



P3-45

JEM-GLIMSによって観測された スプライトとエルブスの 時間・空間変化

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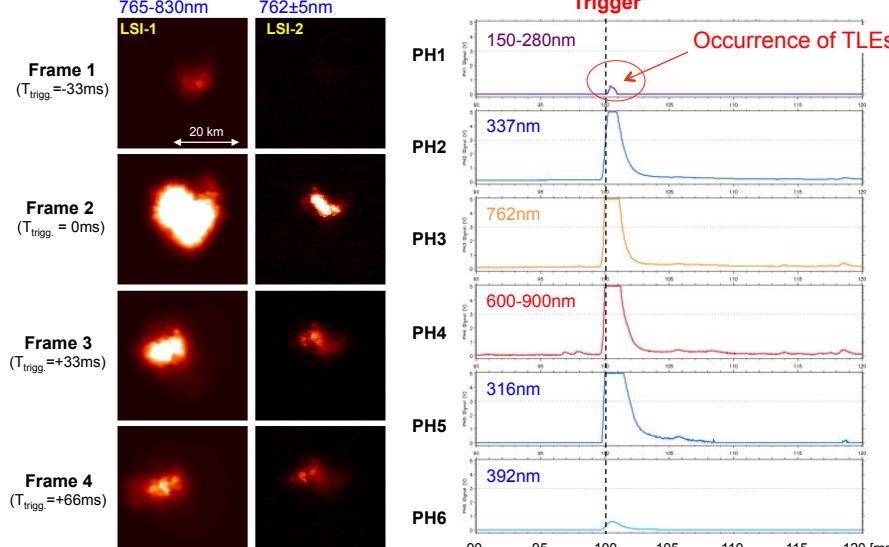
4. Kinki University, Higashi-Osaka, Japan
5. ISAS / JAXA, Sagamihara, Japan
6. Stanford University, Stanford, CA, USA

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#1

Sprite Event / Outline of the Event

2013/09/28 19:50:40.30580 UT @ Central Africa



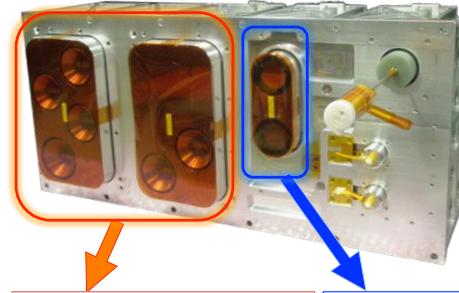
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#3

Identification of TLEs

Methodology to identify TLEs from the transient optical events detected by JEM-GLIMS.

GLIMS



Photometer (PH) data

- Temporal change of the emission
- Absolute intensity [W/m^2]
- Intensity ratio between PH channels

ELF Network



ELF waveform data

- Discharge type: CG or IC/CC
- Time, location, polarization of the parent CG
- Charge moment change (CMC)

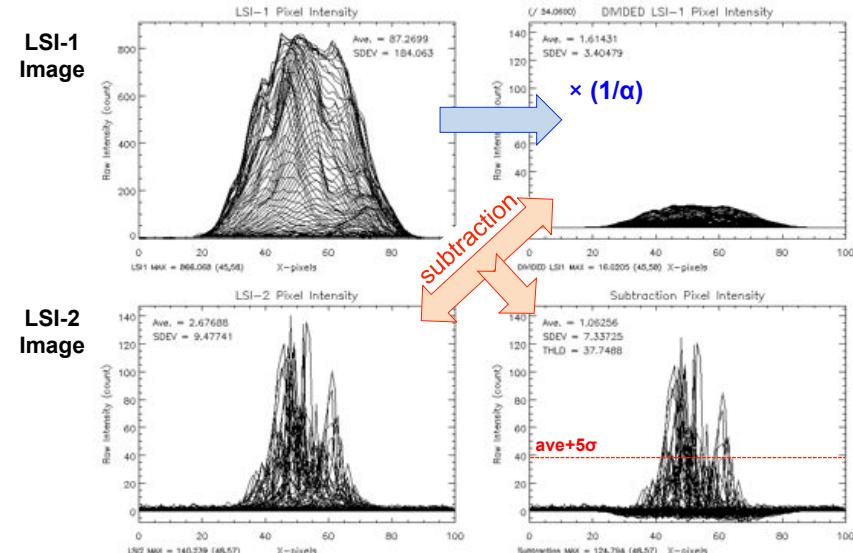
Synthetic data comparison is essential for the judgement of TLEs occurrence !!

