Observations of Lightning in Relation to Transitions in Volcanic Activity during the 3 June 2018 Fuego Eruption

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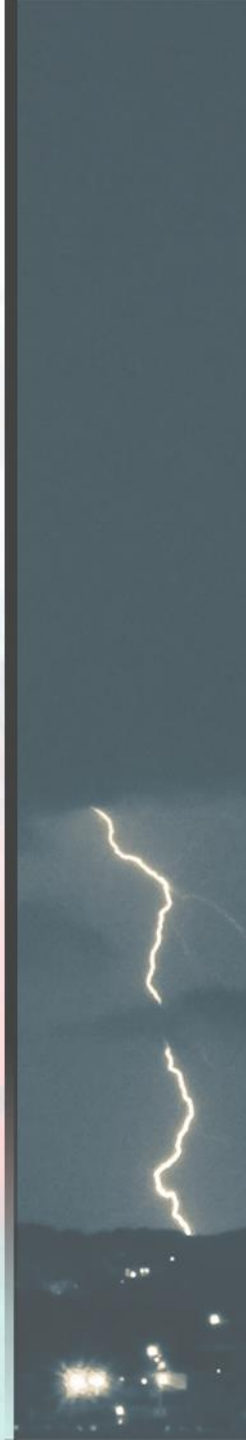
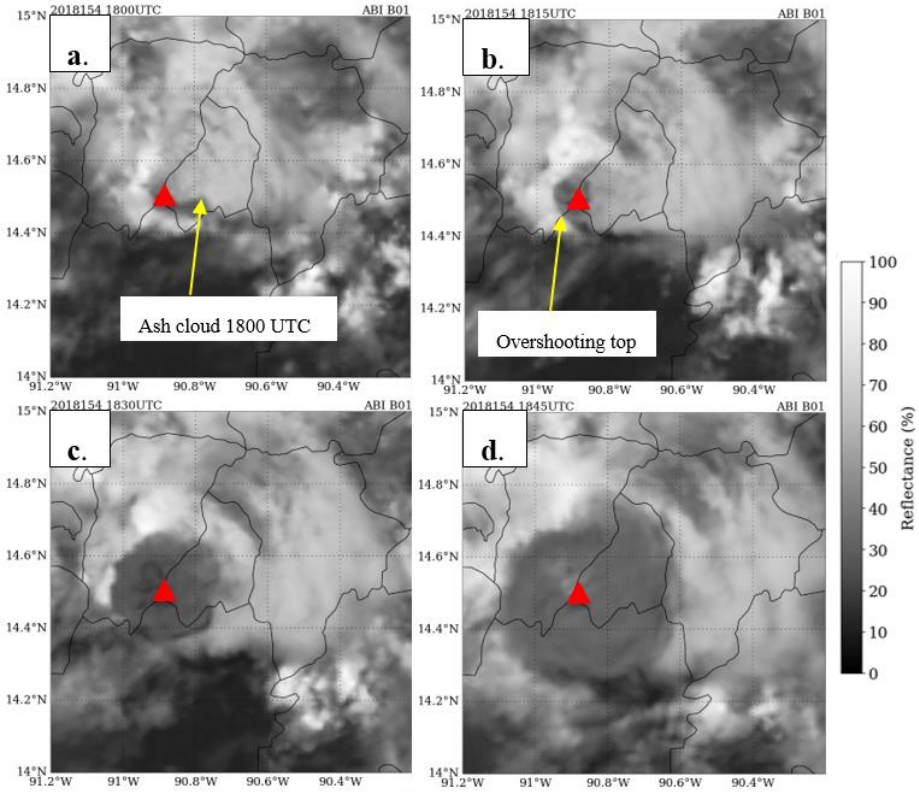


The 3 June 2018 Fuego Eruption



- Eruption began just after 1400 UTC.
  - Explosive eruption started just after 1800 UTC
- Lightning noted in the volcanic plume between 1814 and 2205 UTC
  - Two distinct phases correlated in time with rapid plume growth and PDC generation phases
- Large pyroclastic density current observed around 2200 UTC
  - At least 165 killed and 12,000 people displaced

