Fact-Checked Science

PAPER CHECK · SPACE WEATHER AND THE WEATHER

A thesis sees the Sun's magnetic sectors in US lightning; its tests can't yet confirm it

A 2026 master's thesis at the University of Alberta reports that lightning in the continental USA and the UK rises around the days Earth passes from one of the solar wind's magnetic sectors into the next, that lightning repeats on the sectors' timescales, and that rain and surface pressure follow too [1 pp. ii–iii]. Its significance tests read a band at each of dozens of lags as if each were the whole test, as a 2015 study of UK lightning also did [1 p. 91][3 p. 9628]. Re-tested with public data, the rain and pressure effects aren't significant and noise matches its periodicities; whether its richest US lightning pattern beats chance depends on how its crossing rule is read, so a link stays possible [19][20].

By Fact-Checked Science · Published November 15, 2026

OUR ANALYSIS marks our own reasoning and calculations, including our rebuild of the thesis's list of sector crossings from NASA's OMNI data, our runs of its methods on simulated series with no link to the crossings, and our re-tests with NCEP/NCAR reanalysis; the verdicts are our assessment. Everything else comes from the numbered sources. The thesis [1] is cited by its printed pages (pp. ii–iii are its abstract), figures and chapters; values read off its figures are marked "by eye".

A careful thesis whose tests can't yet tell a link from chance

OUR ASSESSMENT

8–42

days out of 243, in a set of three panels, that the thesis's band test calls significant in simulated lightning with no link to the crossings, depending on how the crossings fall through the year; about 12 are expected by chance (our analysis)

0–10%

of those simulations matched the thesis's richest US pattern, peaks near 10 of 15 expected days: none of 1,000 with the list that reproduces its worked example, 1 in 10 with the list closest in its numbers of each kind of crossing (our analysis) [1 p. 85]

54 of 73

latitudes the thesis's Wilcoxon test flags in reanalysis pressure with the real solar-wind field, and 54 on average with simulated field series unrelated to pressure (our analysis) [20]

THE THESIS'S CLAIMS

OVERSTATED

"We demonstrate that there is a statistically significant connection between lightning rates and solar wind magnetic sector structures for the continental USA"

The thesis's abstract [1 p. ii]

The significance comes from bands of chance built day by day, 81 days in each of three panels, with any peak near five "expected" days counted, and a peak at the band read as "a p value of 0.05" for the whole hypothesis, as a 2015 study of UK lightning read its bands [1 p. 91][3 p. 9628]. Nothing allows for the number of days, panels and regions, and the random dates behind the bands ignore when in the year the crossings fall; on simulated lightning with no link to the crossings, the procedure finds 8–42 "significant" days per set instead of about 12 (our analysis). The thesis counts 25 more peaks at days it didn't expect in its median curves [1 p. 93], and Canada and most other regions show little [1 pp. 91–94]. How rare its richest US pattern is depends on how the crossing rule is read: with our list that reproduces the thesis's worked example, none of 1,000 simulated series matched it; with the list closest in its numbers of each kind of crossing, about 1 in 10 did (our analysis). So a modulation may exist, but the tests can't establish it. See sections 3 and 4.

UNSUPPORTED

"there are statistically significant periodicities inherent in the lightning data which align with the inter-crossing times of the HCS crossings"

The thesis's abstract [1 p. ii]

The thesis's own Lomb–Scargle tests find no lightning periodicity even at the 10% false-alarm level, in the UK, the USA or Canada [1 p. 127][1 p. 136] and [1 p. 144]. The multitaper criteria it relies on flag about 70 peaks per series in pure noise between 4.5 and 30 days, and such series "match" at least three of the crossings' usual spacings in 99.5–100% of cases (our analysis). The thesis matches nearly every period from 5 to 14 days, and sums of them [1 p. 151]. A 27-day period couldn't single out the current sheet anyway: ultraviolet light, cosmic rays and fast solar wind recur with the Sun's rotation too [5 Abstract][13 §1]. See section 5.

UNSUPPORTED

"Here we found statistically significant modulation associated with the current sheet crossings only for the precipitation rate and atmospheric surface pressure."

The thesis's abstract, on ERA5 reanalysis data [1 pp. ii–iii]

These rest on the same reading of bands, in ERA5 data, which need an account we don't use [1 pp. 162–176]. In the public NCEP/NCAR reanalysis over the same US box, with crossing lists like the thesis's, rain around the crossings and their 27-day echoes is within chance (p = 0.37–0.82), and pressure after T-A crossings is higher than after A-T ones by 0.08–0.34 hPa, the same sign as in ERA5, but not significantly (p = 0.08–0.79) (our analysis) [20]. Read the thesis's way, the reanalysis rain peaks near the same days as ERA5's, about 27 and 2 days before the crossings, but against copies of the crossing list that keep its seasons, those peaks are within chance [1 Fig. 6.5]. So no test that allows for the many days and the seasons backs the significance claimed. These tests can't rule out effects as small as the thesis reports, and that reanalysis isn't ERA5, so this isn't a disproof. See section 6.

OVERSTATED

"our ERA5 results strengthen and confirm the connection between atmospheric pressure and the HMF"

The thesis's conclusions, on days with the solar wind's dawn–dusk field, By, at least 3 nT either way [1 p. 193]

The thesis repeats a 2013 analysis [1 pp. 177–179][6 §2]. Its Wilcoxon test pools every longitude and day at a latitude as if each were independent; in NCEP/NCAR pressure it flags 54 of 73 latitudes for the real By, and 54 on average for simulated By series that have nothing to do with pressure (our analysis) [20]. Against series that keep By's day-to-day persistence, the mid-latitude wave pattern the thesis describes is no larger than chance (p ≥ 0.40). The effect has support near the poles [7 Abstract], but the most careful later tests, which allow for persistence and for the many days tested, found no significant response of the kind the hypothesis predicts [10 p. 9][11 p. 16]. See section 7.

TRUE

"we conclude that there is not a significant modulation of Canadian CLDN lightning rates by the HCS crossings for the time period from 2010 to 2023"

The thesis, on the Canadian Lightning Detection Network [1 p. 91]

Canada's data show few peaks near the expected days in any of the thesis's analyses, and the author says so plainly [1 pp. 88–91]. Nothing we found contradicts it. The one feature that stands out by eye, the average curve sitting above the random-date average on most days from about 20 before to 40 after the crossings, is what an uneven spread of crossings through the year could produce (our analysis) [1 Fig. 4.13]. See section 3.

1 · THE THESIS

A master's thesis asks whether the Sun's magnetic sectors reach thunderstorms

Peterson (2026) is a Master of Science thesis in the University of Alberta's Department of Physics, supervised by Dr Ian Mann; it was examined, not published in a journal, and we read all 258 pages [1]. S0 News linked it on November 15, 2026 [2].

