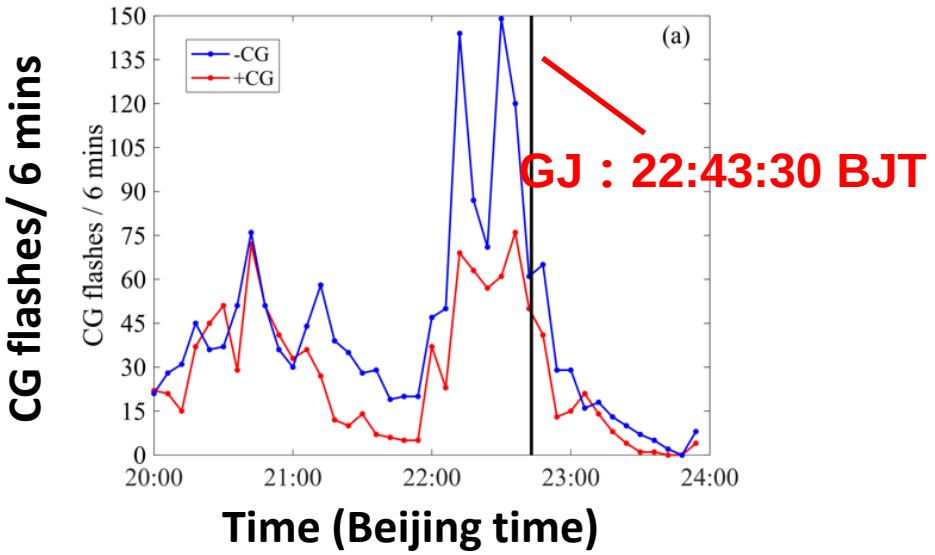
GJ : 22:43:30 BJT

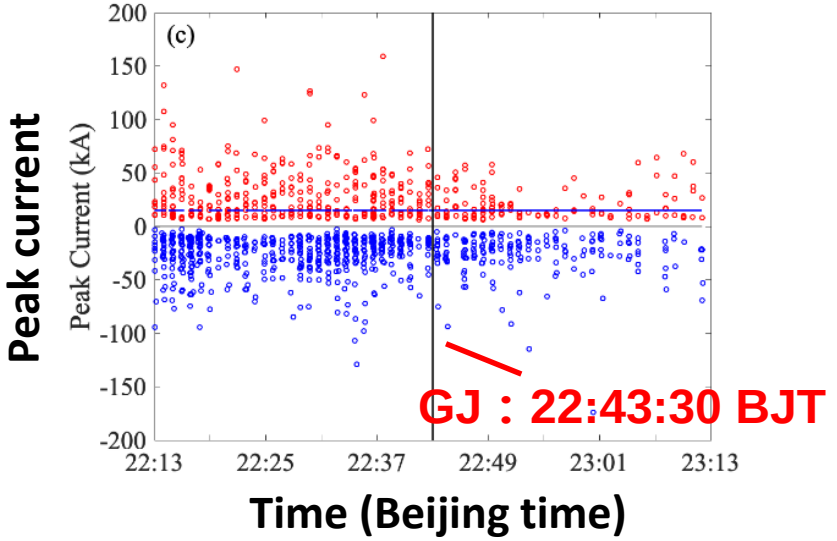
2. Analysis and results

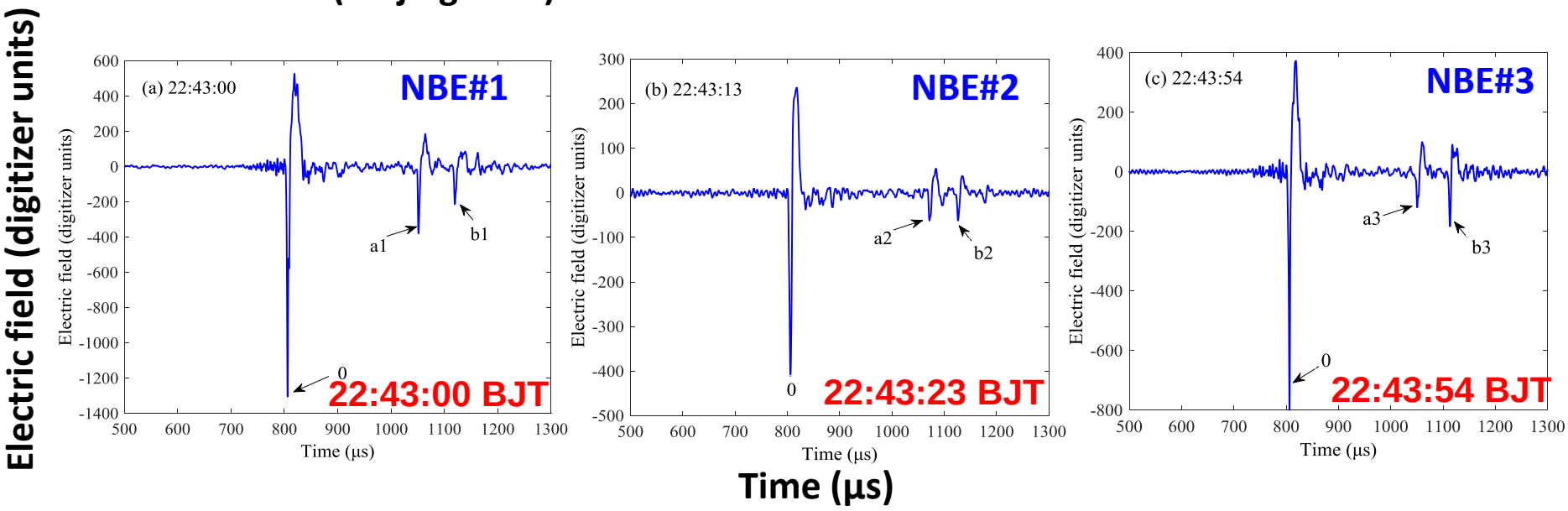




2. Analysis and results







3. Summary

- GJ location was triangulated by two sites
- very humid environment (PWAT >60 mm), high CAPE (2428.89 J/kg), weak 0-6 km wind shear (4.6 m/s)
- overshooting top occurred in a time window containg the GJ
- GJ location close to the convective and high reflectivity region
- The storm was dominated by -CG flashes
- 11 NBEs were recorded in the storm life cycle, 3 NBEs occurred in 1 min centered at the GJ
- NBEs occurred between 11 ~ 13 km above the ground

Thanks for your attention!