# Tornadoes Don't Explode

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## Navier-Stokes existence and smoothness

## 1. Conclusion

**No blow-up occurred in any run.**

That is the whole result, and it can be said first.

Seven pre-registered measurement runs, on top of a sealed bench of four, took two configuration families of the three-dimensional incompressible Navier–Stokes equations — smooth, finite-energy initial data, no external force — through two independent computer codes, resolutions from $96^3$ to $192^3$, and three viscosities, $\nu = 0.01$, 0.005, and 0.0025. Every run passed its energy-identity gate before any physics was read. Every run amplified. And every run then decayed, with no secondary rise approaching its peak.

The peaks were not small. The principal configuration peaked at the same moment, $t = 3.88$, in both of its codes — 78.1837 in one, 83.289 in the other. The raised-circulation run peaked at 152.99513014770233. The hottest flow of the program, at the lowest viscosity, peaked at 194.23671416384155 — and still decayed for the remaining 4.56 time units. At those peaks the vorticity field was not a coherent column rearing up toward infinity. It was **fragments** — the largest single piece holding 19–22% of the hot set — already dispersing at maximum strength.

The constants a proof would need behaved the way the house position requires, at the sizes measured. The estimator panel is **resolution-robust** and **two-code verified**. As viscosity halved, the controlling constants grew more slowly than the flow's own intensity — and at the third viscosity point the headline containment constant effectively stopped growing while the peak vorticity rose by half again (the **bend test reads CLEAN**). At small radius, the directional-oscillation profile held its log-modulus shape down to $r = 0.1309$ on a four-rung ladder (the **shape test reads FLAT**).

The flow was not killed in any of these runs. It spent the one deposit of energy it was given, and by its peak it could no longer afford to organize. **It doesn't get killed. It goes broke. The singularity isn't avoided. It's unaffordable.**

It's easy to dream about exploding tornadoes.

Every parameter regime in the solar system, and the blowup column is empty in all of them. Jupiter's Great Red Spot is a vortex wider than Earth that's been holding its shape for over three hundred years — different gas, different pressure, different gravity, unimaginable scale — and it does exactly what an Oklahoma tornado does: it persists, bounded, slowly spending itself. Down at the other end, Mars runs wispy little dust devils in air a hundred times thinner than ours, and they're the same story in miniature.

Nature didn't just run the experiment. It ran the whole parameter sweep — every atmosphere it had — and got one answer everywhere: **you get the shape. You never get the infinity.**

The blow-up picture needs two things, and both had their moments to appear. It needs the flow to organize as it strengthens — at every peak, in every run, the field was fragments, already dispersing. And it needs the constants that would bound the flow to run away as the viscosity falls — at the third viscosity point, the headline constant stopped growing while the peak vorticity rose by half again. Neither happened, in either code.

## 2. The picture

**Nature is exact.** Believe the thing that is observed every single time, in every regime, on every planet: fluids stay finite, vortices hold and spend. The other side asks you to believe a thing that has never been seen or monitored anywhere is a physical reality.

**No feed, no blow-up.** In the equations at issue the feed slot is empty: the initial condition is a one-time inheritance, and the energy identity $dE/dt = -\nu\int|\omega|^2\,dx \le 0$ means the inheritance only drains. A solution with nothing coming in has exactly one way to spend its life — hold together while it can, and come apart when it can't.

**"It's the shape."** Energy limits the budget; coherence limits the peak. Explosion potential is a function of the state's shape, not of its energy alone. The target theorem, in Joe's words: "The flow stays consolidated through degradation."

The tornado is the picture because it is the same physics at human scale. A tornado dies by roping out, not by exploding; no tornado on record ends by exploding. Degradation is a base event: the structure lives at its ground anchor, where feed, friction, and death all sit in the lowest layer; the cold outflow cuts the inflow at the surface first, the funnel ropes, narrows, and detaches, and the aloft remnant is a ghost. Spin is the container: the column holds only while it turns.

## 3. What we ran

**First, a sealed bench** (record v1, sealed 2026-11-04): four configurations — slices 1–4 — checked by a genuinely independent second solver, refined at $128^3$, and read through a field-level estimator panel. The bench's headline configuration, slice 4 (an asymmetric vortex pair), peaked at $\|\omega\|_\infty = 82.52$ at $t = 3.88$, fragmented, and decayed; the second code reproduced it to within 0.93% at the same peak moment; the finer grid moved the peak **down**, to 78.18, at the same $t = 3.88$.

