BIRKELAND CENTRE
FOR SPACE SCIENCE

New type of electric discharges from aircraft

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1. Introduction
2. In-flight Lightning Damage Assessment System (ILDAS)
3. Remote Lightning Damage Assessment System (ReLDAS)
4. Conclusions

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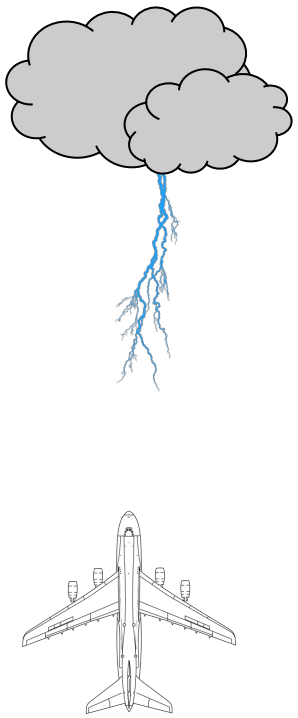
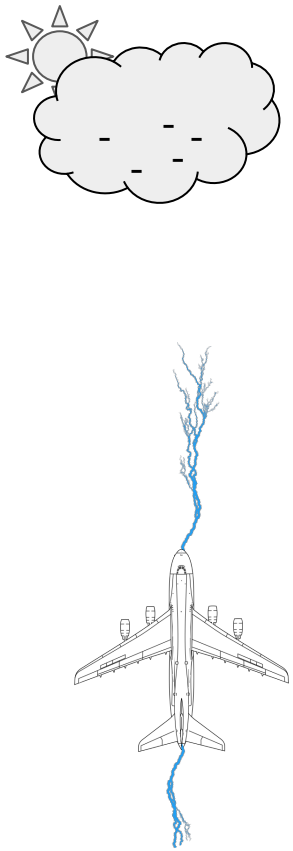
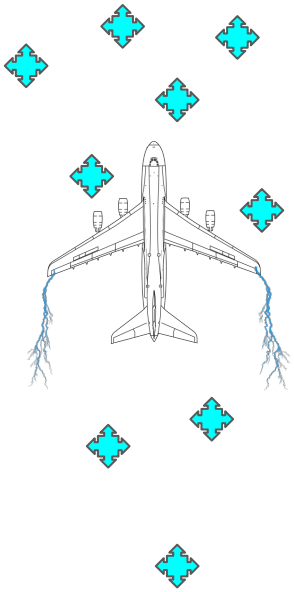
Aircraft-intercepted lightning



Aircraft-triggered lightning



Electrostatic discharge



Lightning-induced discharge

?

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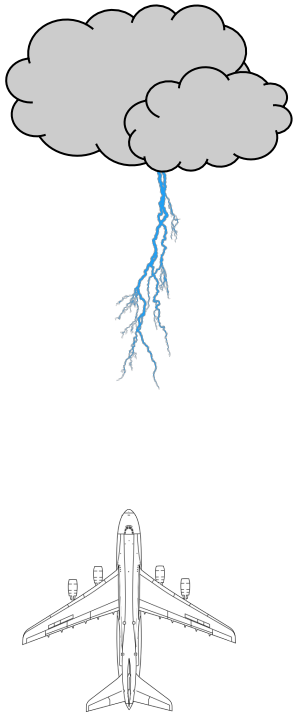
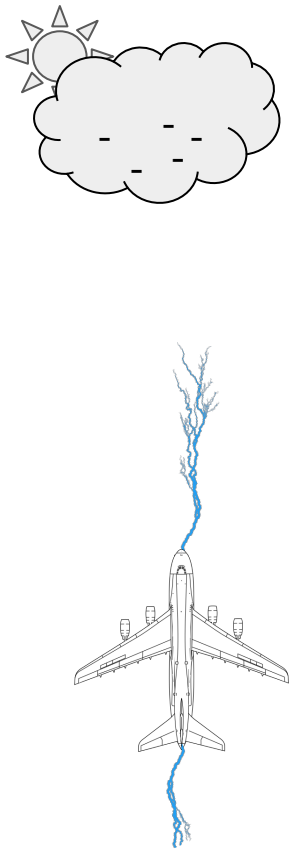
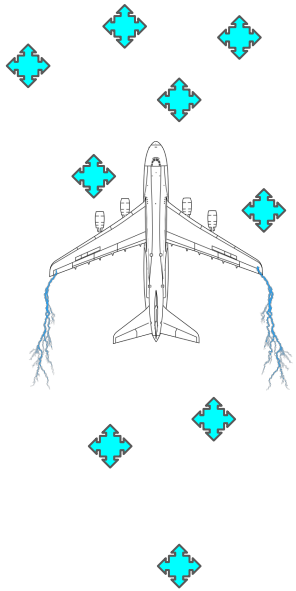
Aircraft-intercepted lightning