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#2

Sprite Event / Image Subtraction

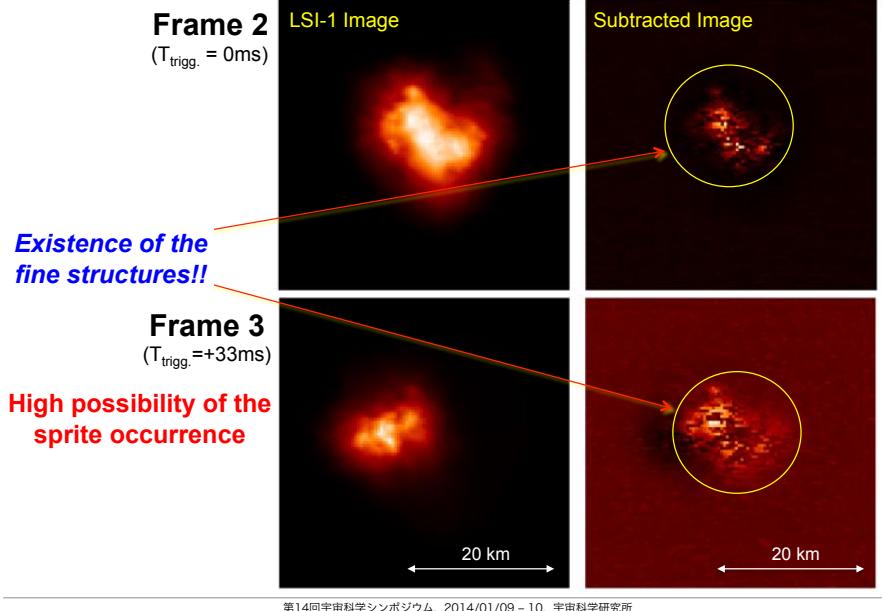
Frame 2 ($T_{\text{trigg.}} = 0\text{ms}$)