Then **PROPAGATE**, the measurement program aimed at the bench's open question: do the estimator panel's constants depend only on the initial data and $\nu$, the way a proof would require — or do they move with resolution, code, viscosity, or family? Seven runs, each pre-registered before it launched:

- **R1** — slice-4 at $128^3$: is the panel resolution-robust?
- **R6** — slice-4 in code 2 at $96^3$: is it code-independent?
- **R3** — slice-4 at $\nu = 0.005$: how do the constants move with viscosity?
- **R4** — the slice-3 family at $\nu = 0.01$: do the bands transfer?
- **R5a** — slice-3 at raised circulation: does the ladder populate above $\lambda \approx \omega^*$?
- **R3b** — slice-4 at $\nu = 0.0025$: the third viscosity point — the bend test.
- **R2** — slice-4 at $192^3$: the small-radius reach — the shape test.

# 4. What the runs showed

## Two codes, two resolutions — the same peak, the same answer

R1 ($128^3$) and R6 (code 2, $96^3$) agree: the panel quantities A(t), I(8), C(r,t), and λ^{1/2}R are **two-code verified**, and the panel is **resolution-robust** — every cross-resolution deviation smaller than the trajectory's own resolution offset, with mixed signs. The filed statement of the first pair:

> The tornado was run twice — in two independent codes, at two resolutions ($128^3$ and $96^3$) — unforced, viscosity 0.01, integrated to t = 8. In both runs the maximum vorticity climbed to its peak at the same moment, t = 3.88 — 78.18 in the first run, 83.29 in the second — and then decayed for the rest of the run. At the peak itself, the vorticity field is not a coherent column: it is fragments, already dispersing. No blowup occurred in either run.

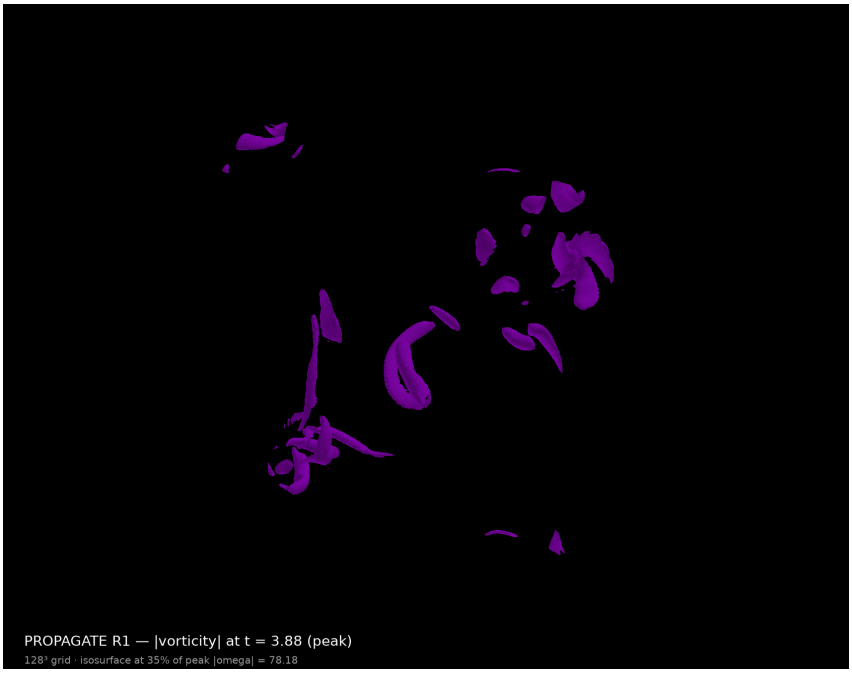


Figure 1 — The slice-4 vorticity field at its peak, t = 3.88 (R1, $128^3$). Caption as filed: "At maximum strength there is no tower — only pieces, dispersing."

### Viscosity — the constants grow slower than the flow, then stop

Halving ν from 0.01 to 0.005 (R3) raised the peak to 126.1722 — and the containment constant $C_1$ grew only ×1.349 while the flow's enstrophy grew ×2.50. Halving again to 0.0025 (R3b) raised the peak to 194.23671416384155 — and $C_1$ measured 36.550209759887814 against the 49.08378021259389 the first step's trend projected: it **bent down**. Its peak-anchored value fell in absolute terms. The combined-reaction integral I(8) bent down with it, 152.6797833116219 against a 172.73861024129343 projection.