Sectors and crossings, in brief

The solar wind carries the Sun's magnetic field out into space. Near Earth the field points roughly toward the Sun in some stretches of wind and away from it in others; these are the sectors, and the boundary between them is the heliospheric current sheet [1 pp. 4–6]. Earth crosses the sheet two or four times in each solar rotation of about 27 days, so crossings come roughly every 13½ or 7 days [1 p. 6]. The thesis calls a crossing "T-A" when the field turns from toward to away and "A-T" for the reverse, judging the direction from the field's dawn–dusk component, By [1 p. 63][1 p. 5].

Two questions

First, whether lightning, rain, surface pressure and a thunderstorm index rise or fall around crossings, and whether lightning repeats on the crossings' timescales [1 pp. ii–iii]. Second, whether days when By is strongly positive go with different surface pressure at middle latitudes from days when it is strongly negative, as a 2013 study proposed [1 p. 177][6 Abstract].

The data the thesis used

DATA	WHERE AND WHEN	NOTES
OMNI solar wind (NASA)	Measured upstream of Earth; daily averages	By in two coordinate systems; public [1 pp. 42–43]
UK lightning (Met Office's ATD network)	Within 500 km of central England, August 31, 2000–April 30, 2007	2,434 days, 27% with no strikes; 92% of the lightning from April to September [1 pp. 52–54]
US lightning (WWLLN)	The "USA bin", 125–60° W and 30–50° N, 2010–2023	Mean 2,108 strikes an hour, median 1,634; 78% from mid-March to mid-September [1 pp. 46–48]
Canadian lightning (CLDN)	Canada, 2010–2023	No strikes on 26% of days; 98% from April to September [1 pp. 50–51]
Lightning in eight more regions (WWLLN)	From Central America to south-eastern Asia, 2010–2023	Figures in an appendix [1 App. A]
ERA5 reanalysis	The USA bin; the whole globe for Chapter 7	Thunderstorm index, precipitation, surface pressure [1 pp. 55–59][1 p. 177]

The lightning data aren't public; Canada's network supplied its daily counts [1 p. 50]. ERA5 needs an account, which we don't use.

What's new, and what isn't

The UK part repeats the network, area, period and scaling of two published studies, "to match the analysis" in them [1 p. 52][3 p. 9625]: it is a re-analysis of data already published, not new evidence. On those data, Owens et al., using a hand-checked list of 141 crossings, found lightning rising from away-to-toward crossings and peaking within a day (p < 0.01), and falling for about a day at toward-to-away ones (p < 0.05) [3 p. 9625][3 p. 9629][3 p. 9630]. With its own list, made by an algorithm, the thesis finds the reverse: a peak on the day of toward-to-away crossings and a dip on the day of away-to-toward ones (by eye) [1 p. 81][1 Fig. 4.2]. Why isn't known; the two lists differ. The new data are WWLLN's for the USA and eight other regions, Canada's network's, and ERA5 [1 pp. 45–59].

2 · ITS RESULTS

Peaks of about a tenth near the expected days, among many others

In the US data the average lightning rate rises by about a tenth on single days near the crossings and 27 days either side. The author also counts many peaks on days no theory predicts, and finds little in Canada or most other regions [1 pp. 85–94].

US LIGHTNING, PEAK DAYS

8–11%

above the random-date average, on the peak days near the crossings and 27 days either side (by eye) [1 Fig. 4.7]

UK LIGHTNING, PEAK DAYS

≈ 2×

the random-date average of about 22 strikes an hour, in data where half the days have under 0.2 an hour (by eye) [1 Fig. 4.2][1 p. 82]

ERA5 PRESSURE, US BOX

±0.5 hPa

the rise after T-A crossings and the fall after A-T ones in average surface pressure (by eye) [1 Fig. 6.9]

In the author's words

On the US lightning, its periodicities, and the thunderstorm index.

> *"There are 25 additional peaks which reach the 95% confidence interval, and which complicate and/or challenge the importance of the HCS connection, overall."*
>
> Peterson (2026) [1 p. 93]

> *"there are many significant periodicities, which makes it more difficult to determine if the commonalities in these two data sets are truly meaningful"*
>
> Peterson (2026) [1 p. 142]

> *"It is, therefore, perhaps not surprising that some of these spectral peaks align with the peaks in the inter-crossing time distribution."*
>
> Peterson (2026) [1 p. 159]

3 · HOW IT JUDGED SIGNIFICANCE

A band of chance at every day, read as if each crossing of it were the whole test

The thesis builds a band of chance at each of 81 days around the crossings and counts a peak that reaches it near an "expected" day as evidence [1 pp. 80–83]. That reading is common in this field, but it doesn't test the hypothesis.

STEP 1

Crossings

A sign change in OMNI's daily By counts if the five-day running mean also changes sign and By is large enough on both sides [1 pp. 63–64].

STEP 2

Line up

Daily lightning is averaged at each day from 40 before to 40 after the crossings, for all of them, T-A only and A-T only, as means or medians [1 pp. 79–81][1 p. 85].

STEP 3

Bands

1,000 sets of random dates, spaced like the crossings, give the 90, 95 and 99% ranges of chance at each day [1 pp. 80–81].

STEP 4

Read

A peak at the 95% band near 27 or 14 days before, the crossing day, or 14 or 27 days after counts for the hypothesis [1 p. 83].

OUR ANALYSIS

Many days, many panels, one p value

The thesis lists a day when its curve rises above the 95th percentile of chance, as its figures show: several listed peaks stay below the 97.5th [1 Fig. 4.7]. So on about 5% of days a chance curve qualifies: about 12 of the 243 days in a set of three panels. Windows of a day or two around the five expected days cover over a quarter of all days, so some chance peaks land there too. The thesis read a peak at the band as a test of the whole hypothesis: "our null hypothesis, which is that lightning rates are not modulated by HCS crossings, has a p value of 0.05" [1 p. 91]. A 2015 study of the UK lightning read its bands the same way [3 p. 9628], so the student followed published practice. But over the days, the three panels, means and medians, the whole year and summer, and eleven regions, about 30 sets of figures in all, nothing allows for the number of chances taken [1 Ch. 4][1 App. A]. A 2022 study of the solar wind's effect on polar pressure warns of exactly this for "a temporal plot showing consecutive days after the onset of a forcing" and corrects for it [10 p. 3]; the thesis cites that study for its percentile bands [1 p. 80], but not for the correction.

OUR ANALYSIS

Echoes aren't separate confirmations

Crossings recur with the Sun's rotation. In our rebuilt lists, 56–63% of crossings are followed by another in the same direction 25–29 days later, and about a quarter by one in the other direction 12–15 days later [19]. So whatever happens at the crossings, a real effect or anything else that recurs with the rotation, tends to show 27 days either side as well: peaks there repeat the one at the crossings rather than confirm it. The 2022 study made the same point for lead–lag analyses of By, whose 27-day rhythm makes the responses 27 days either side "partially replications of the response seen at day 0" [10 p. 6].