Aircraft-triggered lightning



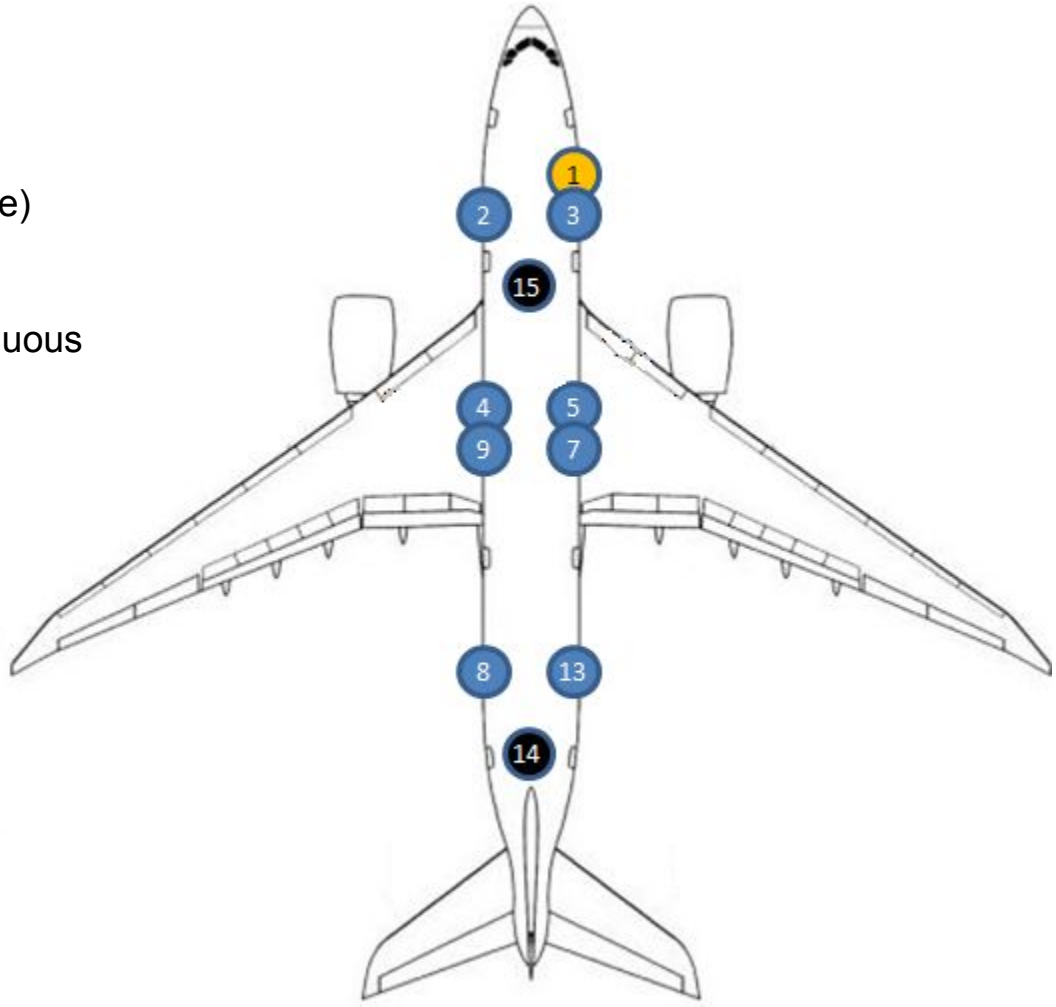
Electrostatic discharge



Lightning-induced discharge

In-flight Lightning Damage Assessment System (ILDAS)

- A340
- ILDAS system:
  - 1 E-field sensor (yellow)
  - 8 H-field window-sensors (blue)
  - 2 X-ray detectors (black)
  - 2 modes: triggered and continuous
- 9 video cameras



