Fact-Checked Science

PAPER CHECK · SPACE WEATHER

The 2025 radiation storm warranted a warning, the paper finds; the flights didn't show it

On November 11, 2025, solar protons energetic enough to register at sea level arrived in the strongest such event since 1989, by one measure [9 p. 9765], and a team from the University of Surrey, the Met Office, KNMI and others measured it with UK neutron monitors, weather balloons and monitors on two flights from London to New York [1 p. 1]. S0 News said the flights' dosimeters showed the airline "should have been warned and redirected" [2 00:02:16–00:02:18]. The paper does find that a moderate radiation advisory should have gone out, and that none did, from its balloons over Shetland and an estimate for the event's peak [1 p. 1][1 p. 12]. But the flights' own monitors stayed below ICAO's thresholds, and the paper never mentions rerouting [1 p. 14]. We read the paper in full and re-ran its published data.

By Fact-Checked Science · Published October 28, 2026

OUR ANALYSIS marks our own reasoning and calculations, including our re-run of the paper's data set, our timeline from NOAA's alert archive, our count of storms in GFZ's Kp record and our dose arithmetic, and the verdicts are our assessment. Everything else comes from the numbered sources. For the paper [1], p. gives a page of its version of record and Table a table; for the episode [2], times are positions in the video; elsewhere p. gives a page (of the PDF, for the slides), Table a table, art. an article of a statutory instrument and Abstract the part of a source we quote.

An advisory was due and none went out, the paper finds; the flights' own monitors stayed below the thresholds

OUR ASSESSMENT

≈58 µSv/h
the paper's estimate at 42,000 feet over Shetland at the event's peak, "very likely" above ICAO's moderate threshold of 30 [1 p. 12]

160 µSv/h
measured at about 60,000 feet over Shetland, over two hours into the event: twice ICAO's severe threshold of 80 [1 p. 12]

+42.6%
the JFK flight's total dose against 13 normal flights, "within two standard deviations of the mean" [1 p. 14]; the press release says 46% [5]

THE CLAIMS

TRUE

A warning for airlines never went out

The presenter, in the episode's opening: "a solar storm warning for airlines that never went out" [2 00:00:23–00:00:26]

The paper says so itself: "During the event no international radiation advisories were issued for aircraft; the measurements show that a moderate advisory should have been issued" [1 p. 1]. Its authors include staff of the Met Office and KNMI, two members of one of ICAO's four space weather centres [1 p. 3]. Their slides of March 2026 say so too [8 p. 19], as do a poster and a news report, which agree with the paper but don't stand apart from it [18][28]. Other warnings did go out: NOAA's proton warnings and alerts from 10:28 UTC, which named the risk to high-latitude flights [13], and ICAO advisories for the flare's radio blackout [8 p. 19]. There is no public archive of ICAO's advisories to check against; the centres' pages list only current ones [19][20]. See section 3.

PARTLY TRUE

No official radiation warnings went out

The presenter: "Here they're saying that while no official radiation warnings went out" [2 00:02:10–00:02:12]

The episode repeats the paper's own words, "no radiation warnings were given out during GLE 77" [1 p. 12] and "no warnings were issued" [1 p. 1], and for ICAO's service they hold. As a statement of fact they don't. NOAA's Space Weather Prediction Center issued a warning at 10:28 UTC that protons above 100 MeV were expected to rise, an alert at 10:29 and an S2 alert at 12:32, each naming the risk to passengers and crew on high-latitude, high-altitude flights; S3 followed at 01:55 on November 12 [13]. The paper doesn't mention them. See section 3.

MISREAD

The flights' dosimeters showed they should have been warned and rerouted

The presenter: "there were in fact flights whose doimeters showed the airline should have been warned and redirected on their flight path away from the radiation bombardment at high latitude." [2 00:02:14–00:02:23]

The warning is the paper's point: "a moderate advisory should have been issued" [1 p. 1], "for private aviation" [1 p. 1], "as a minimum" [1 p. 12], from its balloons and an estimate for the event's peak. But that isn't what the flights' dosimeters showed. On the JFK flight "ICAO moderate was not exceeded", and its 42.6% rise was "within two standard deviations of the mean" of normal flights [1 p. 14]. The Newark flight saw no significant increase [1 p. 1]. The paper never mentions rerouting or redirecting flights. See section 4.

TRUE

They didn't warn because the models said they didn't have to

The presenter: "the reason they didn't warn was because the models said they didn't have to." [2 00:02:26–00:02:30]

That is the paper's explanation too: "The service relies entirely on numerical models, which tend to rely on a handful of ground and space based observations" [1 p. 12], and the advisories "are issued on the output of computer models" [1 p. 3]. The one model with published results, Japan's WASAVIES, found the moderate threshold exceeded only at about 46,000 feet and above, for about ten minutes [10 Abstract], at or above the highest level at which moderate advisories are issued [19]. The paper's measurements "cast doubt on the validity of that conclusion" [1 p. 12]. The duty centre's own model output is not public. See section 5.

TRUE

High-energy protons penetrated deep

The presenter: "But high energy protons penetrated deep anyway." [2 00:02:30–00:02:33]

That is what a ground level enhancement is: solar protons energetic enough for the cascades they set off in the air to reach the ground [9 p. 9765][17 p. 3]. Both Lerwick balloons "showed highly elevated radiation environments throughout the atmosphere" [1 p. 12], and the Lerwick neutron monitor, on the ground, rose 150% [1 Table 1]. The solar protons themselves collide high in the atmosphere; what reaches the ground is the cascade they set off [17 p. 2]. See section 7.

TRUE

ICAO's thresholds were crossed above northern Britain, at business-jet and supersonic altitudes

The paper's abstract [1 p. 1]

"Data from radiosondes launched from the northern extremity of the UK show that the threshold for an International Civil Aviation Organisation (ICAO) moderate radiation threshold was exceeded at business jet altitudes several hours after the event peak, and at supersonic altitudes the severe threshold was exceeded by a factor of two" [1 p. 1]. In its Table 2 the two balloons from Lerwick, in Shetland, read 35.4 and 36.0 µSv an hour at 48,000 feet, and the first 160 at 60,000 feet [1 Table 2], "for several hours in the airspace above Shetland" [1 p. 14]. The published data files read higher still, 1.5 to 2.3 times the paper's values there [4]. See section 2.

1 · THE PAPER

A peer-reviewed paper, read in full from the copy the site's owner supplied

The paper is a peer-reviewed article in *Space Weather*, published online on October 20, 2026, under a CC BY 4.0 licence [1][3]. Its 18 authors work at the University of Surrey, CSDRad Consultancy, Lancaster University and Aspinall Instruments, the Met Office and the Netherlands' meteorological institute, KNMI [1 p. 1]. Wiley's site met our tools and a real browser with a human-verification check, which we did not attempt; the site's owner supplied the version of record, all 16 pages, and we read it in full [1].

In the authors' words The paper's Key Points and Plain Language Summary, on its first page.

> *"During the event no international radiation advisories were issued for aircraft; the measurements show that a moderate advisory should have been issued"*
>
> Baird et al. (2026), Key Points [1 p. 1]

> *"Although GLE 77 was modest in magnitude compared with other historic events, it produced clear radiation increases."*
>
> Baird et al. (2026), Plain Language Summary [1 p. 1]

> *"Measurements recorded during this event showed that an International Civil Aviation Organisation moderate radiation warning should have been issued for private aviation, however no warnings were issued."*
>
> Baird et al. (2026), Plain Language Summary [1 p. 1]

Who made it, and who paid

The data come from the aviation radiation programmes of two members of PECASUS, one of ICAO's four space weather centres: the Met Office and KNMI [1 p. 3]. The paper's new instruments, among them the SAIRA radiation sensor and three neutron monitors, were developed for the Met Office under the UK's space weather programme, SWIMMR [1 p. 3][6], with UKRI grants [1 p. 14]. "The authors declare no conflicts of interest relevant to this study." [1 p. 14]

Received on June 22 and accepted on October 1, 2026 [1 p. 1], it has 59 references [3], among them the GLE 77 data summary [9], the WASAVIES study of the same event [10], NOAA's account of its radiation advisories [11] and the UK's nowcasting model [12].