OUR ANALYSIS

Random dates ignore the seasons

78% of the US lightning falls between mid-March and mid-September [1 p. 48]. The random dates fall evenly through the year; the real crossings need not. In our list R-C, 36% of crossings fall in June–September, against 33% of random dates, enough to lift a curve of lightning-like numbers above the band on many days with no link at all (section 4). The 2015 study checked that its crossings fell evenly "as a function of both time of day and day of year" [3 p. 9625], and a 2014 study of the same lightning tested its summers alone because of a spring–autumn imbalance [5 §4.4]; the thesis reports no such check. Its Canadian average curve sits above the random-date average on most days from about 20 before to 40 after the crossings (by eye) [1 Fig. 4.13], as this effect could make it.

To the thesis's credit

It shows means, medians and quantiles, counts its own off-target peaks, says when the summer samples are too small to judge, and reports Canada's null result plainly [1 pp. 83–94].

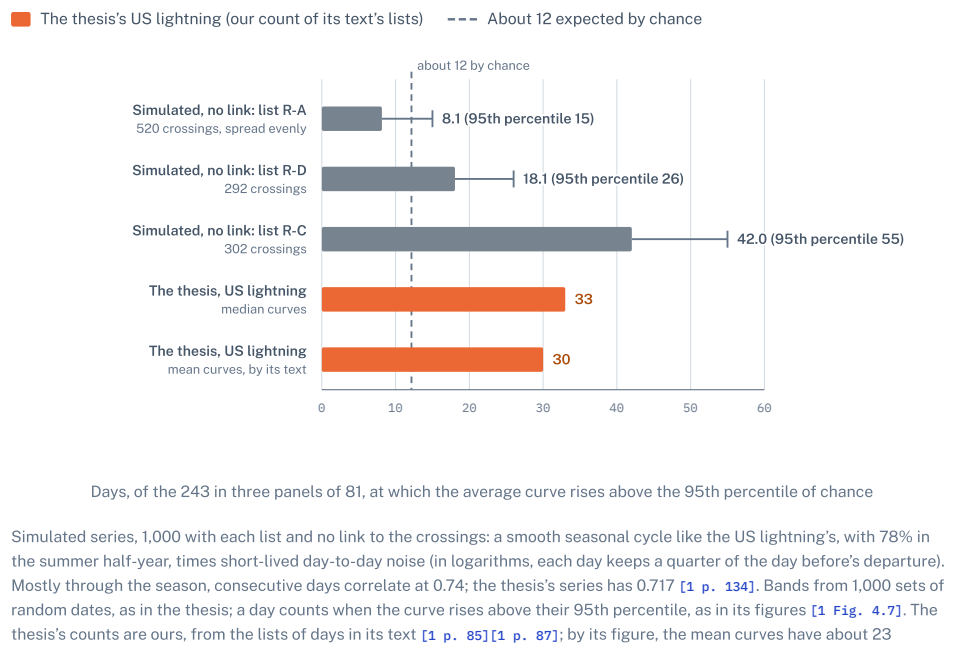
4 · THE METHOD ON CHANCE ALONE

On simulated lightning with no link to the crossings, the method finds "significant" days too, and with one crossing list the thesis's richest US pattern

We ran the thesis's procedure, reading its bands at the 95th percentile as its figures do, on simulated lightning-like series that know nothing of the Sun, with three rebuilds of its crossing list (section 8). What it finds depends mostly on how the list falls through the year.

Days out of 243 that reach the 95% band, over three panels

OUR ANALYSIS



Days, of the 243 in three panels of 81, at which the average curve rises above the 95th percentile of chance

Simulated series, 1,000 with each list and no link to the crossings: a smooth seasonal cycle like the US lightning's, with 78% in the summer half-year, times short-lived day-to-day noise (in logarithms, each day keeps a quarter of the day before's departure). Mostly through the season, consecutive days correlate at 0.74; the thesis's series has 0.717 [1 p. 134]. Bands from 1,000 sets of random dates, as in the thesis; a day counts when the curve rises above their 95th percentile, as in its figures [1 Fig. 4.7]. The thesis's counts are ours, from the lists of days in its text [1 p. 85][1 p. 87]; by its figure, the mean curves have about 23 (section 10). Crossings rebuilt from NASA's OMNI data [19].

What the method finds by chance alone

	LIST R-C (302)	LIST R-D (292)	LIST R-A (520)	THE THESIS, US
Days at the 95% band, of 243 (about 12 by chance)	42.0 (95th percentile 55)	18.1 (26)	8.1 (15)	30 by its text, about 23 by its figure (mean); 33 (median)
Series with a peak within 2 days of the crossings	85%	29%	28%	Yes
Expected windows hit, of 15	7.1	3.1	1.9	10 (mean), 7 (median)
Series hitting 10 or more, mean curves	10% (100 of 1,000)	None of 1,000	None of 1,000	
Series hitting 7 or more, median curves	53% (105 of 200)	1% (2 of 200)	1.5% (3 of 200)	

A day counts when the curve rises above the 95th percentile of the random dates, as in the thesis's figures; a window is hit if any day in it counts: 29 to 25 days before, 15 to 12 before, 2 before to 2 after, 12 to 15 after and 25 to 29 after. The windows were fixed before the runs. Mean curves were run on 1,000 series per list and medians on 200. Our first run counted only days above the 97.5th percentile, stricter than the thesis; a review caught it, and these are the corrected runs (analysis-log.txt). With a rising trend in the series, stronger day-to-day persistence or a flat-topped season, list R-C still matches the mean-curve pattern in 5–8% of 200 series, R-D in at most 0.5% and R-A in none; with random dates that keep the crossings' spacing but not their seasons, R-C matches it in 0.5% and the others in none.

OUR ANALYSIS

What this shows, and what it doesn't

The thesis's bands are a fair yardstick only if its crossings fall evenly through the year. It doesn't say whether they do, and our lists differ on it: with R-C, the season alone puts a no-link curve 1.5 standard deviations (of the random dates' seasonal level) higher on the crossing day and 2.3 at 27 days after. So with R-C, chance alone gives about 42 days at the band, more than the thesis's 30, and 1 series in 10 matches its pattern of peaks near 10 of the 15 expected windows; half reach the 7 windows of its median curves. With R-D, the list that reproduces its worked example, and with R-A, the reading we fixed in advance, none of 1,000 series matches the pattern. Under R-A, as our rules set out in advance, its 30 days are also far beyond chance, which gives about 8 and rarely more than 15: either a real effect or a null that doesn't match the lightning, such as a mismatch in the seasons. A rising trend alone doesn't produce it. So whether the US curves are the method at work depends on a detail of the crossing rule that the thesis doesn't settle. They are, though, the best of about 30 sets of figures, and a test that keeps the crossings' seasons, which the lightning data would allow, hasn't been run.

5 · PERIODICITIES

Peaks that noise would give, at periods the Sun's rotation gives anyway

The thesis compares the periods it finds in lightning with the spacings between crossings, which cluster near 6 or 7, 15 and 27 days in 2010–2023 [1 p. 142][1 p. 168][1 Fig. 3.6].