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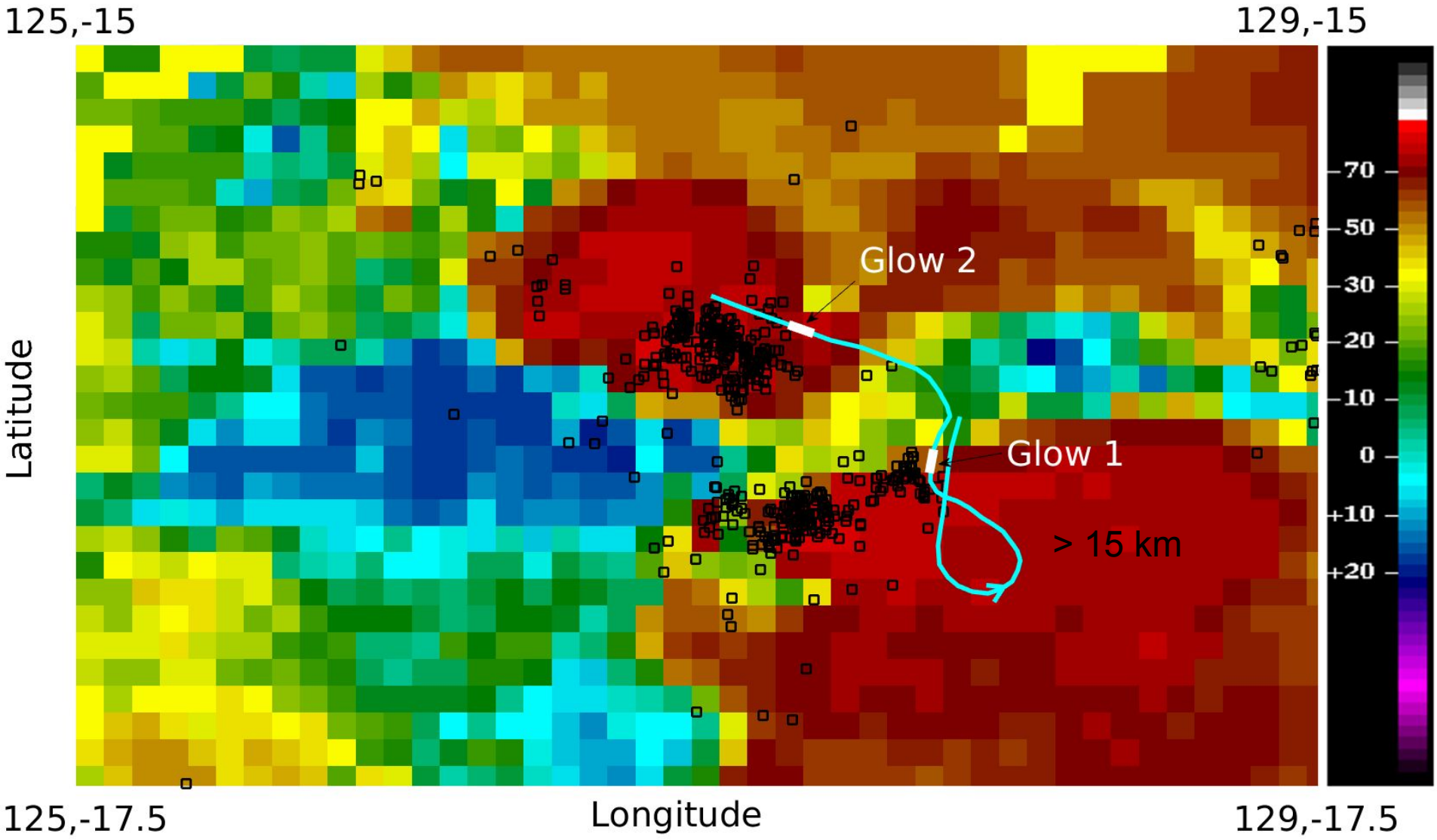