What it measured, and how

Four UK neutron monitors; four balloons carrying SAIRA radiation monitors, two from Lerwick, in Shetland, and one each from Camborne, in Cornwall, and De Bilt, in the Netherlands, beside a test launch from all three sites on October 17, 2025; and monitors on two Boeing 777s from Heathrow to New York [1 p. 4]. SAIRA measures absorbed dose in silicon and estimates the ambient dose equivalent, an operational stand-in for a person's dose, from a calibration [1 p. 5][29 Abstract]. The balloon data are compared with the test flights at the same flight levels; each flight's total with the mean of normal flights on the same route [1 p. 6].

The data are public on Zenodo under CC BY 4.0 [4]. The paper cites the data set's first version [1 p. 15], whose files are embargoed; we use the second, which the site's owner downloaded after Zenodo refused our downloads [4].

2 · WHAT IT MEASURED

Over Shetland the thresholds were crossed for hours, and at the peak very likely at airliner altitudes

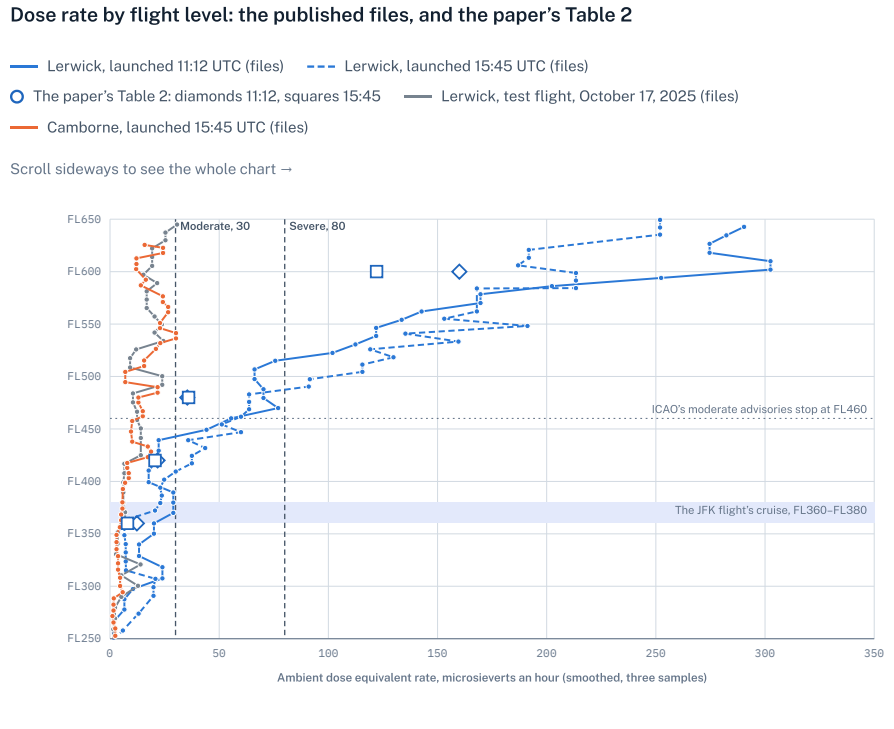
GLE 77 began at 10:15 UTC on November 11, 2025, by the paper's timing, and was "highly anisotropic" from the start [1 p. 4], strongest in the far north [1 p. 1]. The paper puts airliners at about 36,000 to 42,000 feet [1 p. 2], business jets at about 48,000 and supersonic aircraft at about 60,000 [1 p. 9].

An ICAO threshold exceeded, measured
Exceeded by the paper's estimate
No threshold exceeded, measured
At the ground

Supersonic altitudes, about 60,000 feet	**Severe threshold, 80 µSv an hour, exceeded twofold: 160 at 12:14 UTC** on the first Lerwick balloon, "over 2 hr into the event", and 122 on the second at 17:04 [1 p. 12][1 Table 2]
Business-jet altitudes, about 48,000 feet	**Moderate threshold, 30 µSv an hour, exceeded**: 35.4 at 12:00 and 36.0 at 16:46 on the two Lerwick balloons [1 Table 2]. By the paper's estimate for the event's peak, the severe threshold "may have been exceeded" there [1 p. 12].
Airliner altitudes over Shetland, at the peak	**About 58 µSv an hour at 42,000 feet, by the paper's estimate**, scaling the first balloon's reading by the Lerwick neutron monitor: "very likely" above the moderate threshold [1 p. 12]
Airliner altitudes, measured	**Over Shetland, 12.3 and 21.8 µSv an hour at 36,000 and 42,000 feet on the first balloon, 8.0 and 20.6 on the second** [1 Table 2]. The JFK flight peaked at about 15 µSv an hour at 38,000 feet at 14:30, "half of the ICAO moderate threshold"; the Newark flight saw no significant increase [1 p. 12][1 p. 1].
The ground	**Lerwick up 150% at 10:31 UTC**; Lancaster 24% at 10:28; Camborne 12% at 11:20 and Guildford 14% at 11:34, about an hour later [1 Table 1]

Our summary of the paper's findings, highest altitude first; the bands are not to scale [1 Table 2][1 p. 12]. Balloons from Camborne and De Bilt showed no significant increase [1 p. 14]. ICAO's thresholds are dose rates in effective dose, while the paper's are ambient dose equivalent; section 9 has its caveats [1 p. 9]. The Met Office wrote that at 40,000 feet the radiation "reached almost ten times normal background level for a short period", without saying where [6]. The paper's Table 2 puts the Lerwick balloons' absorbed dose rates at 36,000 and 42,000 feet 11% and 60% above the October test flight's [1 Table 2], and finds rises above 1,000% only "at high altitudes" [1 p. 8].

Dose rate by flight level: the published files, and the paper's Table 2



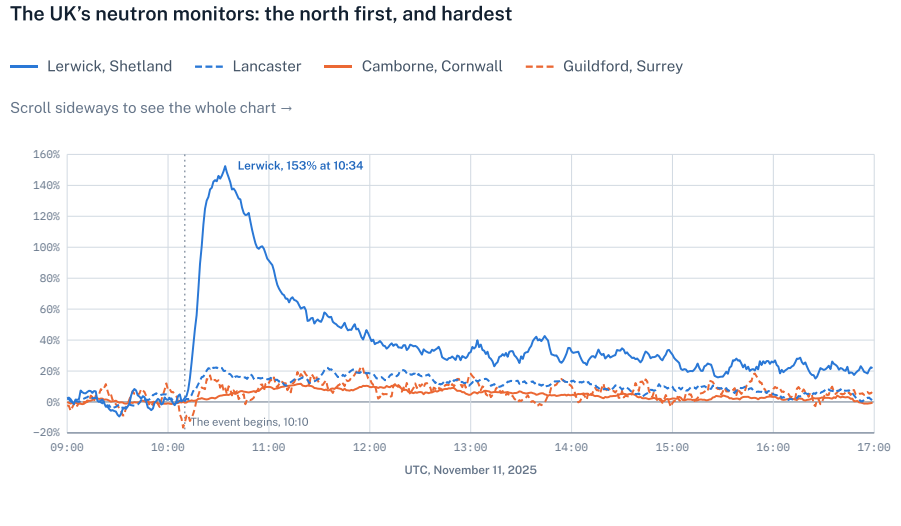
Our analysis of the data set: Baird et al. 2026, data set version 2, doi:10.5281/zenodo.23082794, CC BY 4.0 [4], with the paper's Table 2 [1 Table 2]. Ascents only; each line is the files' one-minute samples, smoothed by us as the median of three in a row, by pressure altitude in hundreds of feet. **The files read higher than the paper.** At Table 2's levels and times, processed the paper's way, the Lerwick balloons' files give 1.5 to 2.3 times its ambient dose equivalent and 1.5 to 2.0 times its absorbed dose, while the flight files match the paper; we cannot tell which is right [4][1 p. 6]. The rates are ambient dose equivalent; ICAO's thresholds are effective dose [1 p. 9]. The test flight's file has timestamps of November 11, but its name, the data set's index and the paper give October 17 [1 p. 4].

OUR ANALYSIS

Two versions of the balloon numbers

The paper's Table 2 puts the first Lerwick balloon at 21.8 µSv an hour at 42,000 feet, 35.4 at 48,000 and 160 at 60,000; the second at 20.6, 36.0 and 122.1 [1 Table 2]. The same balloons' published files, processed the paper's way (a 25-point Savitzky–Golay filter, flight levels rounded to the nearest 20 [1 p. 6]), give 33.3, 63.6 and 249.4 for the first and 38.7, 81.4 and 208.0 for the second [4]. So in the files the moderate threshold is crossed inside the paper's band of airliner altitudes on the afternoon balloon, about 41,000 feet, and the severe one from about 49,000; in Table 2, between 42,000 and 48,000 feet and between 48,000 and 60,000. The data set's record says its second version is "the correct version as displayed in the paper", and the flight files do match the paper, to within about 1% [4][1 Table 4]. This page gives the paper's numbers as the paper's findings, and the files' as the files'.

