A WRITTEN PATH TO THE PAST

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A global inventory of quantitative documentary evidence related to climate since the Late Medieval Period

DOCUMENTARY EVIDENCE

Documentary evidence enables **invaluable insights into the past climate beyond the timescale of (early) instrumental measurements**. It complements other proxies from archives of nature in climate reconstructions, as they often cover seasons (e.g., winter) and regions (e.g., Africa) that are not well covered with natural proxies.

This **comprehensive global inventory of quantitative documentary evidence related to climate** contains almost **700 time series** from all around the world, retrieved from many studies on documentary sources. It promotes the **first-ever global perspective on documentary climate records.**

Written historical evidence range from personal diaries, chronicles, administrative/ clerical documents to ship logbooks and newspaper articles. They include narrative reports on weather and anomalous climate, as well as indirect (proxy) data e.g., plant and ice phenology observations.

The inventory focuses on **quantitative document-based time series** (i.e., numerical time series derived from documentary evidence) with **significant potential for climate reconstruction**.

To **showcase the potential** of documentary climate records, the **temperature response to the Laki eruption** in Iceland during 1783/84 is shown in Figure 3.

First, the 90 available time series depict **very homogenous temperature signals** for all seasons (least for fall). They reproduce the **prominent summer warming** as the immediate effect, and also the distinct cooling in the following winter and spring seasons.

Moreover, these **signals agree very well** with the findings from the **EKF400v2.0 reanalysis**, both on the **sign** and **magnitude** of the temperature response.

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RESULTS

Spatial availability documentary climate records

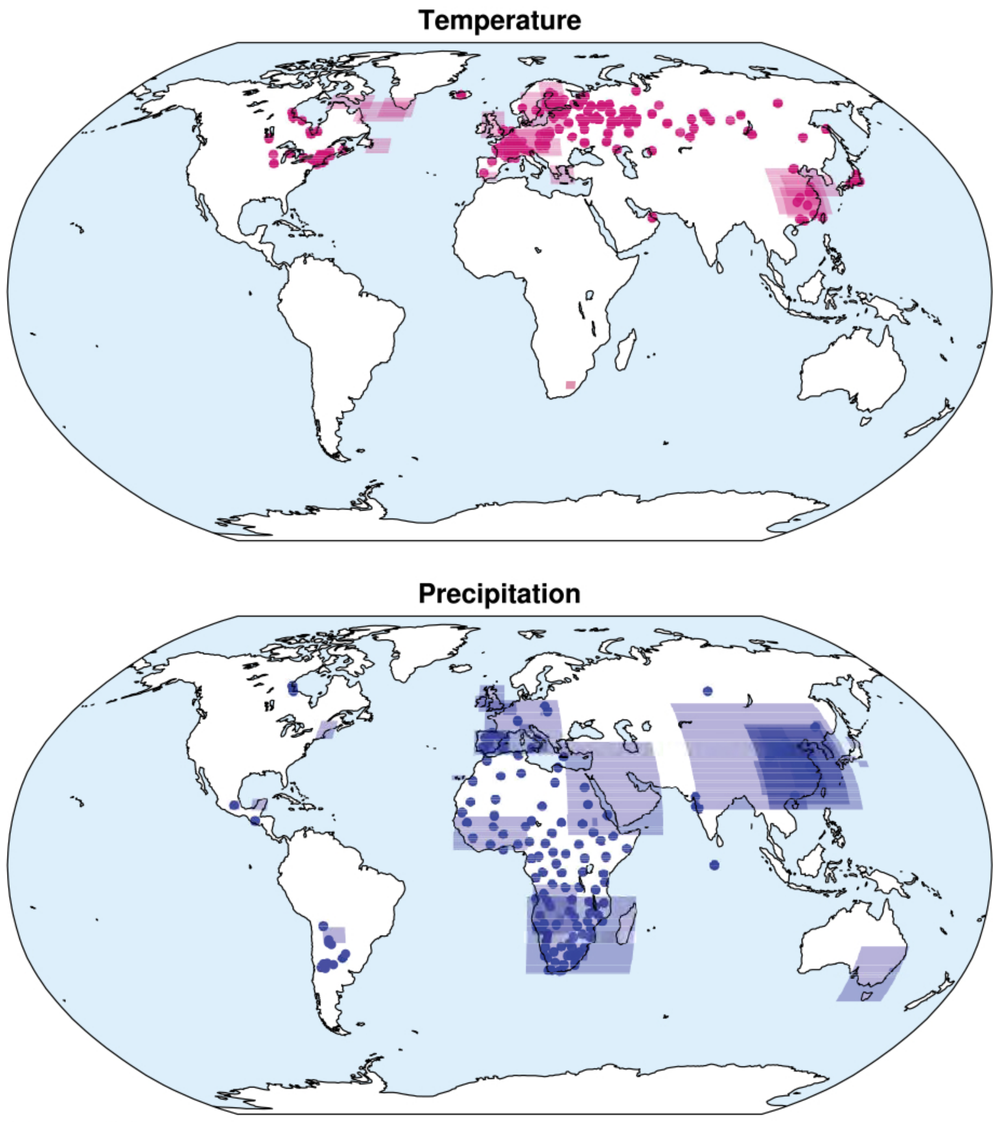

Figure 1 | Spatial distribution of available documentary series on climate from the global inventory for temperature (top) and precipitation (bottom). Dots indicate records assigned to a specific location; rectangles mark relevant domains.