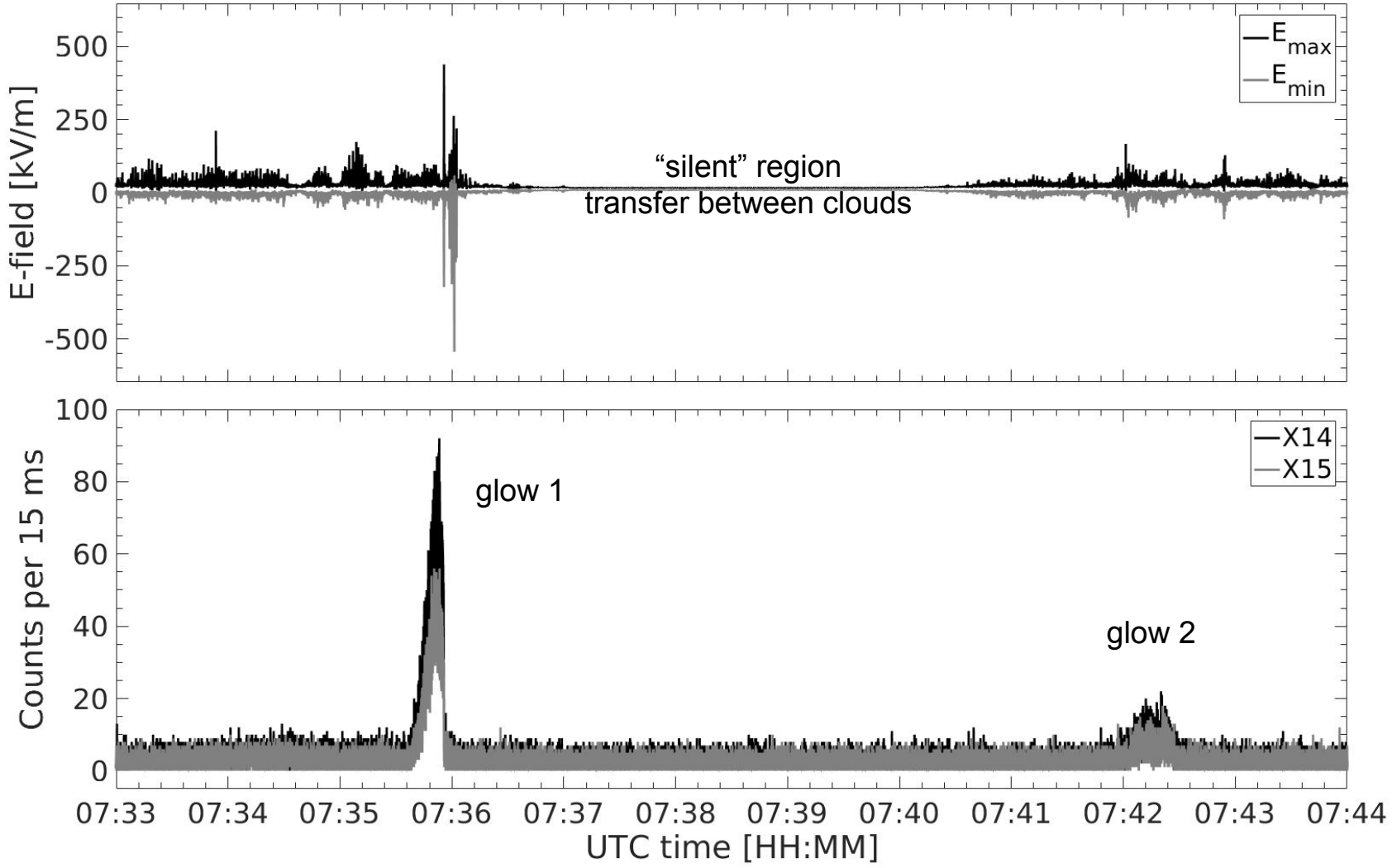
