Observing Cloud-to-Ground Lightning In the Act: Prospects for Systematic Imaging of Lightning-Strike Contact Points

Karl D. Stephan
Ingram School of Engineering
Texas State University
San Marcos, TX
Outline

• Prospects for use of UAVs (drones), advanced imaging
• Coverage statistics
• Challenges
• Conclusions
Example of UAV: DJI Phantom 4 Pro+

- > 20 min. flight time
- 20 Mp camera
- Collision avoidance
- Cost: under $2K
Coverage at 1-km altitude

- FAA Certificate of Authorization needed for >120 m
- Instantaneous field of view (~pixel size) is < 1 m at 1 km altitude
Hypothetical case uses lightning data from actual ball-lightning sighting

- Poughquag, NY, June 23, 2008, ~2100 hr local time
- Cantaloupe-size blue sphere caused door glass to fluoresce a different color
NLDN CG lightning record 0000-0010 UTC

- Blue circles indicate CG strikes
- No CG strikes recorded within ~1 km of BL sighting
- Keul & Diendorfer (ICLP 2018): many BL events > 1 km distant from strike

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Probability contours of imaging CG strike

- Assume 2-km-dia. observation circle
- 10 min. at 1-km-altitude station
- Ignore visibility issues (rain, obstructions, etc.)
2340-2350 UTC
2350-0000 UTC
0000-0010 UTC
0010-0020 UTC
0020-0026 UTC
Challenges

• Rain rates $\geq 15$ mm/hr reduce visibility to $< 1$ km
• Wind reduces UAV battery life
• Timing rapidly-moving storm systems challenging
• Day (drone visibility) versus night (better contrast)
• Flight restrictions near airports (=most populated areas)
Conclusions

• UAVs have technical capability to image lightning impact points
• Many challenges make photography of lightning impact points with UAVs difficult
• Focused efforts may discover locations, techniques yielding numbers of lightning impact images
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