Neue Studie identifiziert „auffällige“ Verbindung zwischen solarem Antrieb und Klimaschwankungen über Jahrtausende

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Kenneth Richard

„Bisher war der Ursprung der Klimadynamik in den zentralen Anden während des letzten Jahrtausends nur spekulativ. Auf der Grundlage statistischer Beweise haben wir die solare Variabilität als ihren Ursprung identifiziert“. – Schittek et al., 2025

In einer neuen Studie haben die Wissenschaftler festgestellt:

1) Die Kleine Eiszeit (LIA) war ein globales Kälteereignis.

2) Klimaschwankungen (Niederschlag) auf der südlichen Hemisphäre (peruanische Anden) stehen in engem Zusammenhang mit Schwankungen der Sonnenaktivität in den letzten 1 000 Jahren.

3) Die moderne (1900er-2000er Jahre) und die mittelalterliche Klimaanomalie sind mit geringeren Niederschlägen verbunden, während die niedrigeren Temperaturen der LIA mit mehr Niederschlägen verbunden sind.

„…die LIA war ein globales Ereignis, das durch ein weltweites Vorrücken der Gletscher gekennzeichnet war.“

„Die Sonneneinstrahlung ist der Hauptantrieb für alle Prozesse der Klimazirkulation auf der Erde. Die Beweise für einen direkten solaren Einfluss auf das Erdklima werden immer zahlreicher.“

„Unsere Studie zeigt, dass Niederschlagsveränderungen in den südöstlichen peruanischen Anden mit Schwankungen der Sonnenaktivität während der Kleinen Eiszeit (LIA) in Verbindung stehen.“

„Mehrere Studien führen die Abkühlung des Klimas während der LIA auf solare Einflüsse zurück, insbesondere während des Wolf-, Spörer-, Maunder- und Dalton-Minimums.“

„Die Position der ITCZ [Innertropischen Konvergenzzone] hängt stark vom innerhemisphärischen Temperaturgradienten ab, der durch den solaren Antrieb ausgelöst wird.“

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Solar forcing as driver for late Holocene rainfall intensity in the Peruvian Andes

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The Little Ice Age (LIA) was a period of increased global temperature and precipitation variability that lasted from approximately 1250-1850 A.D. (Solomina et al., 2015; Autin et al., 2022; Wanner et al., 2011). Proxy climate records from many locations (Jones and Mann, 2004) and climate simulations of varying complexity (see Jomelli et al., 2022) suggest that the LIA was a global event, marked by the advance of glaciers worldwide. Solar irradiation is the primary driver for all climatic circulation processes on Earth (Steinhilber et al., 2009). Evidence for a direct solar influence on the Earth's climate has been growing due to the increasing continuity, length and resolution of paleoclimate reconstructions (Varma et al., 2011; Carozza et al., 2014; Brehm et al., 2021). Reconstructions of total solar irradiance show that the LIA included intervals of lower solar irradiance ("solar minima") that were repeatedly interrupted by warmer phases (Brehm et al., 2021; Wanner et al., 2022).

Throughout the 1070-year sediment record, Ti/coh values were generally low between 900 and 1250calyr AD, during the Medieval Climate Anomaly (MCA). The amplitude of fluctuations increases significantly with the onset of the LIA around 1250calyr AD, peaking at 1280–1400, 1450–1520 and 1620–1880calyr AD. Pronounced minima in Ti/coh ratios during the LIA occur around 1270, 1420–1460 and 1540–1600calyr AD. From 1900calyr AD to the present, Ti/coh values reach the lowest level in the entire record, corresponding with sediments characterized by high organic content and reduced allogenic input.

Ice accumulation at the Quelccaya ice cap increased after 1350calyr AD, indicating a significant decrease in temperature (Thompson et al., 1986, 2013). The Ti/coh ratio in the LC record peaks at 1450–1520, 1600–1750, 1780–1820 and 1840–1850calyr AD. These peaks show striking agreement with LIA-related research in South America (e.g. Licciardi et al., 2009; Varma et al., 2011; Polissar et al., 2006) and interhemispheric approaches to temperature variability during the late Holocene (e.g. Jomelli et al., 2022; Moffa-Sánchez et al., 2014; Mann et al., 2009). The LC record therefore clearly confirms interhemispheric climate linkages.