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#4

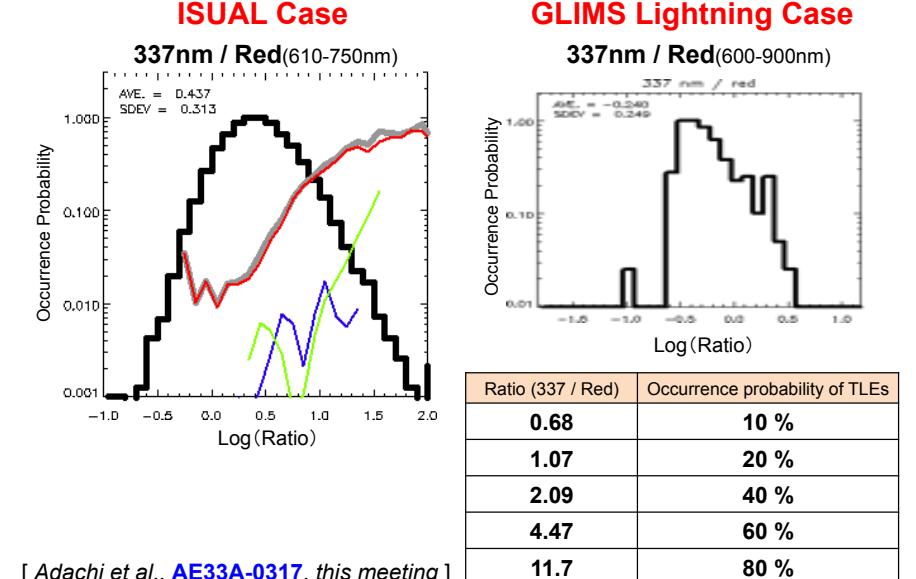
Sprite Event / Image Subtraction



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#5

Sprite Event / Intensity Ratio, Occurrence Probability

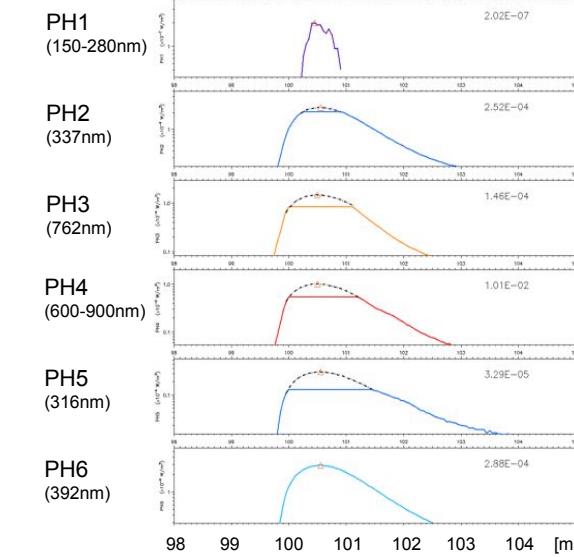


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#6

Sprite Event / Absolute Intensity of PH Data

Peak intensities of PH light curve data

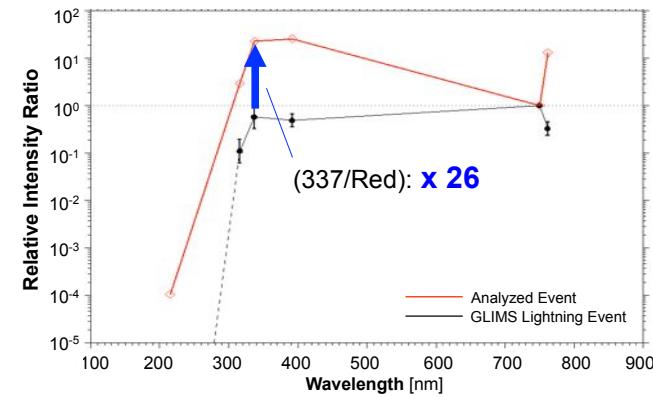


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#7

Sprite Event / Intensity Ratio

Relative Intensity Ratio toward PH4(600-900nm) Intensity



$$(337 / \text{Red}) = \times 26$$

$$(392 / \text{Red}) = \times 25$$

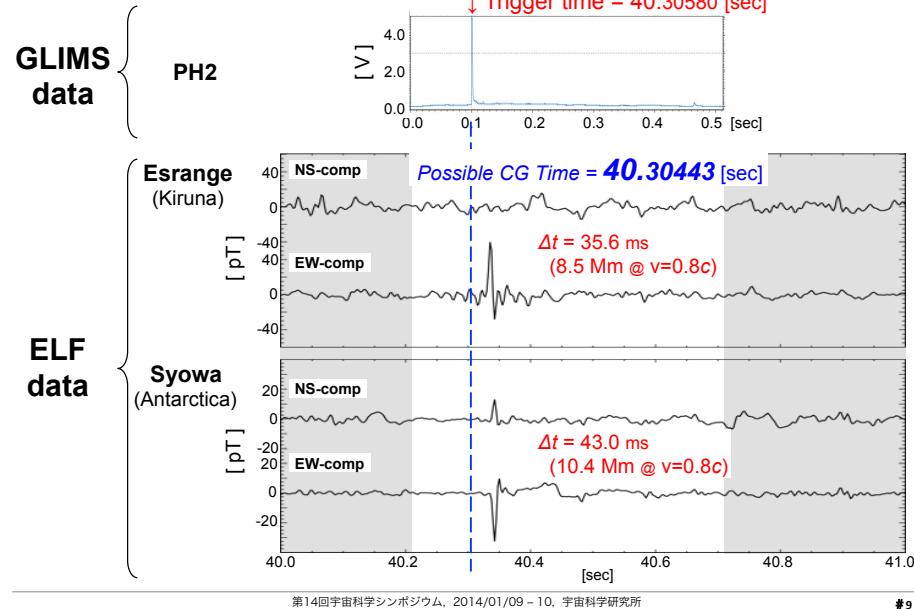
Occurrence Probability of TLEs
80% at (337/Red)=11.7