What the thesis found

The Lomb–Scargle periodogram, whose threshold allows for searching many periods, found no peak reaching even the 10% false-alarm level in the UK, US or Canadian lightning [1 p. 127][1 p. 136] and [1 p. 144]. The multitaper method flagged many: in the US data, near 5, 6, 7, 8, 9, 11, 12, 13, 14 and 26 days [1 p. 139]. The thesis noted that the shorter ones pair up to 14 days, "5+9=6+8=7+7=14" [1 p. 151].

OUR ANALYSIS

What its criteria give for noise

The multitaper criteria test one period at a time, against a flat background. Between 4.5 and 30 days there are about 140 independent periods. In 200 simulated series with no periodicity, the harmonic F-test passed its 95% line at about 70 peaks per series and its 99% line at about 15; for noise with the thesis's day-to-day persistence, the test against a flat background passed its 99% line at about 95. Such series "matched" at least three of the spacings 6, 9, 15 and 27 days in 99.5–100% of cases. In real reanalysis rainfall over the US box, the flat-background test flags 71 peaks, including 25–28 and 14–18 days [20]. The method does find what is there: OMNI's By peaks near 27–28 and 14 days, as the thesis found [1 pp. 118–123][19].

OUR ANALYSIS

Why 27 days can't single out the current sheet

Many things near Earth repeat with the Sun's 27-day rotation. A 2014 study of the same UK lightning found it rose after fast solar-wind streams arrived, as cosmic rays fell by about 1% and solar protons rose by about 6%, with the Sun's ultraviolet output and sunspots changing days before, from an active region rotating with the Sun [5 Abstract]. A Japanese study of a 27-day period in lightning lists sunlight, ultraviolet light and cosmic rays as candidate links, all of which recur with the rotation [13 §1]. Sector crossings usually sit inside the same stream structures [3 Abstract], and a 2023 study of polar pressure at sector crossings, faced with a pattern it couldn't explain, raised the possibility of "an aliasing phenomenon" from the Sun's 27-day ultraviolet cycle [11 p. 17]. A periodicity shared with all of them can't say which one matters.

6 · RAIN AND PRESSURE

In public reanalysis data, rain and pressure show no significant change at the crossings

The thesis found rain rising near crossings, and pressure rising after T-A and falling after A-T crossings, in ERA5, which needs an account. We used NCEP/NCAR Reanalysis 1 over the same box instead [1 pp. 162–176][20].

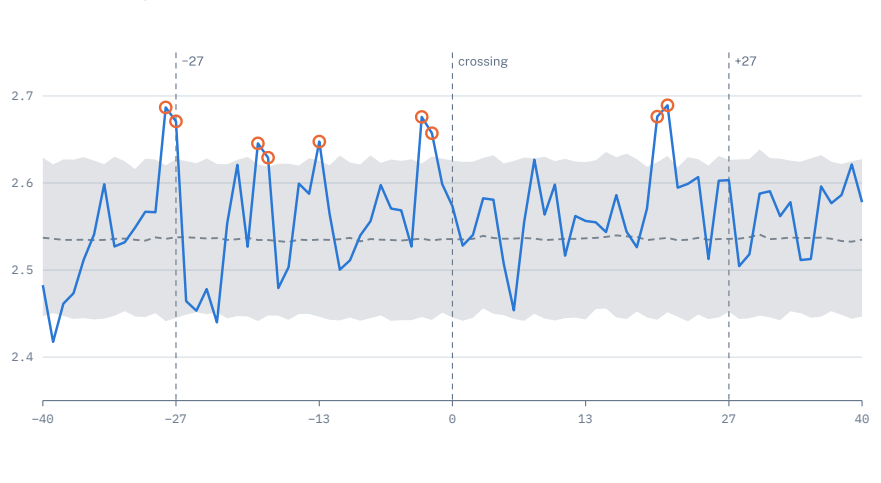
In the author's words

On ERA5's precipitation over the US box.

> *"These figures show very clearly that the ERA5 precipitation dataset contains clear enhancements in precipitation in the US region which are associated with HCS crossings"*
>
> Peterson (2026) [1 p. 162]

Reanalysis rain around the crossings, read the thesis's way

OUR ANALYSIS



Days from the crossing. Vertical axis: average precipitation over the US box, mm a day

Our analysis of NCEP/NCAR Reanalysis 1 [20], with our rebuild R-C of the thesis's crossing list, from OMNI [19]. Read the thesis's way, this rain has "peaks" above the band 28, 27, 19, 18, 13, 3 and 2 days before the crossings and 20 and 21 days after. The tests below, which keep the crossings' spacing and seasons, find nothing significant.

The tests fixed in advance

STATISTIC	LIST R-C	LIST R-D	LIST R-A
Rain within 2 days of the crossings, mm a day above normal	+0.016 (p = 0.60)	+0.025 (p = 0.37)	+0.018 (p = 0.46)
Rain within 2 days of the crossings and of 27 days either side	+0.006 (p = 0.80)	+0.012 (p = 0.55)	+0.004 (p = 0.82)
Pressure after T-A minus after A-T crossings, days 0–3, hPa	+0.15 (p = 0.63)	+0.08 (p = 0.79)	+0.34 (p = 0.08)

Anomalies from each day's normal (the average annual cycle). p is the share of 403 copies of the crossing list, shifted by whole years give or take 15 days, with a result at least as large either way; a crossing pushed past the end of the record wraps back by 14 years, so each copy keeps the crossings' spacing and seasons. Our first run wrapped such crossings about 80 days off season; corrected after review, the p values moved by 0.08 at most. Random dates, as in the thesis, give the same picture. From day to day, rain over the box varies by 0.97 mm a day and pressure by 2.9 hPa (standard deviations).

OUR ANALYSIS

What this does and doesn't show

No change in rain near the crossings or their echoes stands out from chance in the reanalysis. The pressure difference has the same sign as ERA5's in all three lists, largest with R-A (+0.34 hPa, p = 0.08); with R-C it is smaller than the thesis's figure suggests by eye (+0.24 hPa two days after the crossings, against about +0.9 hPa) [1 Fig. 6.9]. These tests can't rule out effects as small as the thesis reports. From one shifted copy of the list to the next, the rain within 2 days of the crossings varies by about 0.03 mm a day, while ERA5's rain there is about 2% above its average, which would be about 0.05 mm a day here; the pressure difference varies by 0.2–0.3 hPa, against about +0.6 hPa in ERA5 over the same days (by eye) [1 Fig. 6.5][1 Fig. 6.9]. The thesis's own thunderstorm index showed no rise either [1 p. 159]. The reanalysis isn't ERA5: it is older and coarser, and in both, rainfall comes from the forecast model [1 p. 57]. Our crossing lists aren't the thesis's. So this doesn't disprove the ERA5 result, though a clear change in average surface pressure over a box this large would be expected to show in both.