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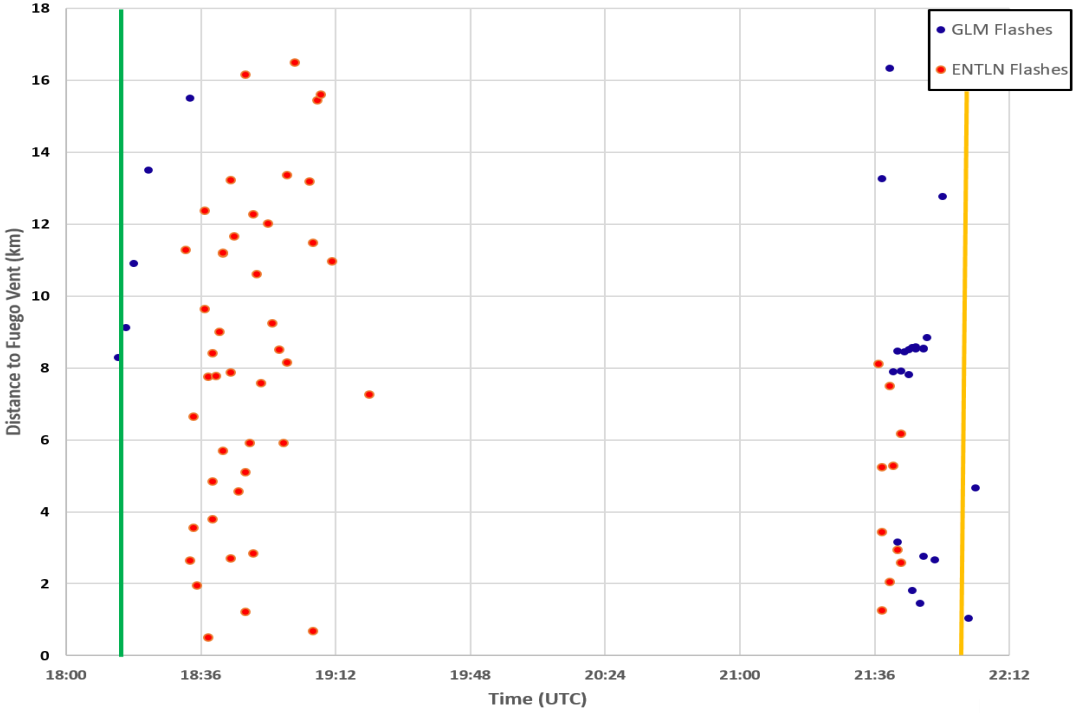
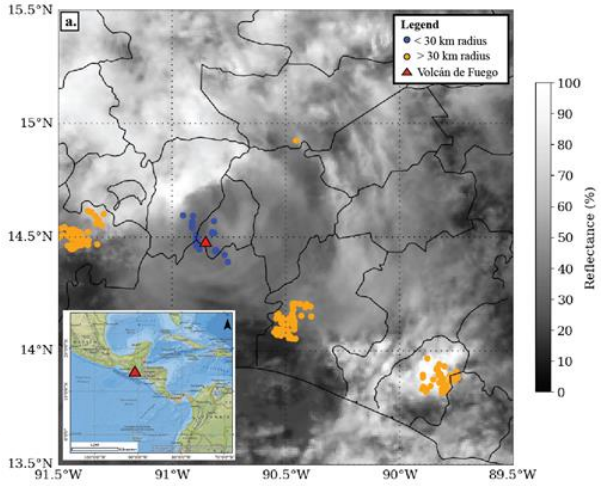
Lightning Observations with GLM and ENTLN