The UK's neutron monitors: the north first, and hardest



Our analysis of the data set: Baird et al. 2026, data set version 2, doi:10.5281/zenodo.23082794, CC BY 4.0 [4]. Each monitor's counts as a percentage above its own average of 08:00–10:00 UTC, the baseline Mishev and colleagues use [9 p. 9765], averaged over ten minutes; the paper uses 06:00–09:30 and a Savitzky–Golay filter [1 p. 6]. Our peaks: Lerwick 153% at 10:34, Lancaster 23% at 10:26, Camborne 12% at 11:19, Guildford 23% at 11:55. The paper's: 150% at 10:31, 24% at 10:28, 12% at 11:20 and 14% at 11:34 [1 Table 1]. Guildford's data are noisy: "an increase cannot be clearly made out" in them, the paper says [1 pp. 6–7].

How big GLE 77 was, and by what measure

By the summed intensity that neutron monitors recorded, it "appeared to be the strongest one, in terms of the integral intensity, over the past 36 years, since GLE #42 on 29-Sep-1989, and the fourth strongest over the neutron-monitor era"; the four earlier ones of this solar cycle were weak [9 p. 9765]. The paper calls it "modest in magnitude compared with other historic events" [1 p. 1].

Other rankings use other measures and don't say which: the press release calls it the largest in "almost 20 years" [5], the authors' conference abstract the strongest "in nearly 25 years" [7], and one author "the strongest Ground Level Event we've seen since December 2006" [6].

The 42.6%, against normal flights

The JFK flight's 52.9 µSv is compared with the mean of 13 flights [1 p. 6] with the same flight number between November 2025 and February 2026, in the absence of a GLE [1 p. 9]: 37.1 µSv, with a standard deviation of 22.9% of the mean [1 Table 4]. The rise is 1.9 standard deviations, by our arithmetic: "within two standard deviations of the mean", as the paper says [1 p. 14]. In absorbed dose, which SAIRA measures directly, the rise was 20.7%, against a spread of 18.8% [1 Table 3].

The press release gives the rise as "a 46 per cent increase in radiation exposure compared to normal background conditions" [5]; the paper's figure is 42.6% [1 Table 4].

3 · WHO ISSUED WHAT

NOAA's radiation warnings went out within 18 minutes; ICAO's radiation advisory never did

Three services matter here: NOAA's alerts, which anyone can read; ICAO's space weather advisories, which go to aviation; and the UK's own forecasters at the Met Office.

November 11–12, 2025, in UTC

TIME	WHAT HAPPENED	SOURCE
09:49–10:17	An X5.1 flare from sunspot region 4274, peaking at 10:04; NOAA scale "R3 - Strong"	[13]
10:10	**The ground level enhancement begins, first at the neutron monitor in Newark, Delaware; the paper gives the onset as 10:15**	[9 p. 9770][1 p. 4]
10:14	The first of three e-mails from the GLE Alert++ system, run from Athens on the European Space Agency's space weather portal	[9 p. 9777]
10:18	The Paris Observatory's alarm detects the event	[17 p. 10]
10:28	**NOAA: "WARNING: Proton 100MeV Integral Flux above 1pfu expected"**	[13]
10:29	NOAA: "ALERT: Proton Event 100MeV Integral Flux exceeded 1pfu"	[13]
10:31	The Lerwick neutron monitor peaks, 150% above normal	[1 Table 1]
10:49	An ICAO advisory from the centre on duty, ACFJ: HF radio communications at the moderate level, ending the flare's event	[8 p. 19]
11:12	The first balloon goes up from Lerwick, Shetland	[1 p. 4]
11:45	The Heathrow–JFK flight departs	[1 p. 4]
12:14	The first balloon reads 160 µSv an hour at 60,000 feet	[1 Table 2]
12:32	**NOAA: protons above 10 MeV exceed 100 particle flux units, "S2 - Moderate"**	[13]
14:15, 15:45	Balloons go up from De Bilt, then from Lerwick again and from Camborne	[1 p. 4]
14:30	The JFK flight's peak, about 15 µSv an hour at 38,000 feet	[1 p. 12]
17:05	NOAA: a watch for a severe, G4, geomagnetic storm on November 12	[13]
17:30	The Heathrow–Newark flight departs, by the paper's text; its abstract says 17:45, the data set's index "from 17:25", and the flight's data show take-off at 17:27 [4]	[1 p. 4][1 p. 1]
01:55, November 12	NOAA: "S3 - Strong", peaking at 1,460 particle flux units at 02:15, after shock waves from the eruptions reached the spacecraft upstream of Earth	[13][9 p. 9774]
Throughout	**No ICAO radiation advisory, says the paper; its authors' slides agree**	[1 p. 12][8 p. 19]

Our analysis: NOAA's products from its archive, filtered by our script in section 10. The X5.1 was the largest of the 18 X-class flares in NOAA's event lists for 2025, by our count [13], and NOAA called it "One of the strongest flares of the cycle" [14].

NOAA: warnings that name aircrew

The 100 MeV warning and alert carried the same note: "An enhancement in the energetic portion of the solar radiation spectrum may indicate increased biological risk to astronauts or passengers and crew in high latitude, high altitude flights." The S2 alert said: "Radiation–Passengers and crew in high latitude, high altitude flights may experience small, increased radiation exposures." [13]

NOAA's news page reported that afternoon that the eruption's coronal mass ejection "is also associated with a moderate level solar radiation storm (S2) that is currently in progress" [14]. The paper does not mention NOAA's alerts.

FROM ONSET TO NOAA'S WARNING · OUR ANALYSIS

18 minutes

from the first rise at Newark, 10:10 UTC [9 p. 9770], to NOAA's warning of 10:28 that protons above 100 MeV were expected to rise [13]; 13 minutes from the paper's onset of 10:15 [1 p. 4], and 8 from its abstract's "approximately 10:20" [1 p. 1]. NOAA's S scale, which counts protons above 10 MeV, stood at S1, from the day before, until 12:32 [13].

ICAO: the radiation advisory that wasn't sent

Four centres take turns on duty in two-week shifts: PECASUS, a European consortium; ACFJ, for Australia, Canada, France and Japan; NOAA's Space Weather Prediction Center; and a China–Russia consortium [1 p. 3][20]. "If the modeled effective dose rate at aviation altitudes exceeds 30 µSv hr^{-1} a moderate radiation advisory should be issued. If 80 µSv hr^{-1} is exceeded then a severe radiation advisory should be issued." [1 p. 3] Moderate advisories are issued only from 25,000 to 46,000 feet, because galactic cosmic rays alone could pass 30 µSv an hour "at the highest flight levels from time to time" [11 p. 5]; severe ones from 25,000 to 60,000 feet [19].

The paper: "These measurements highlight a flaw in the ICAO space weather radiation service (ICAO WACAF Office, 2025), as no radiation warnings were given out during GLE 77, even though these airborne observations would indicate a moderate advisory should have been issued as a minimum." [1 p. 12] According to the authors' slides, ACFJ was on duty [8 p. 19].

The Met Office: no public radiation warning, and later, no health concern

The Met Office belongs to PECASUS, which was not on duty [1 p. 3][8 p. 19], and its forecasters provide alerts and warnings to government and to operators, aviation among them [1 p. 3]. What they sent on November 11 is not public. Its article for the public that day was about aurora: "The peak in geomagnetic activity is expected on 12 November." [31]

Sixteen days later it wrote: "The radiation levels observed at 40,000 feet during the 11 November event reached almost ten times normal background level for a short period. Although this didn't pose any health concerns, the modelling validation will be crucial in preparing for potential larger events in the future." [6]

OUR ANALYSIS

What rests on whom

That no radiation advisory went out rests first on the paper [1 p. 1][1 p. 12]. The authors' slides, the TRIUMF poster and a news report agree [8 p. 19][18], but they don't stand apart from it: the slides are the authors' own, the poster's figures summarise nowcasts that include the University of Surrey's MAIRE-S [18], and the news report relays the paper [28]. There is no public archive to check them against; the centres' pages list current advisories only [19][20]. NOAA's alerts are on record, minute by minute [13]. So the episode's opening, "a solar storm warning for airlines that never went out" [2 00:00:23–00:00:26], is right about the radiation advisory, and its later "no official radiation warnings" [2 00:02:10–00:02:12] is right about ICAO but not about NOAA.