Temporal availability

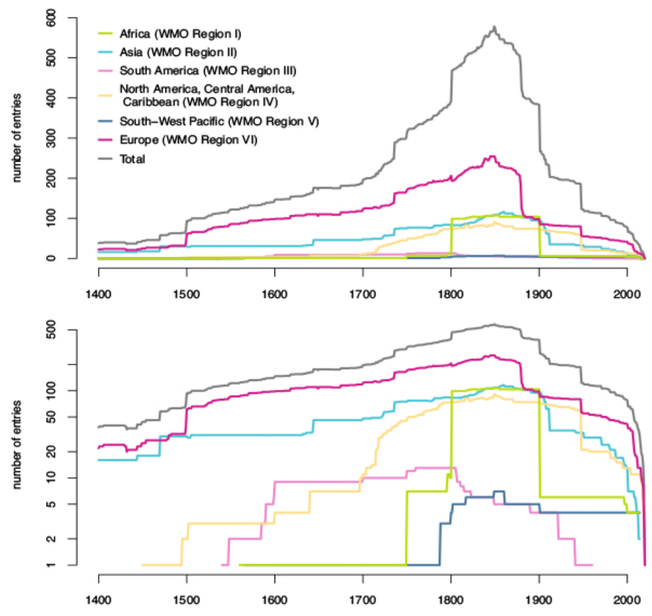

Figure 2 | Number of available documentary series related to climate as a function of time and region. Bottom panel depicts available series with logarithmic scaling of the y axis.

Documentary-based time series are **available across all WMO Regions** but are unevenly distributed in space and time.

While about half of all the data stem from Europe, an approximately even amount of evidence exists for Asia, Africa, and North America. South America and the South-West Pacific are sparsely covered.

The **number of available data series steadily increases with time** across all regions and peaks around the mid 19th century (577 series). The subsequent gradual decrease is among others related to the changing relationship between instrumental and non-instrumental records.

Temperature response to the Laki eruption 1783/84

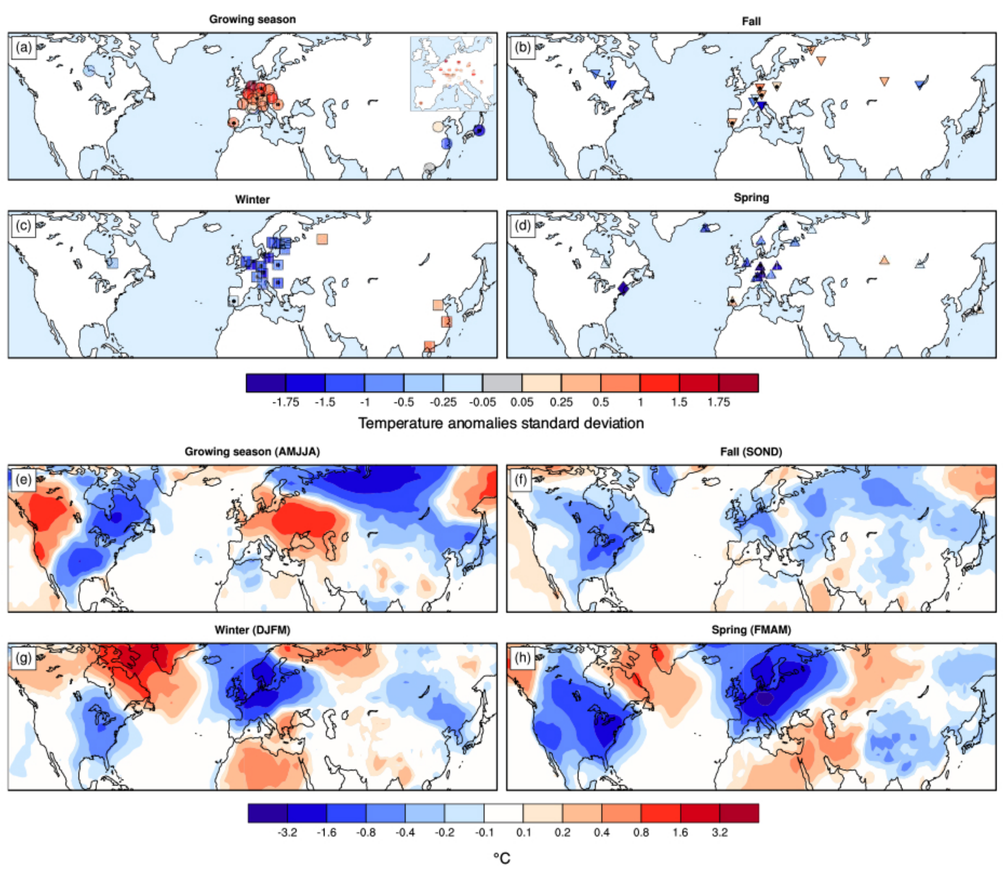

Figure 3 | Seasonal temperature composites from documentary series for the Laki eruption 1783-1784 (relative to the combined averages of the 10 years prior and 10 years after). (a) shows the growing season proxies for 1783, (b) fall proxies for 1783-1784, (c) winter proxies for 1784-1785, and (d) spring proxies for 1784-1785. (e) through (h) show composites of 2m surface air temperature during the corresponding seasons based on the EKF400v2.0 reanalysis. Documentary proxies used in the EKF400v2 are indicated by a black dot.

TAKE HOME MESSAGES

This global inventory of document-based climate time series ...

- **... comprises roughly 700 essential documentary records for temperature and precipitation from all continents.**
- **... promotes the first-ever large-scale perspective on documentary evidence related to climate.**
- **... lies the foundation for incorporating documentary evidence into global climate reconstructions.**