[Adachi et al., AE33A-0317, this meeting]

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#8

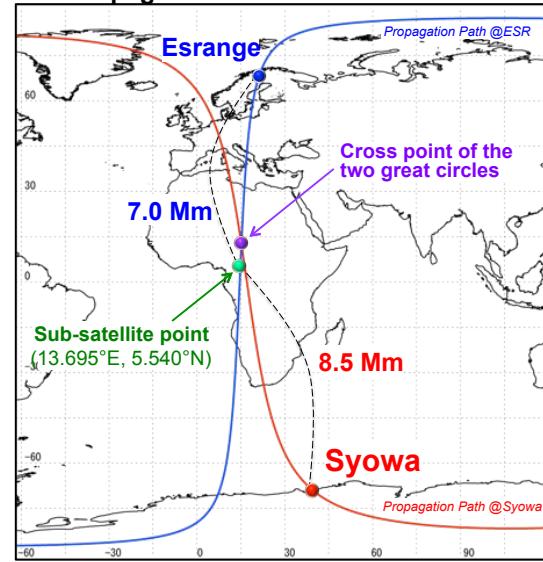
Sprite Event / Electrical Properties of Parent CG



Sprite Event / Electrical Properties of Parent CG



Propagation Paths of the ELF Waves

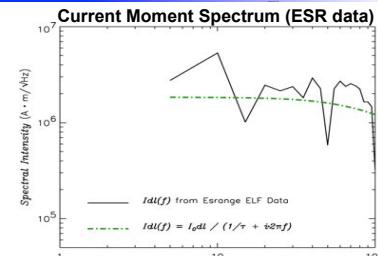


Sprite Event / Electrical Properties of Parent CG



Charge Moment Change (CMC) Estimation

$$\text{Current Moment Spectrum} \quad H_\phi(f, \theta) = \frac{Idl(f)}{4\pi R_E h_0} \sum_n \frac{2n+1}{n(n+1)-v(v-1)} \frac{\partial}{\partial \theta} P_m(\cos \theta)$$

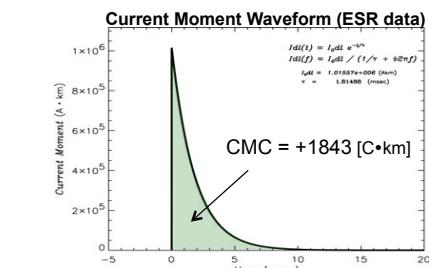


Assumed Current Moment Waveform

$$Idl(t) = I_0 dl \exp(-t/\tau)$$

$H_\phi(f)$: observed magnetic field spectrum
 $Idl(f)$: current moment spectrum
 I_0 : peak current moment
 τ : angular distance
 R_E : radius of the Earth
 h_0 : wave reflection height
 n : mode number
 v : propagation coefficient
 P_m : Legendre polynomial
 τ : time constant of the lightning current

