

Evidence essay · Observation and data

A reproducible chart starts before the chart

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Fictional author and institute · Editorial demonstration, not peer reviewed

ABSTRACT

A chart's source link does not preserve the decisions that produced its values. This essay explains how a reproducible public graphic begins with a defined question, comparable quantities, and an explicit analysis record. NOAA's Arctic temperature chapter illustrates the importance of geographical coverage, water-year timing, baselines, and distinct input products. A simplified baseline example separates a changed reference from a changed observation, while noting that other processing choices can also differ. The proposed compact recipe retains input versions, retrieval dates, selections, weighting, filters, completeness rules, and transformation order. Climate and Forecast history conventions support this record but do not replace explanation. Accessible tables, labelled uncertainty, and distinctions between measurements and estimates help readers recover the calculation even when they disagree with its interpretation.

Keywords: reproducibility · climate charts · baseline definitions · analysis provenance · accessible data

Adapted from the Still North field journal. Original article. A source-based editorial text, not a report of original Still North research. Examples and imagery are illustrative.

A source link beneath a chart is necessary, but it may not explain how the chart was made. A reader can download the same dataset and produce a different result by choosing another region, season, baseline, or missing-data rule. Reproducibility begins with those decisions, before anyone selects a colour or adjusts an axis.

The aim is not to make every public reader run analysis software. It is to leave a route that a careful reader can follow, and a record that the next editor can use without reverse-engineering a finished image. A small, intelligible analysis package is often more durable than an elaborate interactive graphic whose inputs and assumptions are hidden.

Write the question above the calculation

Are we showing how one year compares with a reference period, or estimating a trend over several decades? Those questions use related evidence but require different descriptions. A rank is not a trend. A trend calculated from one start year need not match a trend calculated from another. Record the intended comparison before trying several versions and selecting the most dramatic one.

The NOAA Arctic Report Card temperature chapter provides a useful example. It defines the Arctic as 60° to 90° N, uses an October-to-September water year for annual values, and presents anomalies relative to 1991–2020. Its long-term time series uses NASA GISTEMP v4, while seasonal maps use ERA5 reanalysis. A reader should not assume that every figure on the same page is derived through the same path.

A baseline moves the reference, not the weather

An anomaly is a difference from a defined reference. In a simplified example, if an annual value is two degrees above one fixed baseline and the reference mean is raised by half a degree, that same value becomes one and a

half degrees above the new reference. The observed year has not cooled. The zero on the comparison scale has changed.

For an otherwise identical series, subtracting a different constant baseline changes its vertical position but not its linear trend. In practice, comparisons may also change coverage, weighting, processing, or the years included. Do not attribute every difference between published charts to the baseline alone. First establish that the underlying quantity and calculation are genuinely comparable.

Keep the baseline next to the plotted quantity, not only in an appendix. State whether a value describes an absolute temperature, a temperature difference, a percentage change, or a departure in standard deviations. These are not cosmetic alternatives. A map of standardised departures answers a different question from a map of degrees above average.

Leave a compact recipe

Retain the source dataset's identifier, version, and retrieval date, together with the actual input files where their terms allow. A link labelled latest can lead to a revised product later. Include the region selection, time window, units, area weighting, quality filters, and rule for incomplete periods. Preserve a small output table as well as the image, so another person can compare values without estimating them from pixels.

Document processing with a script or a clearly recorded spreadsheet workflow. The record should show transformations in their actual order. Converting units, screening missing values, and averaging are not always interchangeable operations. Hidden manual exclusions are particularly difficult to reconstruct. If a point was removed, record the reason rather than relying on a cell colour that disappears in export.

The CF guidance on file contents and history describes an audit trail for modifications to original data. That is a

useful foundation, not a substitute for an analysis explanation. Our [Open observations](#) page brings versioning, quality flags, and methods together.

Make the published object honest

Label observed and estimated values differently. Explain whether a shaded band represents uncertainty in a mean, variability among years, or something else. Show the period used for a fitted trend. If an axis is cropped, make that evident and consider whether the choice helps comparison or exaggerates a modest difference. No single axis rule suits every scientific plot, but every design choice should serve the question.

Provide a text description and an accessible table, with a source and method note that travel when the chart is copied. The [Arctic change in 2025 overview](#) is a starting point for checking linked evidence, not permission to detach numbers from their definitions. A reproducible chart lets someone disagree with the interpretation while still recovering the calculation. That is a more useful form of confidence than an immaculate image with no return route.

References

1. NOAA [Arctic Report Card temperature chapter](#) (arctic.noaa.gov)
2. CF guidance on file contents and history (cfconventions.org)