4 · SHOULD FLIGHTS HAVE BEEN WARNED OR REROUTED?

Warned, the paper says; the flights' own monitors didn't show it, and the paper never mentions rerouting

The presenter said the paper found "flights whose doimeters showed the airline should have been warned and redirected" [2 00:02:14–00:02:18]. The paper does conclude that a warning should have gone out, from its balloons and an estimate for the event's peak [1 p. 12]. What it does not say is that the flights' dosimeters showed it, or that anyone should have been rerouted.

In the paper's words On the warning, on the flights, and on the flight that might have met the threshold.

> *"This simple estimate illustrates that it is very likely that the event exceeded the ICAO moderate threshold at commercial aviation altitudes. Applying the same logic to the observations at FL480 implies that the severe threshold may have been exceeded at that altitude."*
>
> Baird et al. (2026), §4.2 [1 p. 12]

> *"ICAO moderate was not exceeded on the flight tracks over the Atlantic Ocean during the time range of 1.5–10 hr after the event onset, up to an altitude of FL390"*
>
> Baird et al. (2026), Conclusions [1 p. 14]

> *"This measurement was half of the ICAO moderate threshold, and it may be the case that, had this measurement occurred at a similar time to the first radiosonde flight from Lerwick or at the event peak, the ICAO moderate threshold could have been exceeded."*
>
> Baird et al. (2026), §4.3 [1 p. 12]

Where a warning was due

Measured: the moderate threshold at about 48,000 feet, business-jet altitudes, and the severe one at about 60,000, for several hours over Shetland [1 p. 14]. Estimated: about 58 µSv an hour at 42,000 feet at the event's peak, scaling the first balloon's 22 by the Lerwick neutron monitor's rise, "very likely" above the moderate threshold [1 p. 12]. Hence the paper's "a moderate advisory should have been issued as a minimum" [1 p. 12], and its Plain Language Summary's "for private aviation" [1 p. 1]. In March 2026 the authors' slides had gone further, "GLE 77 was ICAO SEV at 43 kft near UK North Coast" [8 p. 20]; the paper keeps a more cautious version of that estimate.

The only model with published results for the event, WASAVIES, put the world's highest dose rate above 30 µSv an hour only at about 46,000 feet and above, for about ten minutes, and concluded that the event "did not warrant major operational responses such as route or altitude changes" [10 Abstract]. The paper replies that its measurements "cast doubt on the validity of that conclusion" [1 p. 12].

What the paper says about protecting flights

Nothing about rerouting, diversion or changing altitude. It notes that UK and most international airlines "are required to assess the exposure of their crew and prevent over-exposure" [1 p. 2], and its recommendations are about measuring: more monitors on aircraft, "with a view toward monitors which are integrated to the avionics", and "Include airborne observations of atmospheric radiation alongside models when assessing radiation levels for the purpose of ICAO services." [1 p. 14]

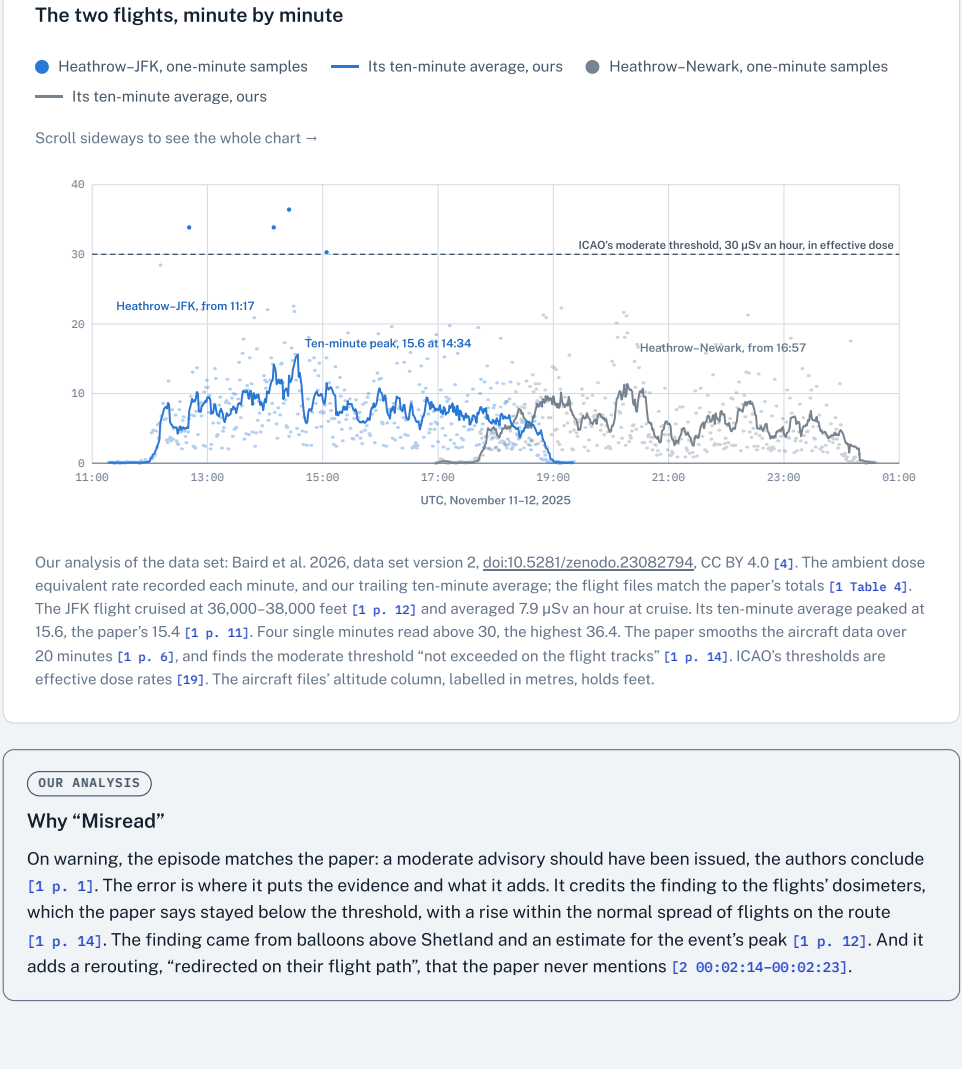
An ICAO workshop on the event added a caution: "care should be taken to avoid radiation exposure mitigating actions which would unreasonably increase risks to the travelling public" [15 p. 3].

OUR ANALYSIS

Against ICAO's own rules

ICAO issues moderate advisories only from 25,000 to 46,000 feet [19][11 p. 5], a rule the paper doesn't mention. Its measured moderate exceedances, at about 48,000 feet, lie above that range; its severe exceedance at about 60,000 feet, and its estimate for 42,000 feet at the peak, lie inside the ranges for severe and moderate advisories [1 p. 12][1 Table 2]. So under the rules, and if ambient dose equivalent stands in for effective dose, as the paper argues [1 p. 12], a severe advisory for the highest flight levels over the far north was called for by the measurements, and a moderate one at airliner levels by the estimate for the peak.

The two flights, minute by minute



Our analysis of the data set: Baird et al. 2026, data set version 2, doi:10.5281/zenodo.23082794, CC BY 4.0 [4]. The ambient dose equivalent rate recorded each minute, and our trailing ten-minute average; the flight files match the paper's totals [1 Table 4]. The JFK flight cruised at 36,000–38,000 feet [1 p. 12] and averaged 7.9 µSv an hour at cruise. Its ten-minute average peaked at 15.6, the paper's 15.4 [1 p. 11]. Four single minutes read above 30, the highest 36.4. The paper smooths the aircraft data over 20 minutes [1 p. 6], and finds the moderate threshold "not exceeded on the flight tracks" [1 p. 14]. ICAO's thresholds are effective dose rates [19]. The aircraft files' altitude column, labelled in metres, holds feet.

OUR ANALYSIS

Why "Misread"

On warning, the episode matches the paper: a moderate advisory should have been issued, the authors conclude [1 p. 1]. The error is where it puts the evidence and what it adds. It credits the finding to the flights' dosimeters, which the paper says stayed below the threshold, with a rise within the normal spread of flights on the route [1 p. 14]. The finding came from balloons above Shetland and an estimate for the event's peak [1 p. 12]. And it adds a rerouting, "redirected on their flight path", that the paper never mentions [2 00:02:14–00:02:23].