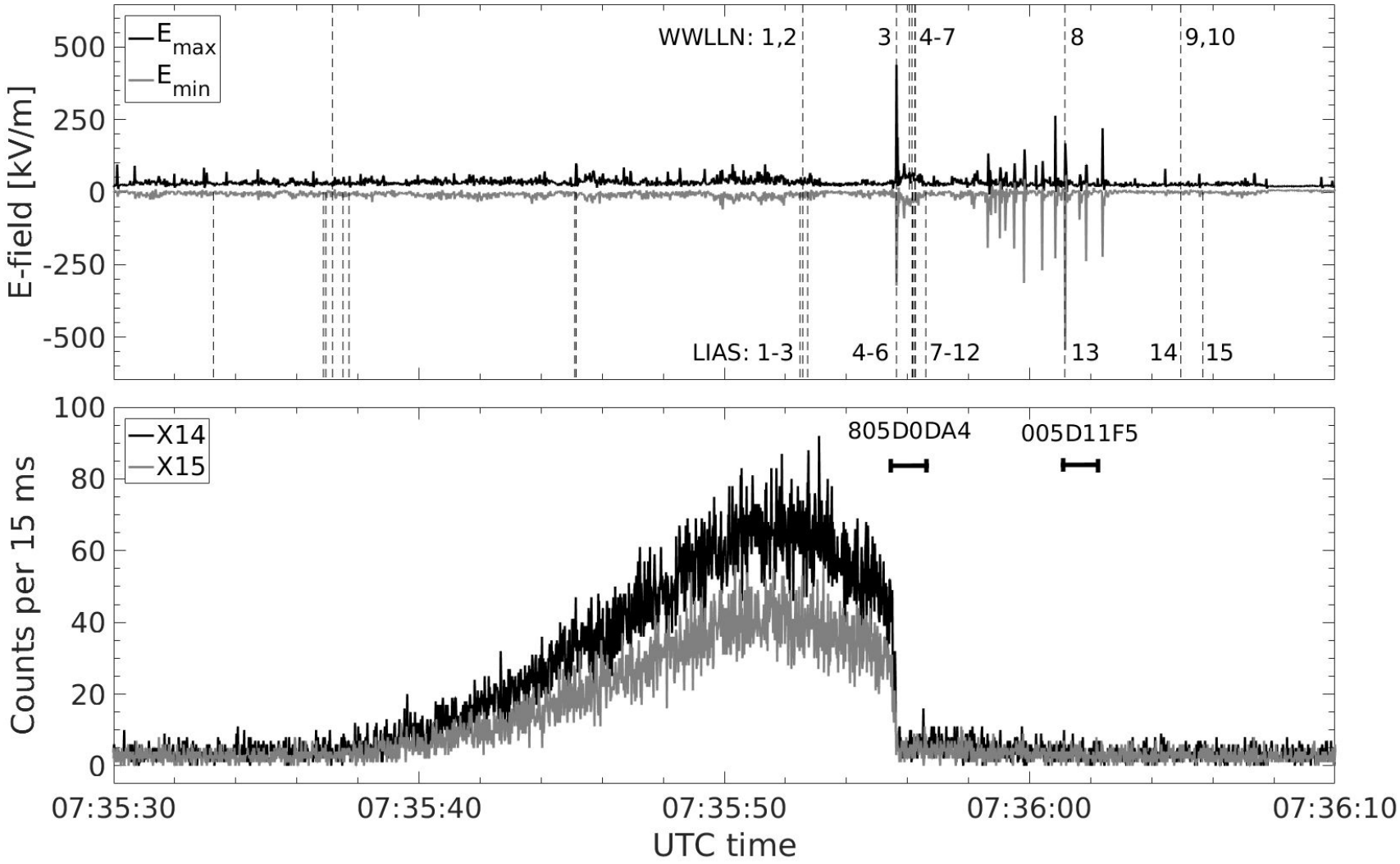
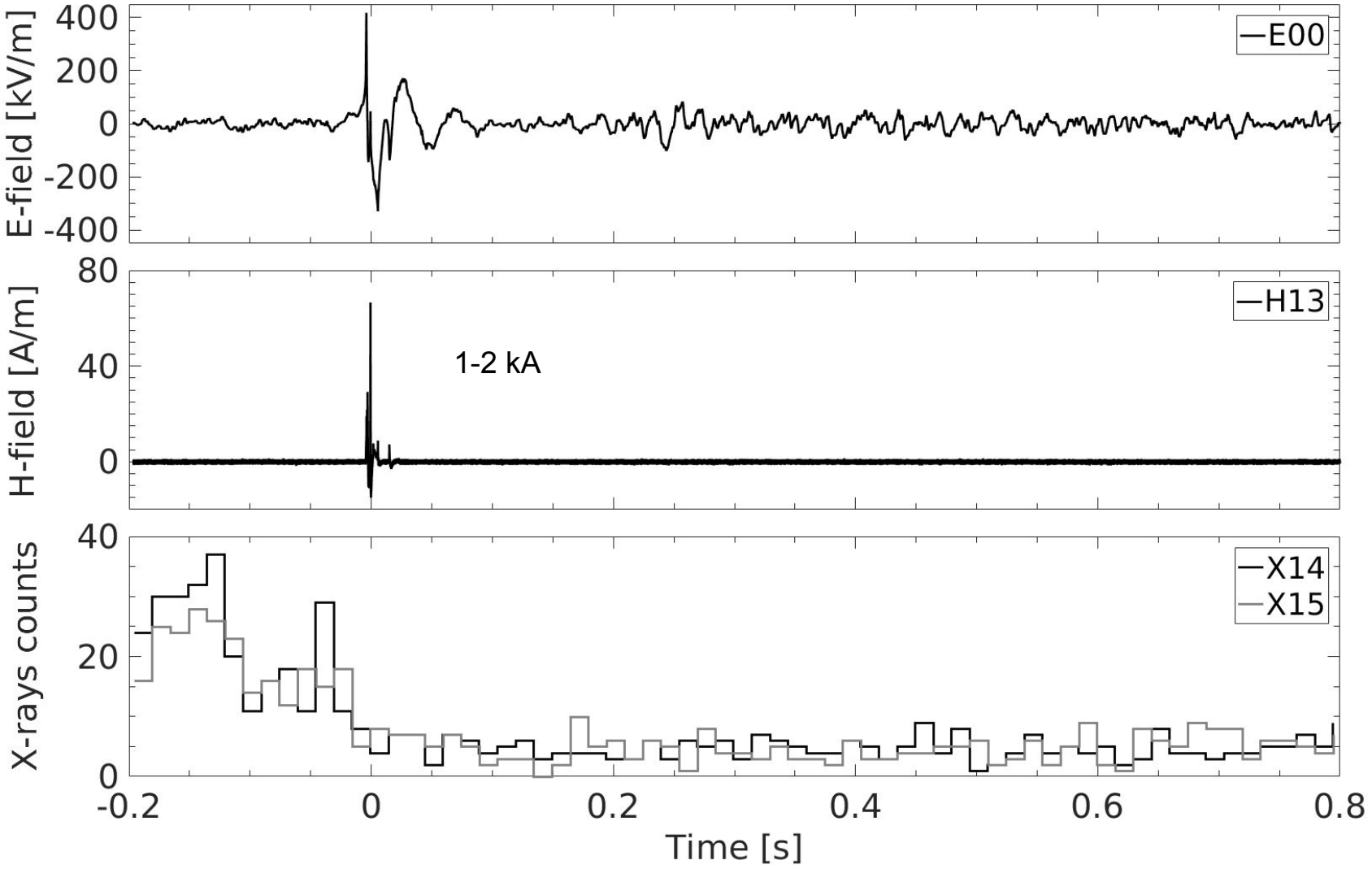