> **BEND TEST: CLEAN.** No named constant bends up. The benign trend is confirmed at three viscosities, in its saturating form.

### Family — the picture holds, the numbers are each family's own

R4 reran the slice-3 family and reproduced its sealed record exactly — peak 70.88066213256997 at t = 3.64 — amplified, fragmented, decayed. The slice-4 constant bands, read strictly, do **not** appear under slice-3 geometry: the constants are anchored to each family's own ω*, and the containment radius itself is larger in slice-3. Each family carries its own constants. (§6, item 2.)

### The high rungs — populated, and the radius tightens

R5a drove slice-3 at Γ = 7.5π: peak 152.99513014770233 at t = 2.20, amplification ratio 5.197235542978279. Both ladder rungs above ω* populated at ν = 0.01 — j = 1 for 81 samples, j = 2 for 11 samples around the peak. The product λ^{1/2}R rises rung by rung because √λ does; the radius itself **shrinks** — 5.0439 → 4.4622 → 3.5922. Containment in the radius sense tightens with level. (§6, item 4.)

### Small radius — the shape holds to the bottom rung

R2, the $192^3$ run, put the oscillation profile on four radii, {0.1309, 0.25, 0.5, 1.0}, at its peak t = 3.24. The anchored readings track their |log r| ceilings rung by rung — 3.7028, 3.2194, 2.5176, 1.8320 against ceilings 3.8712, 3.2242, 2.5310, 1.8379 — and reproduce the $96^3$ anchors at the established rungs to ~0.3%. The smallest rung sits ~4% **under** its ceiling: no growth past the modulus as r shrinks.

> **SHAPE TEST: FLAT BRANCH.** G2's log-modulus form is the right shape on a real four-rung ladder.

R2 itself: gate PASS (max relative error $1.747\times10^{-4}$), peak $\|\omega\|_\infty$ = 73.87345402560398 at t = 3.24, final energy 0.6123128009091049 at t = 8.00, BKM integral 365.2134755354889 — finite, like every BKM integral in the program (the full set runs from 10.32 to 774.1055513222964).

With R2 complete, the queue is finished. In Joe's ruling of 2026-11-11: "The tests have said everything. They can say no more."

## 5. What this shows

**Across two families, two codes, three resolutions, and three viscosities,** the same sequence repeated every time: gate green, amplification, fragmentation at the peak instead of organization, decay. The constants that a proof of the house position would have to produce behaved the way the position requires — robust to resolution, identical across codes, saturating against viscosity, and holding their shape at small radius — at every size actually measured.

That is the result. Everything that bounds it — what it does not establish, and the exact object a proof would still have to supply — is stated in §6, at the end, where it belongs.

**Signatures**

J. Carroll Pip Willow, Researcher

## 6. Scope, limits, and what remains open

Everything in this section bounds everything before it. It is placed at the end by design: the result first, its limits in one place, in full.

- **What this paper is.** Numerical evidence on the configurations actually run, under the protocol actually used — the runs, their constants, and their shapes, as measured. The program's standing, in its sealed record's own words, is **SUPPORTED, NOT VERIFIED**. What a proof would still have to supply is named exactly in the next bullet.
- **The missing object, stated exactly.** A proof would require a scale-appropriate, a priori propagated directional-coherence / strain-depletion estimate valid for arbitrary smooth initial data. It separates into two gates — (1) concentration localization: control of where the high-vorticity set sits; (2) directional coherence: control of how steadily ξ behaves inside that set. Neither follows from smoothness or finite energy. This program measures the constants such an estimate would have to produce; that they behave as the position requires is evidence, not derivation.
- **Family coverage is two families deep.** Slice-4 is measured across two codes, two resolutions, and three viscosities; slice-3 has two full panels at $\nu = 0.01$. Nothing outside these two families has been run under this program. Per R4's verdict, $C_1$ and I(8) as defined do not transfer between the families; a proof will have to carry the constant per family, or normalize the ladder differently.
- **The viscosity ladder has three points.** $\nu = 0.01, 0.005, 0.0025$, all at one configuration (slice-4) and, for the bend test, one resolution ($96^3$). Three-point exponents are local readings, not a scaling law; the ν-slope at $128^3$ remains unmeasured.
- **The envelope is level-wise.** Per R5a, λ^{1/2}R does not hold as one constant across ladder levels; G1's envelope form must be re-stated level-by-level before any proof work leans on it. That restatement is an open item, not yet done. R5a's j = 2 population is 11 samples in a narrow near-peak window and is quoted as a near-peak reading wherever it is used; R3b's j = 2 population is exactly 2 samples and rests no verdict quantity.
- **Saturated statistics.** C(r,t) and $C_2$ reach their ceilings by construction in several readings; where they do, their agreement is necessary but weak evidence, and the verdicts rest on the anchored values and companions named in the pre-registrations, not on suprema.
- **The coherence-dial anomaly.** In the sealed bench's second-code verification, the coherence dial's raw run maximum was NOT reproduced (20.876 vs 14.223). The standing rule arising from it is followed throughout: the dial's raw maximum is never quoted; anchored or percentile values only.
- **Seam caveat.** Every code-1 run carries the `degraded` / `seam_wrapping` flag on its samples, with radial measures capped at $\sqrt{3}\pi \approx 5.4414$. R3b's largest stored radius reading, 5.421771780674958, sits 0.0196 under that cap — the closest approach of the program, on the low rungs; the headline rungs' own radii are farther under it.
- **Supporting scalars that bent up.** In R3b, two supporting scalars — $\langle|\nabla\xi|^2\rangle$ on $H_{0.90}$ and