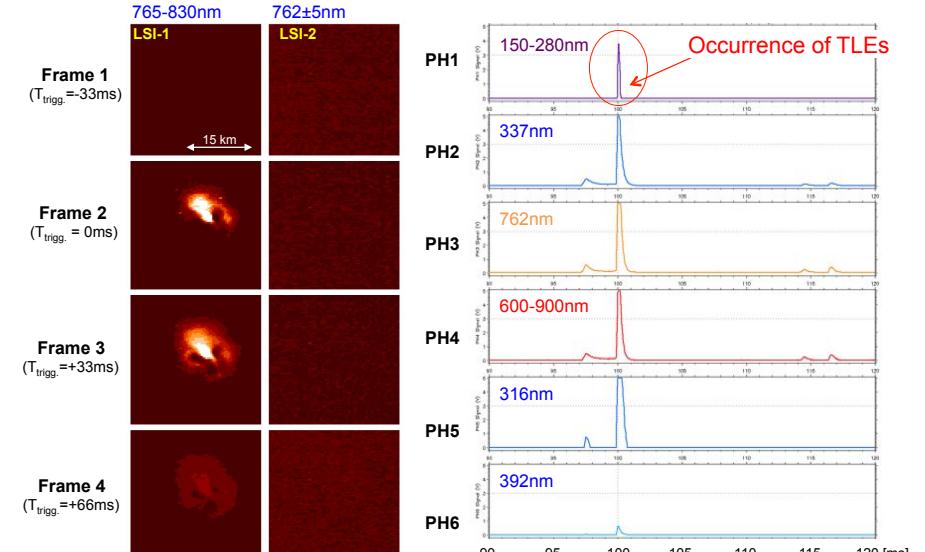
Station	CMC
Esrage	+1843 [C·km]
Syowa	+1622 [C·km]

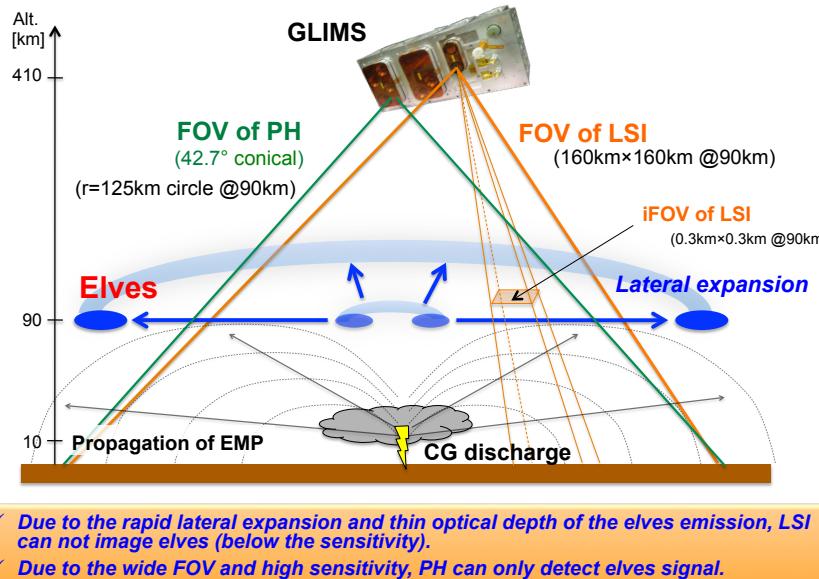


Enough to excite sprites!!

Elves Event / Outline of the Event

2013/09/08 16:57:33.70315 UT @ Southern Australia





Conclusion

- ✓ JEM-GLIMS is continuing nadir observations of lightning & TLEs from ISS, and it succeeded in detecting ~2,600 lighting events since Nov. 2012.
- ✓ In order to identify TLEs, a synthetic comparison of the results derived from LSI data, PH data and ground-based ELF data is essential.
- ✓ Based on the detailed data analysis, sprite event occurred at 19:50:40UT on Sep. 28, 2013 is confirmed. It was found that the fine structures of sprites are horizontally distributed within a 20 km circled area over the peak emission area at the LSI-1 image.
- ✓ Elves event occurred at 16:57:33UT on Sep. 8, 2013 is confirmed. In this event, LSI can not capture any elves emission, while only PH can detect optical signals. This fact suggests that LSI does not have enough sensitivity for elves detection due to the rapid lateral expansion and thin optical depth of the elves emission.

Future Plan

- Comparison between GLIMS optical data and GLIMS/VLF and VHF data to clarify the horizontal distribution and occurrence condition of sprites,
- Identification of seasonal / LT dependences of TLE occurrences.

Recent mission status can be checked at the following web pages;

- GLIMS HP : <http://www.ep.sci.hokudai.ac.jp/~jemglims/>

Acknowledgement

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