

In-flight observation of long duration gamma-ray glows by aircraft

Citation for published version (APA):

Kochkin, P., van Deursen, A. P. J., de Boer, A., Bardet, M., Allasia, C., Boissin, J. F., & Østgaard, N. (2017). In-flight observation of long duration gamma-ray glows by aircraft. In *EGU General Assembly 2017, 23-28 April 2017, Vienna, Austria* European Geosciences Union.

Document status and date:

Published: 01/01/2017

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

openaccess@tue.nl

providing details and we will investigate your claim.

In-flight observation of long duration gamma-ray glows by aircraft

Pavlo Kochkin (1), A.P.J. (Lex) van Deursen (2), Alte de Boer (3), Michiel Bardet (3), Cedric Allasia (4), Jean Francois Boissin (4), and Nikolai Ostgaard (1)

(1) University of Bergen, Bergen, Norway (pavlo.kochkin@uib.no), (2) Eindhoven University of Technology, Eindhoven, The Netherlands, (3) Netherlands Aerospace Centre, Amsterdam, The Netherlands, (4) Airbus, Toulouse, France

The Gamma-Ray Glow is a long-lasting (several seconds to minutes) X- and gamma radiation presumably originated from high-electric field of thunderclouds. Such glows were previously observed by aircraft, balloons, and from the ground. When detected on ground with other particles, i.e. electrons and neutrons, they are usually called Thunderstorm Ground Enhancements (TGEs). Their measured spectra are often consistent with Relativistic Run-away Electron Avalanche (RREA) mechanism. That is why RREA is a commonly accepted explanation for their existence. The gamma-ray glows are observed to be interrupted by lightning discharge, which terminates the high-electric field region.

In January 2016 an Airbus A340 factory test aircraft was performing intentional flights through thunderstorms over Northern Australia. The aircraft was equipped with a dedicated in-flight lightning detection system called ILDAS (<http://ildas.nlr.nl>). The system also contained two scintillation detectors each with 38x38 mm cylinder LaBr3 crystals. While being at 12 km altitude the system detected a gamma-ray flux enhancement 30 times the background counts. It lasted for 20 seconds and was abruptly terminated by a lightning flash. The flash hit the aircraft and its parameters were recorded with 10 ns sampling time including gamma radiation. Ground-based lightning detection network WWLLN detected 4 strikes in the nearby region, all in association with the same flash. The ILDAS system recorded the time-resolved spectrum of the glow. In 6 minutes, after making a U-turn, the aircraft passed the same glow region. Smaller gamma-ray enhancement was again detected.

In this presentation we will show the mapped event timeline including airplane, gamma-ray glow, WWLLN, and cloud data. We will discuss the glow's properties, i.e. intensity and differential spectrum, and its possible origin. This result will also be compared to previously reported observations.