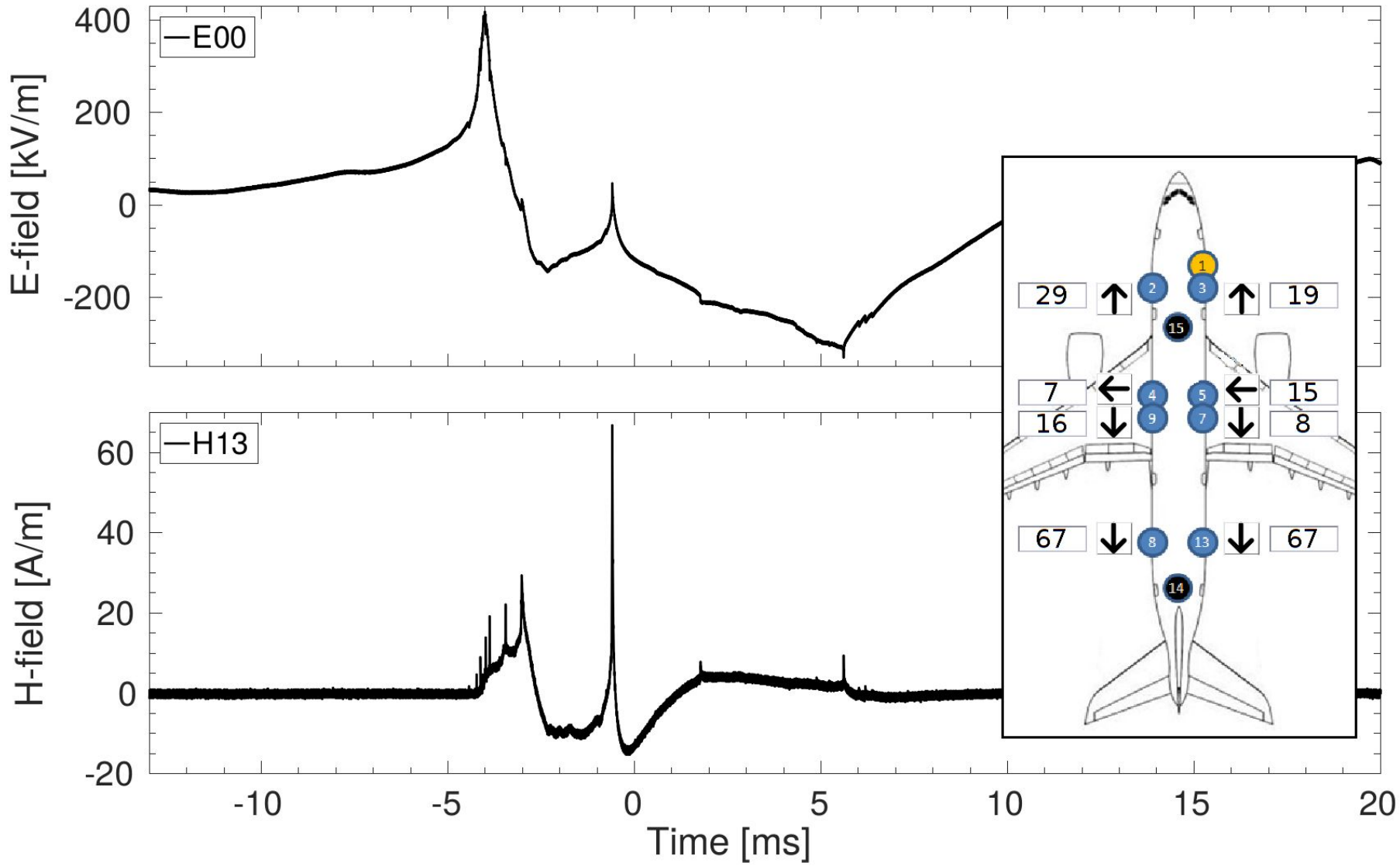
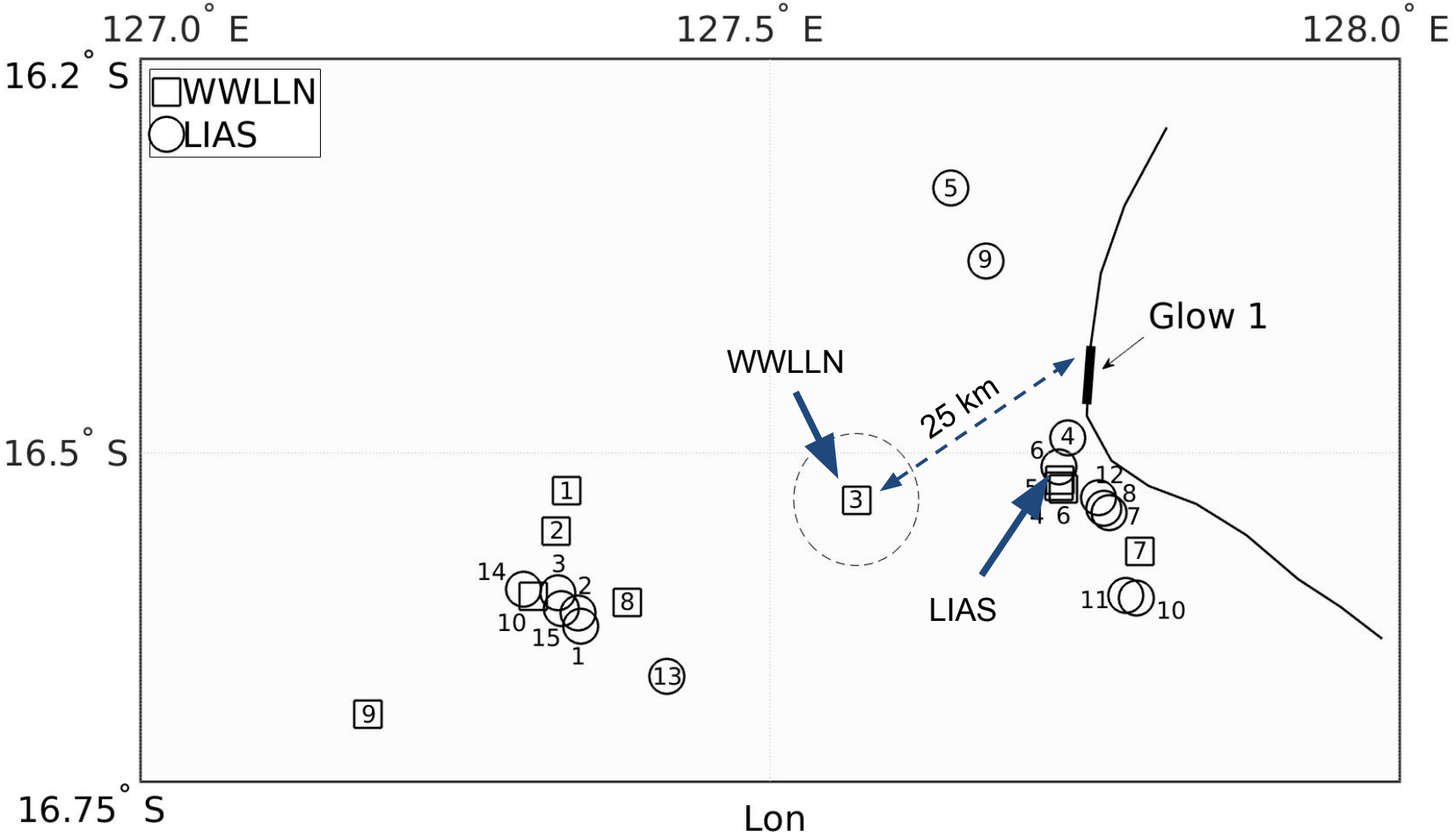