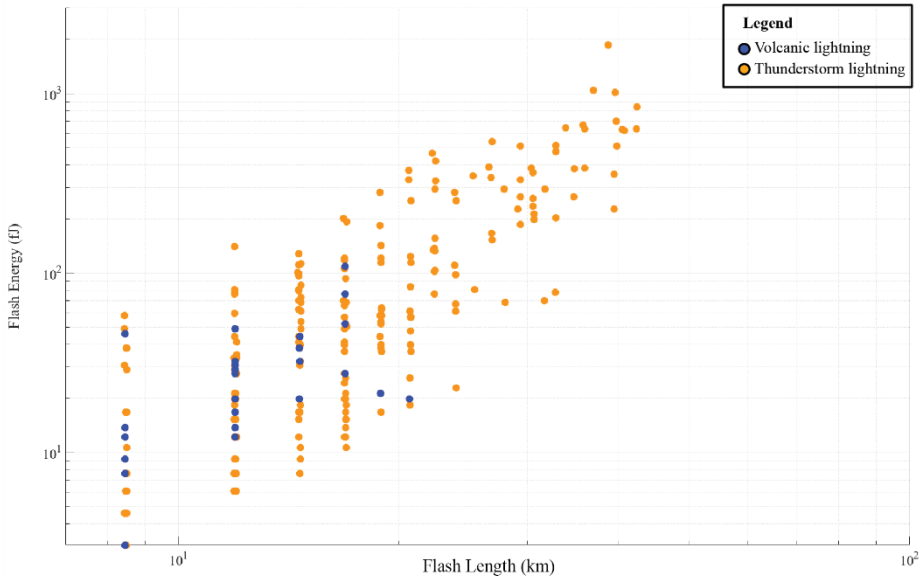


- 75 lightning events between the two lightning observation systems
- 68 of the lightning events were observed only 1 of the 2 systems
- 57 IC flashes, 18 CG
  - Note a GLM flash without a CG id from ENTLN was counted as a cloud flash
  - All CG's were negative polarity
- Median total optical energy was 16 fJ, median length 12 km
  - Thunderstorm flashes had a median total optical energy of 130 fJ and length of 20 km

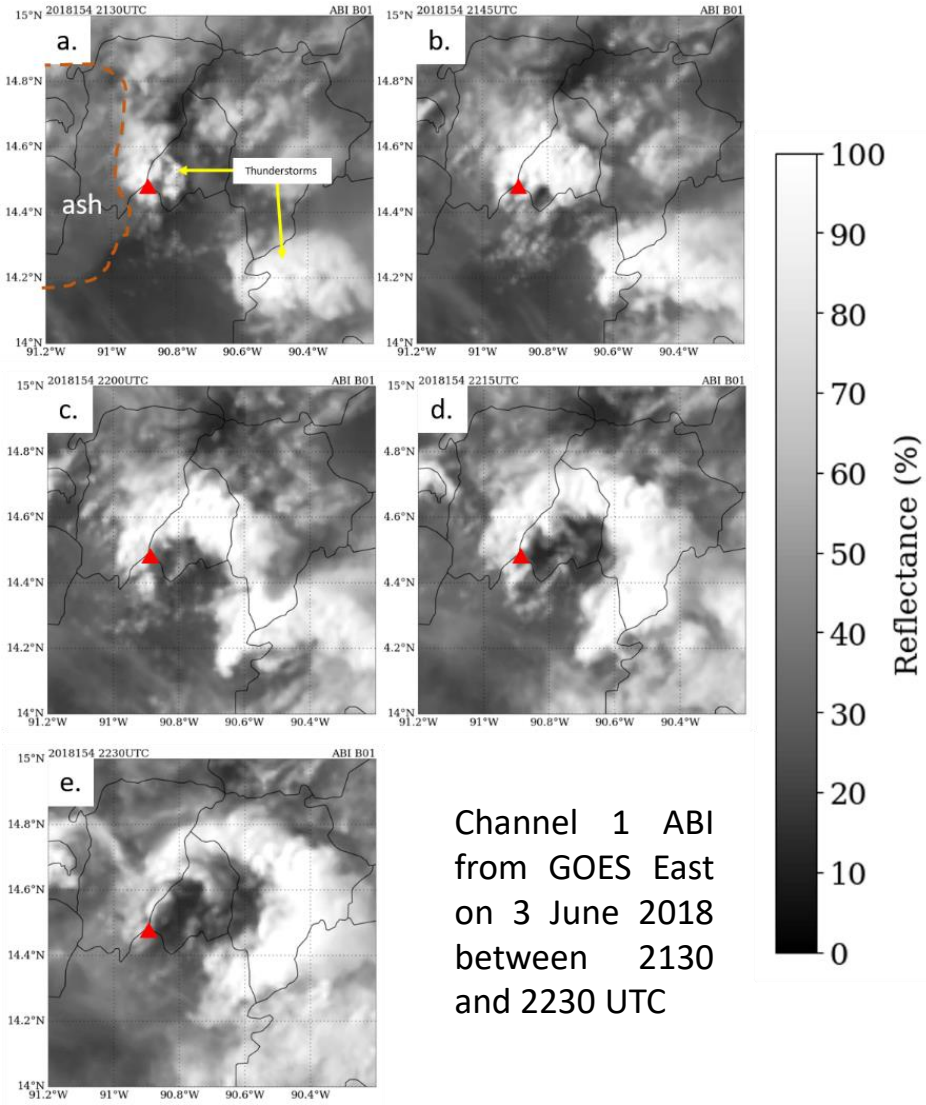
Above: GLM and ENTLN flash information with time. Green bar indicates rapid vertical growth of the ash cloud based on ABI, and gold bar indicates report time of pyroclastic density current.