7 · BY AND PRESSURE

A test that flags most latitudes whatever the solar wind does

The thesis repeats a 2013 analysis: surface pressure on days when By is at least 3 nT, minus pressure on days when it is at most −3 nT, in ERA5 for 2010–2023 [1 pp. 177–179][6 §2].

REAL BY · OUR ANALYSIS

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latitudes the thesis-style Wilcoxon test flags at p < 0.01, in NCEP/NCAR pressure for 2010–2023 [20]

BY UNRELATED TO PRESSURE · OUR ANALYSIS

54

latitudes it flags on average for 200 simulated By series that keep By's values and persistence; from 31 to 70

MID-LATITUDE WAVES · OUR ANALYSIS

p ≥ 0.40

for the wave pattern at 50° N and 50° S, against 1,000 such series: no larger than chance

What the thesis found

Pressure on strongly positive and strongly negative By days differs at the 99% level over wide bands of latitude, and the difference at 50° N and 50° S looks like the atmosphere's large stationary waves, with five and three crests around the globe [1 p. 179]. "Figs. 7.4, 7.5, and 7.6 indicate that these are real and statistically significant," the thesis concludes [1 p. 184].

OUR ANALYSIS

Why the Wilcoxon test can't decide it

The test, used as in the 2013 study, pools every longitude and every day at a latitude as if each were independent [6 §2][1 p. 178]. Neighbouring longitudes and successive days move together, and so does By, which often keeps its sign for days [1 p. 66]. In NCEP/NCAR pressure the test flags 54 of 73 latitudes for the real By, and 54 on average for simulated By series built to keep its values and persistence but unrelated to pressure [20]. By this test, almost any By series "affects" pressure.

OUR ANALYSIS

The comparison with 500 random maps

The thesis's Monte Carlo check made 500 sets of random days and "then averaged all 500 sets of comparator $\bar{p}_+$, $\bar{p}_-$, and $\bar{p}_{\mathrm{diff}}$ to create a Monte Carlo dataset (unrelated to By)", then compared the real map with that average [1 p. 181]. Averaging 500 random maps cancels their noise, by a factor of about 20: in NCEP/NCAR pressure the average of 500 such maps has wave amplitudes of 0.01–0.05 hPa, against 0.2–0.8 hPa for a single random map and 0.03–0.85 hPa for the real one [20]. A flat comparator is therefore certain whatever By does; the real map has to be compared with single random maps, as we do next.

OUR ANALYSIS

Against single random maps

In NCEP/NCAR pressure for 2010–2023, the difference's wave amplitude along 50° N is 0.46 hPa and along 50° S 0.85 hPa. Simulated By series unrelated to pressure give 0.63 and 0.84 on average, and amplitudes at least as large as the real By's in 91% and 47% of cases; the five-crest part at 50° N and the three-crest part at 50° S are smaller than chance gives on average (p = 0.98 and 0.92) [19][20]. One thing does show: north of 70° N, pressure is 0.9 hPa lower on strongly positive By days, the sign the effect predicts for the Arctic, with p = 0.03 in a check we added after the planned tests. This reanalysis isn't ERA5, which the thesis used.

What the literature says

The effect is named after a 1974 report [12]. Changes of about 8 nT in By go with high-latitude surface-pressure changes of about 1–2 hPa, clearest over Antarctica [7 §1], peaking about a day later in the lower troposphere [7 Abstract]. A 2013 study extended it to middle latitudes for 1999–2002 [6 Abstract], a 2019 study found related Antarctic temperature changes that vary by region, season and year [8 Abstract], and a 2016 review calls it "well-established" [9 §2.1]. A 2022 study found that, once day-to-day persistence and the many days tested are allowed for, the evidence offered for it has "a fairly high probability" of arising by chance [10 p. 1]. Its 2023 sequel, with ERA5 since 1968, found "no significant response confirming the current Mansurov hypothesis" [11 p. 1], though it did find a robust, unexplained pressure anomaly from March to May, about five days before the By peaks; as its authors note, an effect that precedes the forcing "is not physically justified" [11 p. 16][11 p. 17].

The thesis says the 2023 study "suggests that two sector solar wind structures should favour the Mansurov effect" [1 p. 28]. The study attributes that idea to a 2022 paper by Tinsley and tests it, finding no significant response in either kind of sector structure over 1968–2020 [11 p. 7][11 p. 11]; only the unexplained anomaly favours two-sector periods [11 p. 11].

8 · THE CROSSING LIST

The 2010–2023 solar-wind numbers reproduce exactly; the crossing counts, to within about a tenth

We rebuilt the thesis's list of crossings from NASA's OMNI daily data, by its stated rule, before using it in sections 4 and 6 [19][1 pp. 63–64].

The thesis beside our rebuild

	THE THESIS	OUR REBUILD
Threshold for a crossing, 2010–2023	1.12 nT [1 p. 64]	1.1203 nT
Days with By below −3 nT and above 3 nT, 2010–2023	12% and 11% [1 p. 66]	12.0% and 11.3%
Mean By, 2010–2023	−0.08 ± 0.04 nT [1 p. 67]	−0.079 ± 0.038 nT
Correlation of By from one day to the next	0.548 [1 p. 118]	0.548
Crossings, 2010–2023	284: 151 T-A, 133 A-T [1 p. 66]	306 and 296 in our two closest readings; 191 and 524 in the two we fixed in advance
Days between crossings, 2010–2023	17.7 ± 0.8, median 15 [1 pp. 69–70]	16.7 ± 0.7, median 14
Days between crossings, 2000–2007	15.4 ± 0.7, median 14 [1 pp. 69–70]	15.6 ± 0.8, median 13
By peaks and troughs beyond 3 nT, 2010–2023	252 and 273 [1 p. 70]	256 and 277

Our numbers are from OMNI's daily averages [19], for list R-C where a list is needed. The peaks and troughs are counted with a reading of the thesis's rule we found after the fact.

OUR ANALYSIS

Reading the rule

As written, the rule can be read several ways, and the two readings we fixed in advance gave 191 and 524 crossings. Its worked example, two crossings in February and March 2010, reproduces only if the third step takes the size of the five-day average of By rather than the average of its size, with the window after the crossing starting the next day: 5.32 and 3.22 nT and 1.78 and 1.16 nT, against the thesis's 5.32 and 3.21 and 1.77 and 1.15 [1 p. 64]. We found this after the fact, so sections 4 and 6 use three lists: R-C, the closest in its numbers of each kind of crossing (306 in all), though it misses the second worked example, whose average after the crossing comes to 1.120 nT in that reading, just under the 1.1203 nT threshold; R-D, the one that matches the example (296); and R-A, our first reading fixed in advance (524). None gives the thesis's excess of T-A over A-T crossings, so its directions can't be checked crossing by crossing.

9 · WHERE THIS SITS

A hypothesis from one network's data, tested in new data for the first time

Before this thesis, the link between sector crossings and lightning rested on UK data from the 2000s [3][4] and [5].