5 · THE MODELS

A service run on models alone, the paper says; the one model with published results found the threshold barely crossed

The presenter: "the reason they didn't warn was because the models said they didn't have to." [2 00:02:26–00:02:30] The paper gives the same reason: "The service relies entirely on numerical models, which tend to rely on a handful of ground and space based observations." [1 p. 12]

How a radiation advisory is made

ICAO's advisories "are issued on the output of computer models which are driven by ground- and space-based observations, not by flight measurement inputs" [1 p. 3], because routine measurements at altitude are lacking [33 Abstract]. NOAA's advisories "are supported by the U.S. Federal Aviation Administration (FAA) CARI-7A model" [11 Abstract], and "Currently CARI-7A runs as a nowcast" [11 p. 5], from particle counts in space and, in an upgrade NOAA planned in 2023, at the ground [11 p. 16]. The centres' models disagreed before this event: "Initial comparisons between the models run in operations by different ICAO centers reveal inconsistencies in MOD and SEV Flight Level boundaries of up to ~10,000 ft." [11 p. 13] The paper's fourth recommendation is to use airborne observations alongside the models [1 p. 14].

What the nowcasts and estimates showed

MODEL OR ESTIMATE	WHAT IT SHOWED	AGAINST THE MODERATE THRESHOLD, 30 MSV AN HOUR
WASAVIES, Japan, reanalysed after the event; the only model with published results [1 p. 12]	The world's highest rate above 30 at 14 km and up, for about ten minutes; the live run "was partially degraded" by irregular neutron-monitor data [10 Abstract]. The paper's measurements "cast doubt on the validity of that conclusion" [1 p. 12]	Briefly above, at about 46,000 feet and higher
NAIRAS, NASA, as shown by a pilots' representative	At 12:00 UTC, 8.5 µSv an hour at 37,000 feet and 16.6 at 49,000 [16 p. 11]; at 20:00 UTC, 13.4 and 40.9 [16 p. 16]	Below at 37,000 feet; above at 49,000 by 20:00
MAIRE-S, University of Surrey, as shown by the authors	"NEARLY 60 AT 40 KFT, 80 AT 43KFT", time and place not given [8 p. 18]	Above
Paris Observatory	"Moderate (MOD)" at 46,000 feet; "dose ~ x1.8 on a transatlantic flight" [17 p. 10]	Above
From neutron-monitor counts alone, polar region	75 µSv an hour at 35,000 feet, "above the threshold for a warning, and close to the alert" [9 p. 9778]	Above, close to severe
A summary on a TRIUMF poster	"~60–100 µSv/h at 40,000 feet", "possibly up to 200 µSv/h with anisotropy effect" [18]	Above

The estimates differ in time, place and altitude, so they are not one comparison; most are for high latitudes, where shielding is least. Whether any of them reached the duty centre in time is not public.

The UK's own model, and the stations it watches

MAIRE+, built at Surrey for the Met Office, uses "Two European neutron monitors (located at Oulu in Finland and Dourbes in Belgium)" as "the primary indicators of GLE intensity in order to maximize accuracy over UK airspace" [12 Abstract]. On the day it ran on those two [8 p. 2]. Dourbes saw none of the event's sharp first phase [9 Table 1], and the authors found that using the Lerwick monitor "GIVES BETTER FIT" [8 p. 15].

OUR ANALYSIS

Why "True"

The episode's reason is the paper's: a service run on model output, fed by few observations [1 p. 12][1 p. 3]. The one model with published results put the moderate threshold's excess at about 46,000 feet and above, at or above the ceiling for moderate advisories [10 Abstract][19], a conclusion the paper's measurements "cast doubt on" [1 p. 12]. The authors' slides offer a guess at why the duty centre issued none: it "maybe use NMs in Southern Hemisphere and/or not well connected to anisotropy - lower than anywhere else" [8 p. 19]. Two caveats stand: the duty centre's own output is not public, and the Paris Observatory, whose page the paper cites for that centre [1 p. 3], estimated "Moderate (MOD)" at 46,000 feet [17 p. 10].

6 · THE DOSES IN CONTEXT

The JFK flight received 0.053 mSv, at most about 0.016 more than usual: about one chest X-ray

ICAO's thresholds are rates, per hour, not doses [19]. Set beside a normal flight, a chest X-ray and the yearly limits, the extra dose on the JFK flight was small, and within the spread of normal flights [1 p. 14].

ICAO'S THRESHOLDS

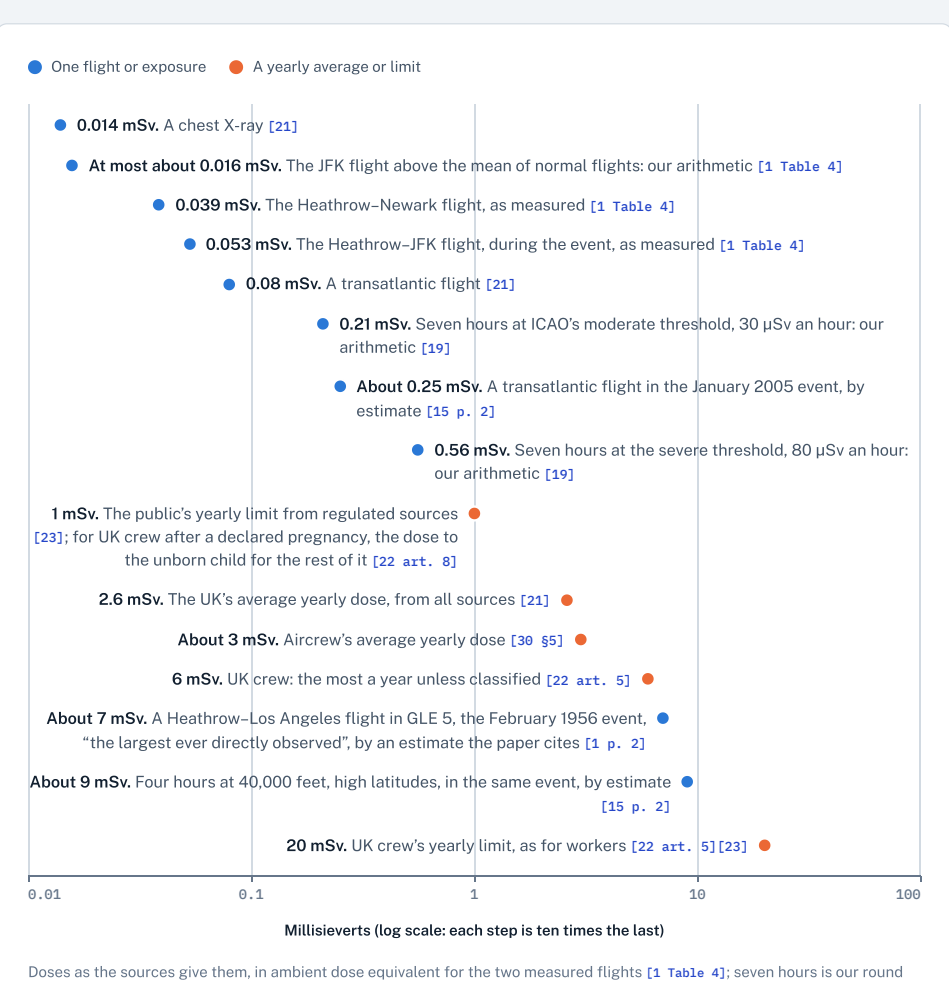
30 and 80 µSv/h
moderate and severe, in effective dose rate, at flight levels from 25,000 feet [19]

A TRANSATLANTIC FLIGHT

0.08 mSv
the UK Health Security Agency's figure [21], and the Paris Observatory's "in the order of 0.08 mSv" [15 p. 1]

THE JFK FLIGHT'S EXTRA, AT MOST · OUR ANALYSIS

≈0.016 mSv
its 52.9 µSv less the 37.1 µSv mean of normal flights, a difference within their usual spread [1 Table 4]: about one chest X-ray, at the UK Health Security Agency's 0.014 mSv [21]



Doses as the sources give them, in ambient dose equivalent for the two measured flights [1 Table 4]; seven hours is our round figure for a London–New York crossing. A chest X-ray is 0.014 mSv in UKHSA's comparisons [21], about 0.1 mSv in the ICAO workshop's summary [15 p. 2]; we use UKHSA's. Aircrew's average is about 3 mSv: our guide puts 4.5 mSv at "about 1.5 times" it [30 §5]. The public limit applies to regulated sources of radiation, not to the cosmic rays passengers meet; it is a yardstick here [23].