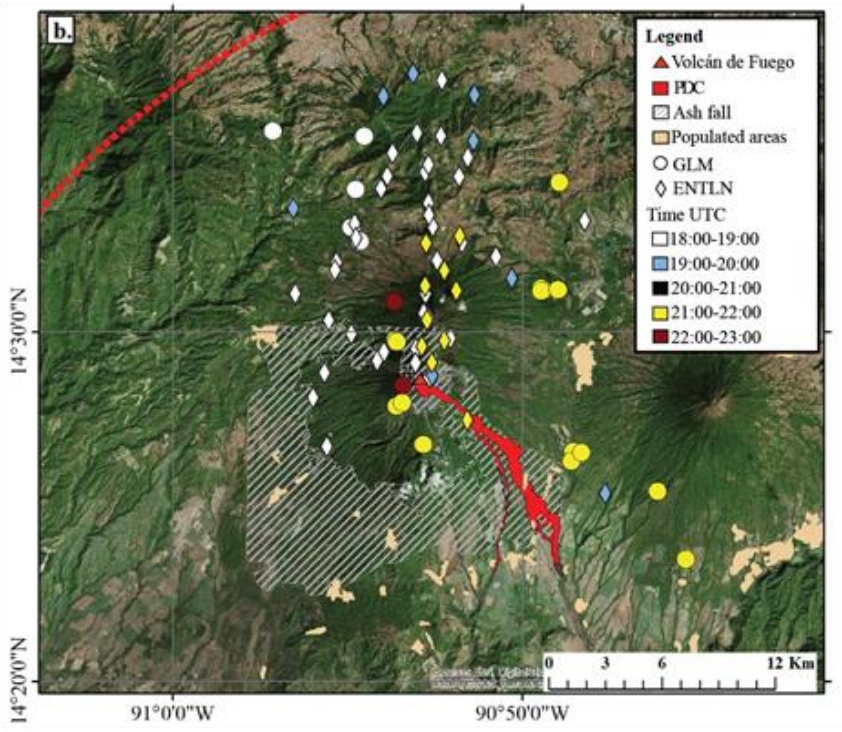
Right: GLM flash size (length) and energy near Fuego vs thunderstorms within 150 km of the volcano (**left**) during the time of the eruption.



The PDC period (2130-2230 UTC)



Channel 1 ABI from GOES East on 3 June 2018 between 2130 and 2230 UTC



- Lightning starts again at 2137 UTC after a 2 hour lull in activity
  - All to the north, east and immediately south of the vent (above)
- 10 ENTLN flashes (8 -CGs) and 22 GLM flashes observed between 2137 and 2205 UTC

- Not clear on source of lightning production given thunderstorm column collapse and PDC all present.
  - Evidence of PDC influence on volcanic thunderstorm (see backward C shape, left)

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Conclusions

- 91% of lightning occurrences in this event were only observed by 1 or 2 of the lightning sensors
- Majority of flashes observed by ENTLN indicated normal charge structure
- During rapid plume development, GLM led first ENTLN observations by 17 minutes
- ENTLN continued to detect lightning nearly an hour after last GLM flash during plume growth stage
- Both ENTLN and GLM observed lightning just prior to PDC report at 2200 UTC.
  - Main source of lightning unclear
- GLM flashes were smaller in size and total optical energy than other flashes observed by GLM in region.