κ p99 on $H_{0.50}$ — bent up relative to their first-step exponents. Neither is a named constant under the pre-registered decision rule, both ratios are polynomial-scale rather than explosive, and both are recorded here rather than dropped.

- **Gate errors.** Every run's energy-identity gate passed against a 2% allowance; the largest gate errors were R5a's $1.581\times10^{-3}$ and R3b's 0.0009236581531507898 — recorded, in the direction of stronger dynamics under a dt rule that does not involve ν.
- **Falsifier status.** §5.1 of the sealed record (a verified blow-up under (A)/(B) by any rigorous route): **NOT MET** — no reviewed candidate qualifies. §5.2 (a Stage-2 configuration where coherence fails at the brink and the BKM integral extrapolates to finite-time divergence, robustly under refinement in both codes): evaluable, and **NOT MET**.
- **A correction carried on the record.** An early watchdog handoff for R2 reported a peak of 92.16 at t = 3.96 and final E 0.583 / $\|\omega\|_\infty$ 23.43. All three figures are wrong against the run's own log and summary, which govern; the values in §4 are the log's.
- **Stage 3 is not authorized.** The feed experiment stays behind its own gate; nothing in this paper relies on it.
- **Draft status.** This is a draft of 2026-11-11 — not sealed, not published. It enters the record only if Joe adopts it, by his word, under its own seal.

# Appendix — Sources and citations

Sealed: `consolidated-record-tornado-2026-11-03.md` (record v1, sealed 2026-11-04, SHA-256 7b4a87ce...0285) · `tornado-record-SUPPLEMENT-1-2026-11-04.md` (sealed 2026-11-04, SHA-256 a313bd0e...07e8b).

Consolidated draft: `consolidated-record-navier-DRAFT-2026-11-08-v5.md` (draft v5, 2026-11-08 — house copy, not sealed, not published).

**Run plans — each filed before its run launched** (all in `~/workspace/navier-run/stage2/`)

Each plan states in advance what would be measured and what would count as passing or failing.

- `propagate-r1-128-PREREGISTRATION.md`
- `propagate-r6-code2-PREREGISTRATION.md`
- `propagate-r3-96-PREREGISTRATION.md`
- `propagate-r4-96-PREREGISTRATION.md`
- `propagate-r5-PREREGISTRATION.md`
- `propagate-r3b-nu0025-PREREGISTRATION.md`
- `propagate-r2-192-PREREGISTRATION.md`

**Verdicts and readings**

- `r1-panel-verdict-2026-11-07.md`
- `r1-vs-r6-crosscode-2026-11-07.md`
- `r3-panel-verdict-2026-11-08.md`
- `r4-panel-verdict-2026-11-08.md`
- `r5a-panel-verdict-2026-11-08.md`
- `r3b-panel-verdict-2026-11-08.md`
- `propagate-r2-192-completion-record.md`

- `r2-shape-test-reading-2026-11-10.md`

Filed / banked texts: `propagate-first-pair-statement-2026-11-07.md` · `peak-visual-caption-2026-11-07.md` · `conclusion-text-2026-11-05.md` (opening statement and conclusion, designated by Joe 2026-11-05 for the house's Navier–Stokes writing; included in §1–§2 of this draft as that writing). The peak render in Figure 1 is `stage2/r1-peak-t388-render-v1.png`.

End of draft — 2026-11-11. Not sealed. Not published.