The UK studies

Scott et al. (2014) found UK lightning rising after fast solar-wind streams arrived and staying higher for about 40 days [5 Abstract]. Owens et al. (2014) found lightning and thunder 40–60% more common when the field pointed toward the Sun than away [4 Abstract][4 §5]. Owens et al. (2015) found lightning raised within a day or two of crossings and about 27 days before and after, and called the mechanism open [3 p. 9630].

Elsewhere

A 27-day period appears in wide-area summer lightning in Japan, 1989–2015, at 4.2 standard deviations [13 Abstract][13 §4]. Yearly WWLLN lightning, 2009–2022, correlates with By mainly over the South Atlantic Anomaly [14 Abstract]. Of the 38 records in OpenAlex that cite the 2015 study, 28 of them articles, none re-tests the crossings in another region, judging by their titles [22]; the thesis is the first such test we found.

The Wilcox effect

Sector boundaries were first tied to weather in 1973, when the area of strong winter troughs at the 300-millibar level shrank by about a tenth around them [16 Abstract]; a re-test found the response "no longer evident" in 1974–77 [17 p. 200], and a 2009 study found it again in reanalysis winters [18 Abstract], as our check of a 2026 storms-and-weather paper sets out.

How such studies go wrong

A 2013 methods paper showed how small changes in how a superposed epoch study is built can make non-significant data look significant, and how Monte Carlo tests can guard against it [15 Abstract].

Pressure at sector crossings

With a public list of crossings and tests that allow for persistence and many days, a 2023 study found a statistically significant difference in Arctic pressure in spring between away-to-toward and toward-to-away crossings, peaking two days before them, and none in the Antarctic [11 pp. 12–13]. Its authors called the UK lightning results "compelling", could find no physical reason for the two-day lead, and recommended a study of lightning with "improved and prolonged data" [11 p. 16]. The thesis is a study of that kind.

The wider picture

Blanc et al.'s 2026 forum report on links between space weather and the lower atmosphere says nothing about sector crossings and lightning or about the Mansurov effect [21]; our check of that report groups both among the contested lines of evidence. For another proposed solar effect on the weather, a 2018 index of geomagnetic activity and temperature, see our check of the PC-index paper.

10 · STRENGTHS AND LIMITS

Careful, candid work whose tests can't carry its conclusions

What the thesis does well

- It tests published hypotheses on new data from three lightning networks [1 pp. 42–59].
- It uses Monte Carlo bands rather than textbook formulas, and shows means, medians and quantiles [1 pp. 80–90].
- It reports its null results (Canada, the thunderstorm index, the Lomb–Scargle tests and most other regions) and counts its own off-target peaks [1 pp. 83–94][1 p. 159].
- It names other explanations: weekly pollution cycles, the lunar half-month, the Madden–Julian Oscillation and detection efficiency [1 pp. 131–153][1 pp. 190–194].
- Its 2010–2023 solar-wind numbers reproduce exactly (section 8).

Where it falls short

- Significance is read day by day, with no allowance for the number of days, panels and regions [1 p. 91].
- The random dates ignore the crossings' seasons (section 4).
- Echoes at 27 days either side are counted as confirmations, though crossings recur with the Sun's rotation, so anything at the crossings tends to show there too (section 3).
- Periodicities are matched to the crossings after the fact (section 5).
- Its Wilcoxon tests treat persistent days as independent (section 7).
- It credits a 2023 study with an idea that the study tested and didn't support (section 7).
- Its conclusion of "strong evidence" goes further than its own caveats [1 p. 195].

Small slips we noticed

- ERA5 precipitation over the US box is given as about 0.11 "mm per day" [1 p. 58][1 Fig. 6.5]. The reanalysis we used averages 2.5 mm a day there, or 0.105 mm an hour [20], so the label probably means millimetres an hour. The relative results are unaffected.
- Average surface pressure over the box is said to range "from 928 hPa in February to 955 hPa in November", with most days between 952 and 955 hPa [1 p. 59]; in the reanalysis we used, the box's monthly averages vary only from 957.4 to 959.7 hPa [20], so 928 is probably a typing slip.
- A sentence dates the 175 crossings it counts to between "August 31st, 2000 and April 30th, 2007" [1 pp. 65–66], but the figure it points to covers the whole of 2000 to 2007 [1 p. 72], and the thesis's By averages for "2000 to 2007" match those whole years exactly (our analysis) [1 pp. 66–67][19]. So the slip is the dates in that sentence: the 139 crossings of the UK analysis are close to the share of 175 that its shorter span would hold [1 p. 81].
- The days listed for the US mean curve of away-to-toward crossings don't match its figure: 7 of the 13 sit inside the lightest band of Fig. 4.7(c), below even the 95th percentile (by eye) [1 p. 85][1 Fig. 4.7]. The list is nearly the same as the one for the median curve, which does fit its own figure [1 p. 87][1 Fig. 4.10]. By the figure, the US mean curves have about 23 days at the band rather than 30; the windows hit, 10 of 15, are the same.
- The caption of Fig. 1.15 describes ERA5 profiles for 2010–2023 but credits the 2013 study's supplementary material [1 p. 37].
- A cited study of cosmic rays at sector crossings, El-Borie et al. (1998), is listed as "El-Boric" with the year 1988 [1 p. 197].

None of these changes a verdict. We haven't put them, or the comparison in section 7, to the author.

Not the lightning itself

The lightning data aren't public, so we tested the method, not the data. Our simulated series are simple: a smooth season and short-lived day-to-day noise. They are more skewed than the thesis's US lightning (mean 1.47 times the median, against 1.29; highest day about 7 to 8 times the mean, against 6.2), and the thesis's lightning also changes from year to year [1 pp. 47–48][1 p. 86].

Not ERA5

We used NCEP/NCAR Reanalysis 1, coarser than ERA5, which needs an account [20].

Not the thesis's exact list

Our crossing lists differ from the thesis's by about a tenth (section 8).

By eye

Values read off the thesis's figures are approximate.

What would change these verdicts

01

A single test fixed in advance, with random dates that keep the crossings' spacing and seasons and a correction for the number of days, panels and regions, finding the US lightning effect again.

02

The same effect in lightning from 2024 on, which the thesis didn't use, or in another network.

03

Lightning lining up better on sector crossings than on fast solar-wind streams, ultraviolet maxima or cosmic-ray minima, which share the 27-day rhythm.

For By and pressure: the mid-latitude pattern passing a test that allows for day-to-day persistence and for the many days tested, as Edvartsen et al. used [10 p. 4].

11 · SUDDEN CHANGE?

At most a small, regular nudge; nothing about sudden change

OUR ANALYSIS

Our reading

The effects the thesis reports are modest: single-day rises of about a tenth in average US lightning and a few percent in rain, up to about twice the average on single days in the sparse UK lightning data, and half a hectopascal in average pressure. Its own closing words put the Sun's light first: "global weather systems and the Earth's climate are primarily influenced by the sun's electromagnetic radiation" [1 p. 195]. Even if it were confirmed, such an effect would be a small, predictable nudge on thunderstorm days, tied to the Sun's 27-day rotation, perhaps of use in forecasting, as a 2014 study suggested [5 Abstract]. It says nothing about a pole shift, a solar outburst or the Sun suddenly driving the weather.