The UK's rules for crew

DOSE IN A CALENDAR YEAR	WHAT THE LAW REQUIRES
More than 1 mSv likely	The operator must be authorised to employ the crew member [22 art. 5], and must assess the exposure and tell the crew member the dose [22 art. 7]
More than 6 mSv	Only for a classified crew member [22 art. 5]
More than 20 mSv	Not allowed [22 art. 5]
After a declared pregnancy	The equivalent dose to the unborn child must be as low as reasonably achievable, and it must be "unlikely that that dose will exceed 1 mSv during the remainder of the pregnancy" [22 art. 8]

The limit for other employees is also 20 mSv a year, and for the public 1 mSv [23].

How rare a real hazard is

"It has been observed that most of the 77 GLEs which have been recorded would not have exceeded the ICAO MOD (30 µSv/h) and SEV (80 µSv/h) thresholds", the ICAO workshop heard. The February 1956 event would have given about 9 mSv at 40,000 feet at high latitudes in its first four hours, and the January 2005 one about 0.25 mSv on a transatlantic flight [15 p. 1][15 p. 2].

In everyday flying, passengers in Europe and North America would exceed the International Commission on Radiological Protection's annual dose limits at "an annual average of 510 or 420 flight hours per year, respectively", a figure that "falls to 160 or 120 h on specific routes under maximum exposure conditions" [24 Abstract].

7 · WHO CAN TELL ME WHY?

Because GLE 77's protons were energetic and arrived in a beam, while Earth's shield was quiet

The presenter ended the segment with a question: "Who can tell me why?" [2 00:02:33–00:02:36]. A question isn't a claim, so we treat it as Context and add the facts it leaves out.

What a ground level enhancement is

Solar protons strike nuclei high in the atmosphere and set off cascades of secondary particles, and how deep a cascade reaches depends on the protons' energy: "10 km asl (>200 MeV), sea level (>430 MeV)" [17 p. 2][17 p. 3]. When neutron monitors near sea level register the cascade and a satellite sees the protons, it counts as a GLE; 77 have been recorded since 1942, about one every 1.08 years on average [9 p. 9765]. Our check of the Sun's two worst cases covers the largest.

Why this one went so deep

Its first phase "had a hard spectrum, but was highly anisotropic", arriving along the direction of the interplanetary magnetic field, so the monitors that looked that way saw the most [9 p. 9766]. The paper found it "highly anisotropic, both at the initial onset and for the first few hours" [1 p. 4]: on the UK's ground monitors, a strong peak in the north at the start and a weaker one in the south about an hour later [1 p. 1]. WASAVIES found it "the hardest-spectrum GLE since 2000" [10 Abstract], and protons above 500 MeV rose tenfold [9 p. 9775]. Earth's magnetic shield was undisturbed at the time: "the Kp index was below 3 during the GLE", and the geomagnetic storm began only at midnight [9 p. 9770].

OUR ANALYSIS

Not a failing shield

Nothing in the paper, or in the event's data summary, ties the depth of GLE 77 to a weaker magnetic field [1][9]; the protons' energy and direction explain it. The field's weakening since 1900 lowered the average shielding by less than a tenth, against far larger swings from the Sun, as our guide's section 7 shows, and the idea that a weaker field amplifies storms is rated False at stop 8, "More auroras from less solar input?"

8 · THE STORM IN ITS CYCLE

An X5.1 flare, an S3 radiation storm and a Kp 9− geomagnetic storm

The episode set the event in its cycle: "It was a severe ex-class solar flare that drove a huge proton storm as part of one of the four solar storms this sunspot cycle that created low latitude super aurora." [2 00:01:57–00:02:07] That sentence is rated on our review of the episode, as "Severe flare, huge proton storm" and "One of four super-aurora storms". Here are the records.

THE FLARE

X5.1
peaking at 10:04 UTC on November 11, "R3 - Strong" on NOAA's scale [13][27], and the largest of the 18 X-class flares in NOAA's event lists for 2025, by our count [13]

THE PROTON STORM

S3
"Strong" by protons above 10 MeV: S1 at the event's onset, S2 from 12:32 UTC and S3 from 01:55 on November 12, peaking at 1,460 particle flux units at 02:15 [13][27]

STORMS OF THIS CYCLE · OUR ANALYSIS

4 of 13
storms since December 2019 at G4 or more, Kp 8− and up, reached Kp 9− or more; only May 2024 reached 9o, NOAA's G5 [25]

The four storms at Kp 9− or more

STORM	HIGHEST KP	LOWEST DST, NT (PROVISIONAL)
May 10–11, 2024	9o	−406
October 10–11, 2024	9−	−333
November 12, 2025	9−	−217
January 19–20, 2026	9−	−236

Our analysis of GFZ's Kp [25] and Kyoto's provisional Dst [26]. Of January's storm the Met Office said: "We would expect geomagnetic storms of this magnitude a couple of times a year at this point in the solar cycle." [32] Our check of a study of these four storms covers their effect on ozone.

NOAA's S scale is not the aviation scale

The S scale counts protons above 10 MeV; for the dose at flight altitudes, the ICAO workshop heard, "the 10 MeV and 50 MeV channels are irrelevant" [15 p. 1]. January 2026 shows the gap: an S4 "Severe" storm, 37,000 particle flux units, with no 100 MeV proton warning or alert from NOAA [13]. The authors place it at the bottom of their proposed aviation scale, "Event AR0 but S4", beside November's "ICAO SEV but only S2" [8 p. 21][8 p. 22].

9 · LIMITS

What this page can and can't settle

Two versions of the balloon numbers

The published balloon files read 1.5 to 2.3 times the paper's Table 2 at Lerwick, and higher at most levels at Camborne and De Bilt, though the flight files match the paper [4][1 Table 2]. The data set's record calls its second version "the correct version as displayed in the paper" [4]. We give the paper's numbers as its findings and cannot say which calibration is right; only the authors can.

Two measures of dose

SAIRA measures absorbed dose and estimates the ambient dose equivalent from a calibration made in a normal cosmic-ray field, so during a GLE "the instruments may underestimate the ambient dose equivalent" [1 p. 5], and those data are "calibration-dependent" [1 p. 13]. "An important caveat is that the ICAO thresholds are for effective dose, not ambient dose equivalent" [1 p. 9]. The paper argues that, since one may be higher or lower than the other, a threshold exceeded in ambient dose equivalent "will likely have been exceeded in terms of effective dose" [1 p. 12]. By our reading, that one may be higher or lower does not by itself make an exceedance likely; it is likelier where the margin is wide, twofold at 60,000 feet, than where it is narrow, a fifth at 48,000.

Estimates, beside the measurements

The 58 µSv an hour at 42,000 feet is an estimate for the event's peak, scaling a later reading by the Lerwick neutron monitor, and the paper calls it "simple" [1 p. 12]. The measurements are from four balloons and two flights.

No archive of advisories

We found no public record of the ICAO advisories issued on November 11–12, 2025. The absence of a radiation advisory rests on the paper and its authors' slides [1 p. 12][8 p. 19], and what the duty centre's model showed is not public.

Slips in the data set

Our charts are our analysis of the published files, and our smoothing is ours [4]. The three test-flight files are named, and described in the data set's index, as flights of October 17, 2025, which the paper confirms [1 p. 4], but their timestamps read November 11: we treat them as the October 17 references, never as data from the day of the event. The index calls the event files "_GLE.csv" where they end "_GLE77.csv"; the aircraft files' altitude column, labelled in metres, holds feet; and the De Bilt event file's GPS altitudes run about 5 km above its pressure levels [4].

Slips in the paper

The Newark flight departs at 17:30 in the text and 17:45 in the abstract [1 p. 4][1 p. 1]. Camborne's and De Bilt's balloons have two sets of launch times, 15:45 and 14:15, then 15:51 and 14:02 [1 p. 4][1 p. 12]. Table 2 gives the second Lerwick balloon the first one's absorbed dose rates and increases at 36,000 and 42,000 feet, and puts it at 42,000 feet at 16:27, a minute before 36,000, where its file has 16:37 [1 Table 2][4]. The text and Tables 3 and 4 put the Newark flight's highest level at 36,000 feet [1 p. 9][1 Table 3], where its file has three minutes at 38,000 [4]. Figure 6 labels altitude in feet as "Altitude (FL)" [1 p. 11]. None of these changes a finding on this page.