E-field [kV/m]
500
250
0
-250
-500
E_{max}
E_{min}
"silent" region
transfer between clouds
Counts per 15 ms
100
80
60
40
20
0
X14
X15
glow 1
glow 2
07:33
07:34
07:35
07:36
07:37
07:38
07:39
07:40
07:41
07:42
07:43
07:44
UTC time [HH:MM]


E-field [kV/m]
500
250
0
-250
-500
—E max
—E min
WWLLN: 1,2
3
4-7
8
9,10
LIAS: 1-3
4-6
7-12
13
14
15
Counts per 15 ms
100
80
60
40
20
0
—X14
—X15
805D0DA4
005D11F5
07:35:30
07:35:40
07:35:50
07:36:00
07:36:10
UTC time


E-field [kV/m]
400
200
0
-200
-400
—E00
H-field [A/m]
80
40
0
—H13
1-2 kA
X-rays counts
40
20
0
—X14
—X15
-0.2
0
0.2
0.4
0.6
0.8
Time [s]

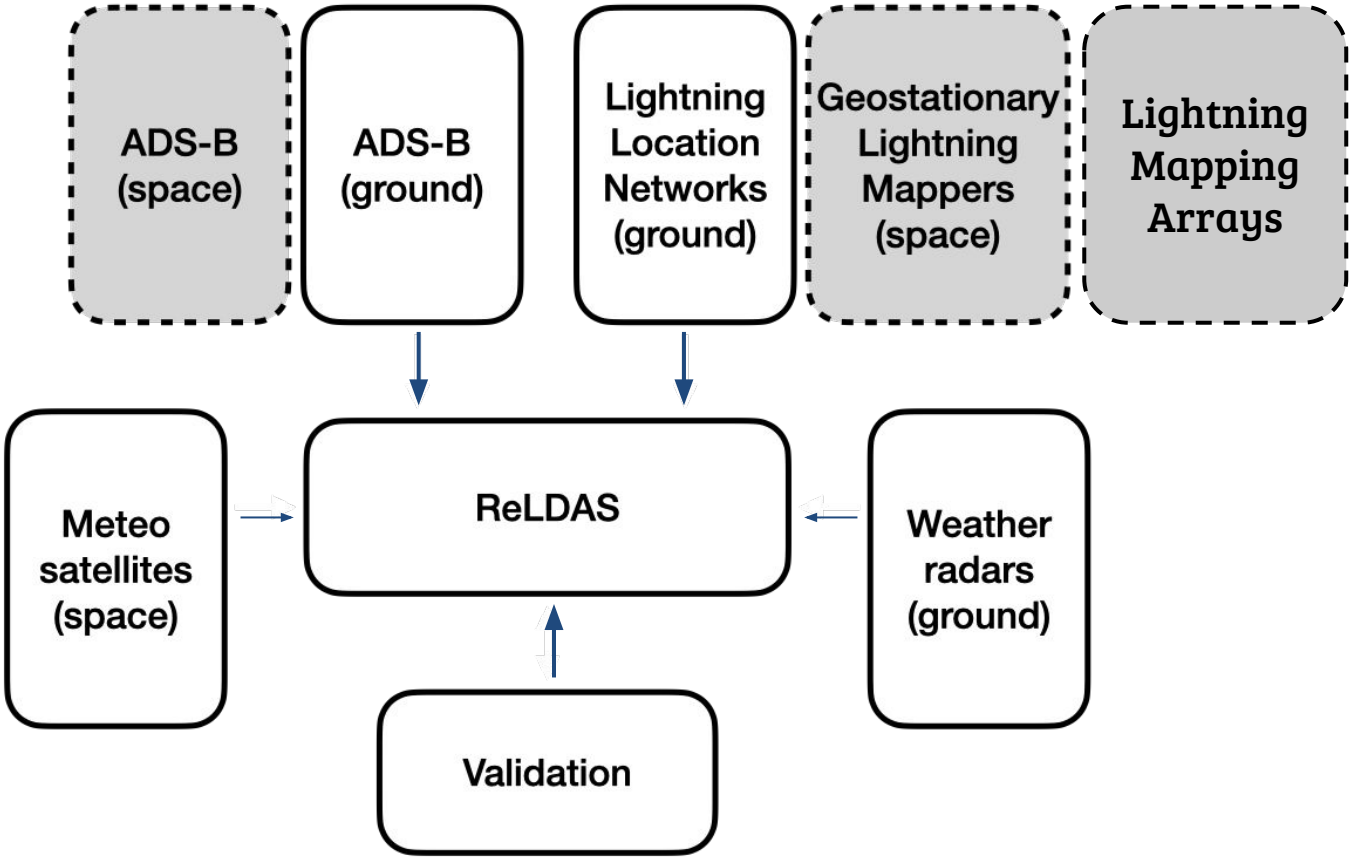

—E00
E-field [kV/m]
400
200
0
-200
—H13
H-field [A/m]
60
40
20
0
-20
-10
-5
0
5
10
15
20
Time [ms]
29
19
7
15
16
8
67
67
1
2
3
15
4
5
9
7
8
13
14


127.0° E
127.5° E
128.0° E
16.2° S
16.5° S
16.75° S
Lon
WWLLN
LIAS
Glow 1
25 km


©AIRBUS2017
07:35:55.760

Remote Lightning Damage Assessment System (ReLDAS)

Main objective: to reduce number of lightning accidents in aviation globally


ADS-B (space)
ADS-B (ground)
Lightning Location Networks (ground)
Geostationary Lightning Mappers (space)
Lightning Mapping Arrays
Meteo satellites (space)
ReLDAS
Weather radars (ground)
Validation

1. Detect lightning strikes to aircraft (near-real-time, Scandinavia)
2. Classification (4 types)
3. Lightning attachment and detachment points
4. Severity of the event
5. Possible damage character (direct/indirect)
6. Assess meteorological conditions
7. Accumulate statistics and macro parameters
8. (work in progress) global coverage, forecast

ReLDAS lightning-induced discharge

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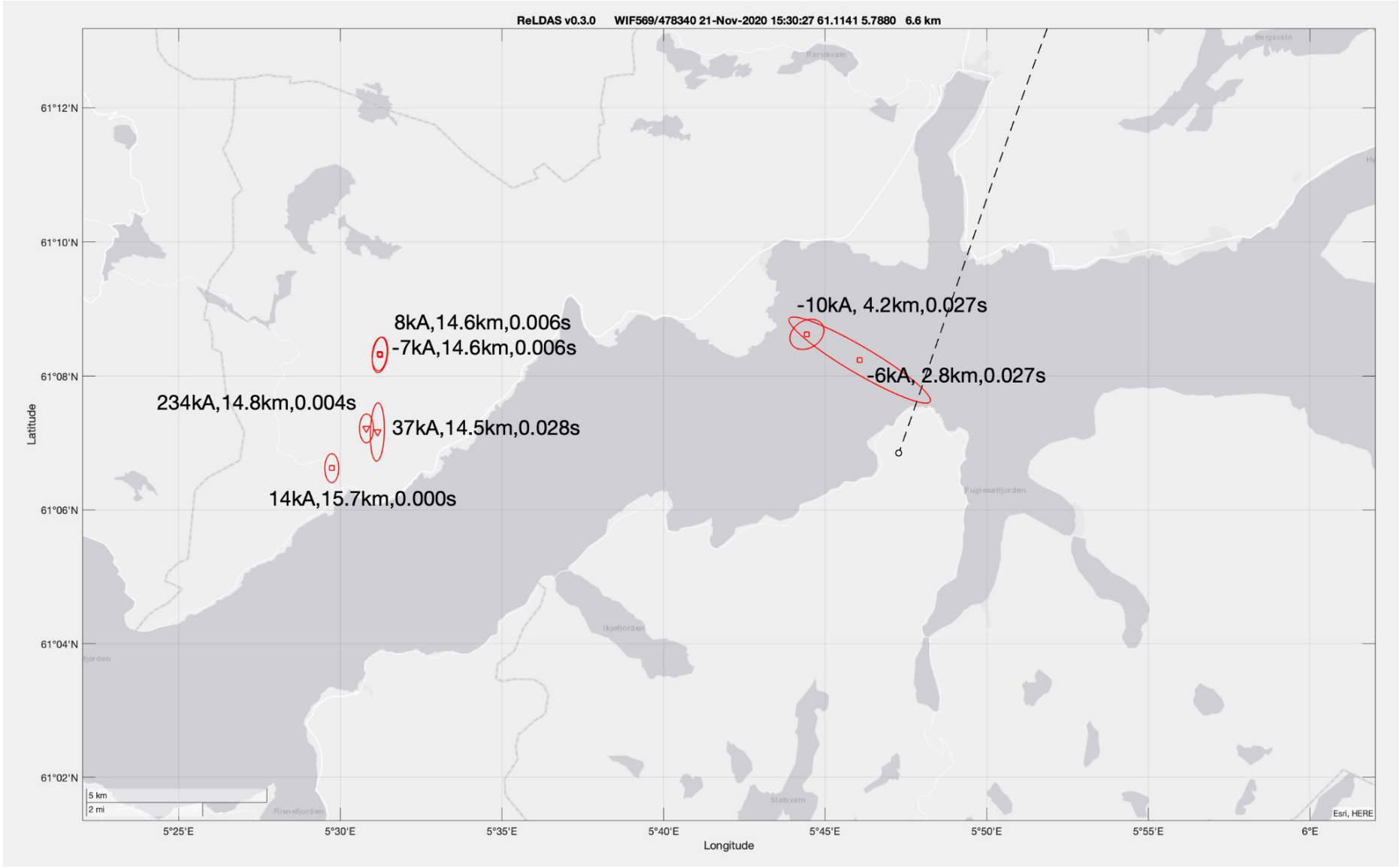