12 · CONCLUSION

A hypothesis worth a stricter test, not yet a finding

The thesis concludes

> *"the results in this thesis present strong evidence supporting the concept that the Earth's weather systems are also coupled to the effects related to the heliospheric magnetic field"*
>
> Peterson (2026) [1 p. 195]

OUR ANALYSIS

Our conclusion

The thesis asks a fair question with care, and reports more of its own null results than many papers do. But its tests read bands of chance one day at a time, ignore the seasons, count echoes as confirmations and match periods after the fact, so they can't show the link it reports. In public data its weather effects aren't significant, though those tests can't rule out effects as small as the thesis reports, and its By and pressure test finds effects for By series that have nothing to do with pressure. Whether its richest US lightning pattern beats chance depends on how its crossing rule is read; a stricter test on the same lightning could settle it.

13 · REPEAT OUR NUMBERS

The rules, the scripts and our outputs; the thesis and the raw data stay with their owners

Each rules file was written before the tests it governs first ran; the log gives their hashes and marks what came later. One script fetches every input by URL under a plain client name. Run into an empty folder, the first run's scripts gave its outputs byte for byte; the steps corrected after review, re-run from the hosted copies, gave theirs byte for byte too.

PY **fetch_inputs.py**
Fetches NASA's OMNI files and the NCEP/NCAR reanalysis files by URL, about 180 MB, and compares each with the copy we used; standard library only · 6 KB

PY **check_inputs.py** and **run_all.py**
Compare the fetched values with ours, then run every step below in order · 8 KB and 3 KB

PY **common.py**, **hcs_list.py**, **hcs_variants.py**, **extrema_variants.py** and **make_lists.py**
The crossing rule and its readings, the solar-wind numbers, and the three lists (section 8) · 27 KB in all

PY **sea_null.py**, **sea_null_p95.py** and **seasonal_bias.py**
The thesis's band test on simulated series, first at the 97.5th percentile and, corrected after review, at the 95th with the sensitivity runs; and how each list falls through the year (section 4) · 22 KB in all

PY **multitaper_null.py** and **multitaper_ar1.py**
The multitaper criteria on noise, OMNI and reanalysis rain (section 5) · 5 KB and 2 KB

PY **r1_sea.py**
Rain and pressure around the crossings, with both nulls; the shifted-list null was corrected after review (section 6) · 8 KB

PY **by_pressure.py** and **by_pressure_polar.py**
By and pressure, with simulated By series and shifted ones (section 7) · 6 KB and 3 KB

TXT **RULES_hcs_list.txt**, **RULES_sea_null.txt**, **RULES_multitaper_null.txt**, **RULES_r1_sea.txt**, **RULES_by_pressure.txt** and **RULES_post_review.txt**
The five sets of rules, written before the tests ran, and the corrections and extra runs decided after review, written before they ran · 21 KB in all

TXT **analysis-log.txt**
The rules' hashes, written before any test ran, the inputs' and outputs' hashes, and what was decided after the first results and after review, with times · 21 KB

ZIP **our-outputs.zip**
Every output: the crossing lists, the test results and the numbers behind the charts. Derived numbers only · 50 files, 86 KB

TXT **HASHES.txt**
The SHA-256 of every file listed here · 7 KB

Run it

`python3 -I fetch_inputs.py <folder>`, then `python3 -I check_inputs.py <folder>` and `python3 -I run_all.py <folder>`, with the scripts side by side. The analysis needs numpy, scipy and netCDF4 and takes about an hour and a half; the random draws are seeded, so the outputs come out the same each time. NASA revises OMNI now and then, which the checker reports.

The data and their terms

OMNI: NASA's Space Physics Data Facility, CC0 [19]. **NCEP/NCAR Reanalysis 1:** provided by the NOAA PSL, Boulder, Colorado, USA, from their website at https://psl.noaa.gov [20]; the script fetches both. **The thesis:** CC BY-NC-SA 4.0; we quote it, but host none of it and redraw none of its figures [1].

Sources

Bracketed numbers refer to this list. For the thesis [1], p. gives a printed page (pp. ii–iii are its abstract, pp. 1–195 its chapters), Fig. a figure, Ch. a chapter and App. its appendix; values read off its figures are marked "by eye". For the other sources, § gives a section, p. a page and Abstract the abstract; where only an abstract or a record was read, the entry says so. The two papers by Edvartsen et al. were read in copies the site's owner downloaded, because the journal's site refused our client. Links checked November 15, 2026.

1 Peterson, J. A. (2026). New Evidence for the Modulation of Lightning and Weather Systems by Solar Wind Magnetic Sector Structures. Master of Science thesis, Department of Physics, University of Alberta, supervised by Dr Ian Mann, as the thesis states. Deposited in ERA, the University of Alberta Library's repository, on June 10, 2026; issued November 2026. Licensed CC BY-NC-SA 4.0, as its title page states, so it is quoted here, not reproduced, and none of its figures is redrawn. An examined thesis, not peer reviewed in a journal; no journal paper from it was found in Crossref or OpenAlex on November 15, 2026. Read in full (258 pages).

2 SpaceWeatherNews (S0) (November 15, 2026). Solar Electromagnetic Earth Dance | S0 News Nov.15.2026. YouTube video, https://www.youtube.com/watch?v=gzYwpyefO5g. Linked the source; no transcript was available, so nothing it says is rated here.

3 Owens, M. J., Scott, C. J., Bennett, A. J., Thomas, S. R., Lockwood, M., Harrison, R. G., and Lam, M. M. (2015). Lightning as a space-weather hazard: UK thunderstorm activity modulated by the passage of the heliospheric current sheet. *Geophysical Research Letters* 42(22), 9624–9632. CC BY 4.0. Read in full in the University of Reading's repository copy of the published version.

4 Owens, M. J., Scott, C. J., Lockwood, M., Barnard, L., Harrison, R. G., Nicoll, K., Watt, C., and Bennett, A. J. (2014). Modulation of UK lightning by heliospheric magnetic field polarity. *Environmental Research Letters* 9(11), 115009. CC BY 3.0. Read in full in the University of Reading's repository copy of the published version.

5 Scott, C. J., Harrison, R. G., Owens, M. J., Lockwood, M., and Barnard, L. (2014). Evidence for solar wind modulation of lightning. *Environmental Research Letters* 9(5), 055004. CC BY 3.0. Read in full in the University of Reading's repository copy.

6 Lam, M. M., Chisham, G., and Freeman, M. P. (2013). The interplanetary magnetic field influences mid-latitude surface atmospheric pressure. *Environmental Research Letters* 8(4), 045001. CC BY 3.0. Read in full in the NERC Open Research Archive's copy.