What would change these verdicts

01
The authors' account of why the published balloon files read higher than their Table 2, and which numbers are right.

02
A record of the ICAO advisories issued on November 11–12, 2025, or an account from the centre on duty of what its model showed.

03
Published results from the other centres' models, or other measurements on aircraft during the event.

The other pages from the same episode: planetary alignments and earthquakes, a Russian index of solar effects on temperature and the episode itself.

10 · FILES

Repeat our analysis

Three short scripts produce the numbers of ours on this page, apart from arithmetic shown where it is used, and they need only Python 3. One fetches NOAA's alert archive and event lists [13], GFZ's Kp [25] and four months of Kyoto's Dst [26], or reads your own copies; the other two read the paper's data set, which you download from Zenodo [4]. All three treat their inputs as data.

PY **gle77_records.py**
NOAA's proton, flare and storm products of November 10–13, 2025, and the minutes from the event's onset to the first warning; the X-class flares of 2025; January 2026's S4 summary; the storms of cycle 25 by Kp and their Dst; hours at ICAO's thresholds · 11 KB

PY **gle77_data_check.py**
The data set re-run: the balloons' dose rates by flight level and where they stay above ICAO's thresholds, the flights' totals, one-minute peaks and ten-minute averages, and the neutron monitors' rises; it can save the numbers our charts draw · 11 KB [4]

PY **sonde_table2.py**
The balloon files processed the paper's way, against its Table 2, at FL360, 420, 480 and 600 · 4 KB [1 Table 2]

Run it

`python3 -I gle77_records.py` fetches its eight inputs, about 1.2 MB, prints the checksum of each, then its results; give it your own copies as arguments to skip the downloads. For the data, download the 15 files of the data set's version 2 into one folder and run `python3 -I gle77_data_check.py FOLDER` and `python3 -I sonde_table2.py FOLDER`. Add a file name ending in .json to any of them to save the results.

Related checks

FALSE More auroras from less solar input? The Disaster Cycle, Fact-Checked

Sources

Bracketed numbers refer to this list. For the paper [1], p. gives a page of its version of record (its Key Points, Plain Language Summary and abstract are on p. 1), and Table a table. For the episode [2], times are positions in the video (hours:minutes:seconds), from the first to the last transcript line of each quotation; its automatically generated transcript writes "doimeters" for dosimeters. For the slides [8], [16] and [17], p. gives the page of the PDF. For the other sources, p. gives a page, Table a table, art. an article of a statutory instrument and Abstract the abstract of the cited work; where only an abstract was read, the entry says so. Charts drawn from the data set [4] are our analysis and say so. Times are UTC. Years are those of the printed issue where there is one, otherwise of online publication. Links checked October 28, 2026.

1 Baird, F., Clewer, B., Ryden, K., Morris, P., Lei, F., Davis, C., Dyer, C., Aspinall, M., Marlton, G., Bocquet, F.-X., Edwards, D., Finn, C., Gibbs, M., Machin, S., Marsh, M., Hammond, K., van Dam, K., and Nedeljkovic, I. (2026). Observations of Atmospheric Radiation Increases During GLE 77 From New Airborne and Ground Level Instruments. *Space Weather* 24(10), e2026SW005279. Received June 22, accepted October 1, published online October 20, 2026. Peer reviewed; open access, CC BY 4.0. Read in full, all 16 pages: Wiley's site met our tools and a real browser with a human-verification check, which we did not attempt, so the site's owner supplied the version of record, which he downloaded from Wiley in his own browser. Quoted with page and table locators; no figure is redrawn.

2 SpaceWeatherNews (S0) (October 28, 2026). They Should Have Warned the Airline | S0 News Oct.28.2026. YouTube video, https://www.youtube.com/watch?v=OPyP2JW3y6g. Quoted from the automatically generated transcript; times are positions in the video. The label "Solar Storm Missed Airline Warning" is the episode's own, on its link to the paper in the video's description.

3 Crossref. Metadata record for doi:10.1029/2026SW005279. Retrieved October 28, 2026: the abstract as the publisher deposited it; the received, accepted and published dates; the licence, CC BY 4.0 for the version of record from October 20, 2026; the authors' affiliations, at the University of Surrey, Lancaster University and Aspinall Instruments, CSDRad Consultancy, the Met Office and KNMI; and 59 references.

4 Baird, F., Clewer, B., Morris, P., Lei, F., Davis, C., Dyer, C., et al. (2026). Observations of GLE 77 from Radiosondes, Aircraft, and UK Neutron Monitors (data set), version 2, October 1, 2026. Zenodo. CC BY 4.0. Its record says that version 1 of the aircraft and radiosonde data files (doi:10.5281/zenodo.20607872, the version the paper cites, its files embargoed until June 2027) "were generated using an erroneous calibration", and that version 2 "should be regarded as the correct version as displayed in the paper". We analysed all 15 files: Zenodo refused our own downloads, for "unusual traffic" from our network, so the site's owner downloaded them from the record in his browser, and all 15 match the MD5 checksums of version 2. The flight files match the paper's totals to about 1%; the balloon files read 1.5 to 2.3 times the paper's Table 2 at Lerwick, a difference we cannot explain. Its three test-flight files carry timestamps of November 11, 2025, though their names and the index give October 17; our charts of the data are our analysis and say so.

5 University of Surrey (October 20, 2026). Rare solar radiation storm gives scientists clearest picture yet of flight risks. Press release.

6 Met Office Press Office (November 27, 2025). World-first data collected in innovative space weather project. Met Office blog.

7 Baird, F., Clewer, B., Davis, C., Ryden, K., Dyer, C., and Lei, F. (2026). Observations of GLE 77 from the Ground, On Aircraft and Balloons. EGU General Assembly 2026, Vienna, May 3–8, 2026, EGU26-20506. CC BY 4.0. Conference abstract, read in full.

8 Dyer, C., Ryden, K., Lei, F., Morris, P., Clewer, B., Baird, F., and Davis, C. (2026). Space weather radiation impacts and mitigation for aircraft, including preliminary flight data from event of 11 November 2025. Slides, Surrey Space Centre in collaboration with MOSWOC, for the ICAO NAT Region workshop on radiation exposure at aircraft altitudes, March 18, 2026. Read in full (31 pages); no licence is stated, so they are quoted briefly and not reproduced.

9 Mishev, A. L., Heber, B., Klein, K.-L., Vainio, R., Mavromichalaki, H., Raukunen, O., Larsen, N., Petrov, N., Nikonov, N., Masson, S., Pesce-Rollins, M., Kress, B. T., Bindi, V., Gerontidou, M., Hörlöck, M., Koldobskiy, S., Riihonen, E., Rodriguez, J. V., and Usoskin, I. (2026). Ground level enhancement GLE #77 on 11 November 2025: a data summary. *Advances in Space Research* 77(9), 9764–9783. CC BY 4.0. We read the full text in the NOAA Institutional Repository.

10 Sato, T., Shiota, D., Kubo, Y., Kataoka, R., Yasuda, H., Miyake, S., Ishii, M., and Miyoshi, Y. (2026). Estimation of Global Increase of Radiation Dose Rates During the Ground Level Enhancement on 11–12 November 2025 Using WASAVIES. *Space Weather* 24(4), e2026SW004949. CC BY-NC 4.0. Abstract only, as deposited with Crossref; Wiley's site showed the same check.

11 Bain, H. M., Copeland, K., Onsager, T. G., and Steenburgh, R. A. (2023). NOAA Space Weather Prediction Center Radiation Advisories for the International Civil Aviation Organization. *Space Weather* 21(7), e2022SW003346. CC BY-NC-ND 4.0. We read the full text in the NOAA Institutional Repository.

12 Hands, A. D. P., Lei, F., Davis, C. S., Clewer, B. J., Dyer, C. S., and Ryden, K. A. (2022). A New Model for Nowcasting the Aviation Radiation Environment With Comparisons to In Situ Measurements During GLEs. *Space Weather* 20(8), e2022SW003155. CC BY 4.0. Abstract only, as deposited with Crossref.