ReLDAS lightning-induced discharge

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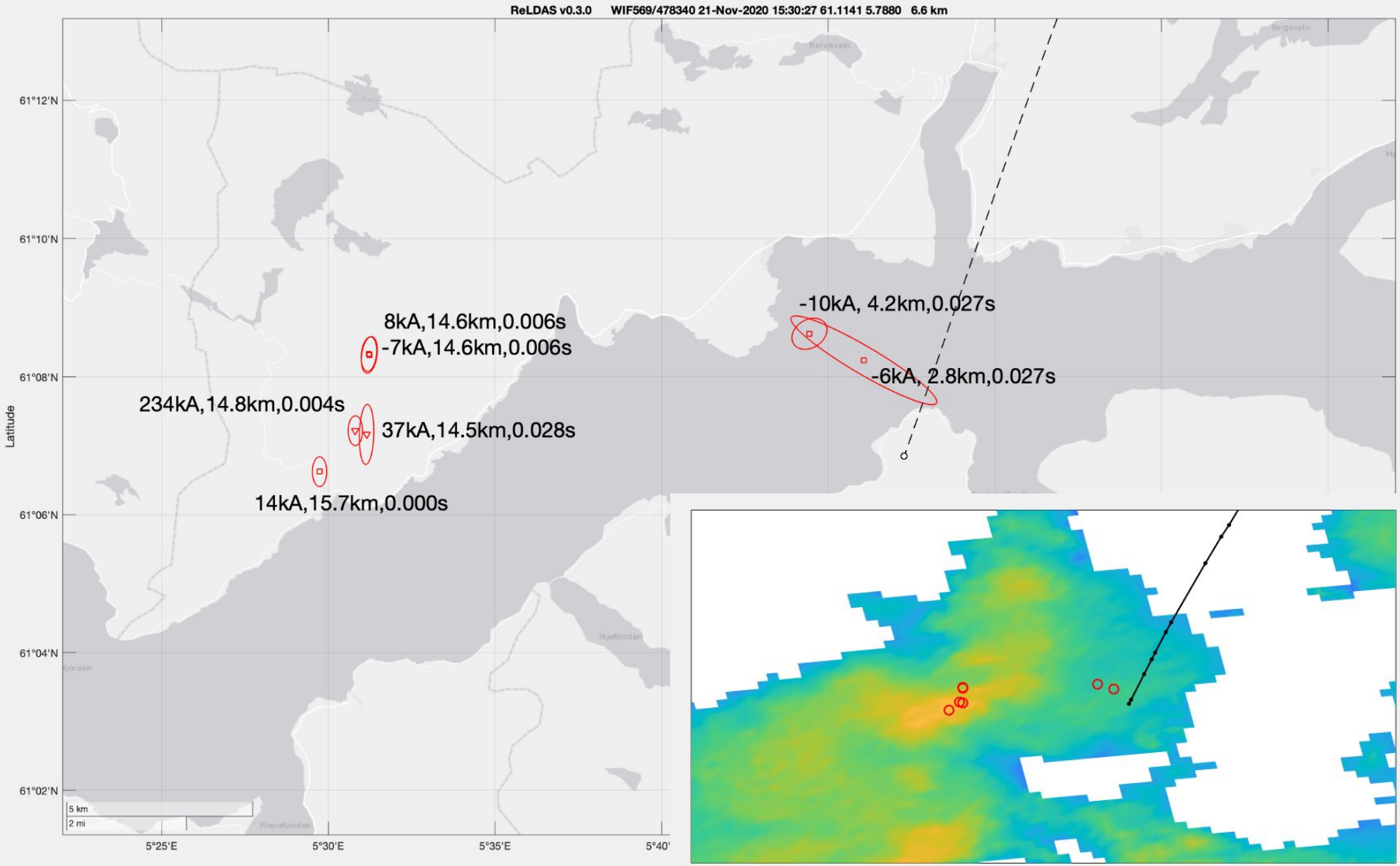

1. New type of electric discharges developing from aircraft
2. Basic features
    a. low to medium intensity
    b. high probability of being missed by pilots
3. New observations needed and currently underway
4. Interested in ReLDAS data? Contact for collaboration!