7 Lam, M. M., Chisham, G., and Freeman, M. P. (2014). Solar wind-driven geopotential height anomalies originate in the Antarctic lower troposphere. *Geophysical Research Letters* 41(18), 6509–6514. Read in the accepted version in the NERC Open Research Archive.

8 Freeman, M. P., and Lam, M. M. (2019). Regional, seasonal, and inter-annual variations of Antarctic and sub-Antarctic temperature anomalies related to the Mansurov effect. *Environmental Research Communications* 1, 111007. Open access (CC BY). Abstract only.

9 Lam, M. M., and Tinsley, B. A. (2016). Solar wind-atmospheric electricity-cloud microphysics connections to weather and climate. *Journal of Atmospheric and Solar-Terrestrial Physics* 149, 277–290. Read in the authors' accepted manuscript in the NERC Open Research Archive.

10 Edvartsen, J., Maliniemi, V., Nesse Tyssøy, H., Asikainen, T., and Hatch, S. (2022). The Mansurov effect: Statistical significance and the role of autocorrelation. *Journal of Space Weather and Space Climate* 12, 11. CC BY 4.0, as it states. Read in full, from a copy the site's owner downloaded; the journal's site refused our client. Cited by its own page numbers (of 10).

11 Edvartsen, J. Ø., Maliniemi, V., Nesse, H., and Hatch, S. (2023). The Mansurov effect: Seasonal and solar wind sector structure dependence. *Journal of Space Weather and Space Climate* 13, 17. CC BY 4.0, as it states. Read in full, from a copy the site's owner downloaded; the journal's site and a repository refused our client. Cited by its own page numbers (of 21).

12 Mansurov, S. M., Mansurova, L. G., Mansurov, G. S., Mikhnevich, V. V., and Visotsky, A. M. (1974). North-south asymmetry of geomagnetic and tropospheric events. *Journal of Atmospheric and Terrestrial Physics* 36(11), 1957–1962. Record only.

13 Miyahara, H., Higuchi, C., Terasawa, T., Kataoka, R., Sato, M., and Takahashi, Y. (2017). Solar 27-day rotational period detected in wide-area lightning activity in Japan. *Annales Geophysicae* 35(3), 583–588. CC BY 3.0. Read in full.

14 Chum, J., Langer, R., Kolmašová, I., Lhotka, O., Rusz, J., and Strhárský, I. (2024). Solar cycle signatures in lightning activity. *Atmospheric Chemistry and Physics* 24(16), 9119–9130. CC BY 4.0. Abstract and conclusions read.

15 Laken, B. A., and Čalogović, J. (2013). Composite analysis with Monte Carlo methods: an example with cosmic rays and clouds. *Journal of Space Weather and Space Climate* 3, A29. Read in its arXiv version, 1310.0266.

16 Wilcox, J. M., Scherrer, P. H., Svalgaard, L., Roberts, W. O., and Olson, R. H. (1973). Solar Magnetic Sector Structure: Relation to Circulation of the Earth's Atmosphere. *Science* 180(4082), 185–186. Cited as our storms-and-weather check reads it.

17 Williams, R. G., and Gerety, E. J. (1978). Does the troposphere respond to day-to-day changes in solar magnetic field? *Nature* 275(5677), 200–201. Cited as our storms-and-weather check reads it.

18 Prikryl, P., Rušin, V., and Rybanský, M. (2009). The influence of solar wind on extratropical cyclones – Part 1: Wilcox effect revisited. *Annales Geophysicae* 27(1), 1–30. CC BY 3.0. Cited as our storms-and-weather check reads it.

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20 NOAA Physical Sciences Laboratory. NCEP-NCAR Reanalysis 1 [data set]: daily mean surface pressure worldwide, and daily mean precipitation rate over 29–51° N, 126–59° W, 2010–2023, downloaded November 15, 2026, through PSL's THREDDS server. NCEP-NCAR Reanalysis 1 data provided by the NOAA PSL, Boulder, Colorado, USA, from their website at https://psl.noaa.gov; free to use, with that acknowledgement. The data set is described by Kalnay, E., et al. (1996), The NCEP/NCAR 40-Year Reanalysis Project, *Bulletin of the American Meteorological Society* 77(3), 437–471.

21 Blanc, M., Taylor, M. G. G. T., Strømme, A., et al. (2026). Physical Links Between Weather in Space and Weather in the Lower Atmosphere. *Surveys in Geophysics*. CC BY 4.0. Searched for the topics of this page; reviewed in full in our check of the paper.

22 OpenAlex. Works citing Owens et al. (2015): 38 records, read November 15, 2026.

METHOD

How this was checked

On November 15, 2026, we checked every statement, number, quotation and citation on this page against its source: the thesis, read in full in the University of Alberta's copy [1]; NASA's OMNI data and NCEP/NCAR reanalysis, which we re-analysed [19][20]; and the 18 further sources listed, read as the list says. The DOIs of the thesis and of OMNI's data were resolved through DataCite, and the others through Crossref. Two were read as an abstract or a record only, two in copies the site's owner downloaded because the journal's site refused our client, and three are cited as our check of a 2026 storms-and-weather paper reads them.

The verdicts and the items tagged "Our analysis" are our own assessment, built on the cited sources. S0 News linked the thesis in its episode of November 15, 2026, but no transcript of the episode was available, so this page reviews the thesis on its own and rates nothing from the episode [2].

We could not re-run the thesis's lightning analyses: its lightning data aren't public, and ERA5 needs an account. We rebuilt its list of sector crossings from OMNI, where its 2010–2023 threshold and solar-wind statistics reproduce exactly and its crossing counts to within about 10%, with a reading of its rule that we found after the fact; ran its significance procedures on simulated series with no link to the crossings; re-tested its weather results with NCEP/NCAR reanalysis instead of ERA5; and tested its By and pressure result against a null that keeps By's day-to-day persistence. Every test was written down before it ran, except those marked post hoc. The scripts, rules and outputs are hosted on the page; a run from an empty folder reproduced every output of the first run, and the steps corrected after review reproduce from the hosted scripts.

A fresh reviewer then checked the built page against its sources and reproduced our numbers with independent code; it found that our simulations judged the thesis's day counts at the 97.5th percentile, stricter than the 95th its figures use, and that one of our nulls moved some crossings off season, so we re-ran both under rules written beforehand, corrected the numbers and wording that depended on them, and kept every verdict.

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

OVERSTATED	Has some basis but claims much more than the evidence supports.
UNSUPPORTED	No evidence we could find backs it up, though it hasn't been strictly disproven.
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

Nov 15, 2026	Published on factchecked.science after a full check against the sources. Built from the thesis (CC BY-NC-SA 4.0, quoted only; none of its figures reproduced), the published studies it builds on, and our own re-analysis of NASA's OMNI data and NCEP/NCAR reanalysis, whose scripts, rules and outputs are hosted on the page: five of the thesis's claims rated on the site's scale. Two papers on the Mansurov effect were read in full from copies the site's owner downloaded. The charts are our own analysis of public data.

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Last updated Nov 15, 2026