13 NOAA Space Weather Prediction Center. Alerts, Watches and Warnings: every product issued in November 2025 and January 2026, from the Center's archive (ftp.swpc.noaa.gov, pub/alerts/alerts_202511.html and alerts_202601.html), and its event list for 2025 (pub/warehouse/2025/). Read October 28, 2026; times UTC.

14 NOAA Space Weather Prediction Center (November 11, 2025). Veteran's Day fireworks! X5.1 flare (R3-Strong) from Region 4274, published 10:45 UTC, and G4 (Severe) Watch in Effect for 12 November, published 17:21 UTC. News items.

15 ICAO EUR/NAT Office (2026). ICAO NAT Region workshop on Radiation Exposure at Aircraft Altitudes (virtual event 18 March 2026): the summary of the workshop. Read in full.

16 Sievers, K. (2026). Radiation event 11/12 Nov 2025. Slides, IFALPA ATS Committee, for the same workshop, March 18, 2026. Read in full; no licence is stated.

17 Fuller, N., and Klein, K.-L. (2026). Cosmic ray-induced radiation doses in the terrestrial atmosphere. Slides, Observatoire de Paris, for the same workshop, March 18, 2026. Read in full; no licence is stated.

18 Hands, A., Bélanger-Champagne, C., Trinczek, M., and Blackmore, E. (2026). Recreating the enhanced neutron environment of GLE 77 at TRIUMF. Poster, Space Weather Workshop 2026. Read in full; no licence is stated.

19 Bureau of Meteorology (2023). Aviation products – space weather advisories, updated February 14, 2023, with the thresholds of ICAO's Manual on Space Weather Information (Doc 10100); and the Bureau's Space Weather Advisories page, which lists current advisories only. Read October 28, 2026.

20 PECASUS consortium. PECASUS for ICAO and The Consortium, read October 28, 2026; and The ICAO Space Weather Information Service, a flyer dated June 2026.

21 UK Health Security Agency. Ionising radiation: dose comparisons. Updated September 28, 2026. Open Government Licence v3.0.

22 The Air Navigation (Cosmic Radiation: Protection of Air Crew and Space Crew and Consequential Amendments) Order 2019, SI 2019/1115, as made. legislation.gov.uk, Open Government Licence.

23 The Ionising Radiations Regulations 2017, SI 2017/1075, Schedule 3, Dose limits, as made. legislation.gov.uk, Open Government Licence.

24 Alvarez, L. E., Eastham, S. D., and Barrett, S. R. H. (2016). Radiation dose to the global flying population. *Journal of Radiological Protection* 36(1), 93–103. Abstract only.

25 Matzka, J., Stolle, C., Yamazaki, Y., Bronkalla, O., and Morschhauser, A. (2021). The geomagnetic Kp index and derived indices of geomagnetic activity. *Space Weather* 19(5), e2020SW002641. Data: Matzka, J., Bronkalla, O., Tornow, K., Elger, K., and Stolle, C. (2021). Geomagnetic Kp index, V. 1.0, GFZ Data Services, read through GFZ's web service on October 28, 2026. Kp from Geomagnetic Observatory Niemegk, GFZ Helmholtz Centre for Geosciences, CC BY 4.0; counted by us.

26 World Data Center for Geomagnetism, Kyoto, Nose, M., Iyemori, T., Sugiura, M., and Kamei, T. (2015). Geomagnetic Dst index. Provisional values for May and October 2024, November 2025 and January 2026. Read October 28, 2026.

27 NOAA Space Weather Prediction Center (2023). NOAA Space Weather Scales, with the table of the scales dated December 11, 2023, as read for our guide to the magnetic field.

28 Gizmodo (October 21, 2026). Last Year's Monster Solar Storm Gave a Transatlantic Flight a 43% Radiation Boost. A news report on the paper, used only for what it says the paper says.

29 Clewer, B., Morris, P., Ryden, K., O'Neill, J., Lei, F., Baird, F., Davis, C., and Dyer, C. (2026). Development and Deployment of the Smart Active Ionising Radiation at Altitude (SAIRA) Instruments for Space Weather Applications. *Space Weather* 24(6), e2026SW004939. CC BY 4.0. Abstract only, as deposited with Crossref.

30 Larsen, N., Usoskin, I., Mishev, A., Koldobskiy, S., and Väisänen, P. (2026). Reduced geomagnetic shielding during the Laschamps excursion and its impact on cosmic-ray-induced atmospheric radiation. *Journal of Geophysical Research: Space Physics* 131(2), e2025JA034820. CC BY 4.0. As read for our guide to the magnetic field.

31 Met Office (November 11, 2025). Aurora to be visible to parts of the UK tonight, but will it be clear?

32 Met Office (January 21, 2026). How the Met Office forecasts space weather and why it matters. Met Office blog.

33 Bain, H. M., Onsager, T. G., Mertens, C. J., Copeland, K., Benton, E. R., Clem, J., et al. (2023). Improved space weather observations and modeling for aviation radiation. *Frontiers in Astronomy and Space Sciences* 10, 1149014. CC BY 4.0. Abstract only, as deposited with Crossref.

METHOD

How this was checked

On October 28, 2026, we tried every route the site allows to the paper's text: the DOI and Wiley's full-text, PDF and reader links, through our tools and in a real browser; Crossref, OpenAlex and Semantic Scholar; ESS Open Archive; the University of Surrey's and Lancaster University's repositories; Europe PMC; and the Internet Archive. Wiley's site met our tools and our browser with a human-verification check, which we did not attempt, and we found no other copy.

The site's owner then supplied the paper's version of record, all 16 pages, which he downloaded from Wiley in his own browser. We read it in full and, after a fresh review that read it too, revised this page against it: the paper's own words, with page and table locators, now carry the verdicts, and its conclusion that a moderate advisory should have been issued is reported as its own.

Beside the paper, the page rests on its data set, all 15 files; the authors' conference abstract and their slides of March 2026; the press releases of the University of Surrey and the Met Office; NOAA's alert archive for November 2025 and January 2026 and its event lists for 2025; the advisory system's own documents; eight papers on the event, its models and aviation doses (two read in full, five as abstracts and one as read for our guide); two other presentations to an ICAO workshop and the workshop's summary; a poster; the UK's dose limits in law; and the Kp and Dst records: the 33 sources listed. Every quotation was checked word for word against its saved source.

The verdicts and the items tagged "Our analysis" are our own assessment, built on the cited sources. They include every number and chart for our own re-run of the paper's data set: the balloons' dose rates by flight level and where they stay above ICAO's thresholds, the same files processed the paper's way against its Table 2, the flights' totals and averages, and the neutron monitors' rises; our timeline of November 11, 2025, from NOAA's archive, with the minutes from the event's onset to NOAA's first warning; our count of the X-class flares of 2025, and of the storms of solar cycle 25 in GFZ's Kp record with their Dst; our dose arithmetic, hours at ICAO's thresholds and the JFK flight's excess over its route's mean; ICAO's altitude rules set against the paper's findings; and our reading of what the paper and the authors' slides do and do not say.

Our three scripts, hosted on this page, re-derive the numbers of ours: one from the public records it fetches, the other two from the paper's data set (CC BY 4.0). Zenodo refused that data set to our network from 16:16 to at least 18:04 UTC, though its API answered later that day; the site's owner downloaded the files for us, and all 15 match the MD5 checksums of the record's version 2. The flight files match the paper's totals; the balloon files read 1.5 to 2.3 times its Table 2 at Lerwick, so the page gives the paper's numbers as the paper's and the files' as the files'. Our smoothing of the one-minute samples is ours, and our data charts say so and credit the data set. No figure of the paper is redrawn.

This page was researched and written with Claude, an AI assistant made by Anthropic, and then re-checked against its sources in a separate verification pass.

The verdicts on this page

MISREAD	Cites a real source but gets wrong what it says.
PARTLY TRUE	Part of the claim holds up and part doesn't.
TRUE	The evidence supports the claim.

All ten verdicts, and how we check

CORRECTIONS

Corrections and changes

If we get something wrong, we fix it and record the change below with the date. If a correction changes a verdict, the log says what the old verdict was.

Change log

Oct 28, 2026 Published on factchecked.science after a full check against the sources: the paper, read in full from the version of record the site's owner supplied, with the authors' conference abstract and slides, NOAA's alert archive, the advisory system's documents, the literature on the event and on aviation doses, and our own analysis of the paper's public data set and of public records, whose scripts are hosted on the page: six claims rated on the site's scale, five of them the episode's and one the paper's own. Three