Increased allogenic sediment accumulation in the peat matrix occurred during the solar minima of the LIA. Hence, our study reveals evidence that precipitation changes in the south-eastern Peruvian Andes are linked to variations in solar activity during the LIA (Fig. 6).

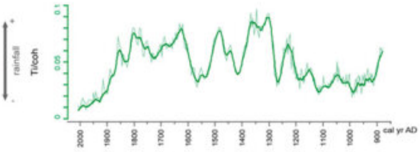

Fig. 6. The late Holocene Ti/coh ratio and Senecio-type Asteraceae/Poaceae pollen ratio sequences of the LC

Changes in humidity associated with changes of the strength of the SASM have been demonstrated by several studies in the Peruvian Andes (e.g. Arnold et al., 2021; Campos et al., 2022; Jara et al., 2020; Novello et al., 2018; Schittek et al., 2018, 2016; Bustamante et al., 2016; Stroup et al., 2014; Vuille et al., 2012; Bird et al., 2011; Reutter et al., 2009), all confirming the transition from a warmer and drier climate during the MCA towards a significantly cooler and wetter climate during the LIA.

So far, the large-scale climate oscillation signature of the LIA has remained relatively unclear outside the North Atlantic region (Mann et al., 2008). From our data, we suggest that the role of the Sun in modifying SH tropospheric circulation patterns needs to be reconsidered. Several studies attribute climate cooling during the LIA to solar forcing, particularly during the Wolf-, Spörer-, Maunder- and Dalton-Minima (Wanner et al., 2022; Brehm et al., 2021; Owens et al., 2017; Usoskin et al., 2015; Burn and Palmer, 2014). Volcanic forcing has also played an important role (Steinhilber et al., 2012) and features prominently in recent work (see Wanner et al., 2022). However, while volcanic eruptions have had a strong climatic impact, their influence on climate has been rather short-lived (Versteegh, 2005; Hegerl et al., 2003; Shindell et al., 2001). According to Helama et al. (2021), they can enhance cooling beyond a tipping point, leading to repeated Holocene cold climate events.

On a centennial scale, the evidence for solar-climate relationships in South America is clearly underrepresented. This is due to a lack of information and a lack of resolution in the archives, rather than a lack of response to solar forcing (Versteegh, 2005). Varma et al. (2011) showed that the XRF-measured iron contents of a marine core from the Chilean continental slope (41°S) are significantly correlated with reconstructed solar activity (Solanki et al., 2004) over the past 3000 years (r=0,45 [0,37; 0,53]). Our measured Ti/coh values show an even higher correlation (r=−0,52 [−0,38; −0,92]) compared to a new solar activity reconstruction (Steinhilber et al., 2009).

The correlation of the LC Ti/coh record with the solar activity minima and maxima is striking. Solar forcing appears to trigger the sedimentation characteristics of the chosen site, as changes in solar activity have a strong influence on regional precipitation rates via the modification of the SASM intensity. A stronger SASM provokes a stronger precipitation, which leads to a stronger erosion within the LC catchment and finally to a stronger lithic influx into the peat/organic sediment matrix.

Until now, the origin of the climate dynamics of the Central Andes during the last millennium has been speculative. On the basis of statistical evidence, we have identified solar variability as its origin. The interhemispheric climate link is based on the perturbation of the global heat balance. NH cooling due to solar forcing together with an increase in Arctic sea ice export weakens the AMOC, followed by an increase in southern tropical Atlantic sea surface temperatures, affecting the southward migration of the ITCZ (Schneider et al., 2014; Vuille et al., 2012). Proxy evidence documents such southward shifts of the ITCZ during cooling events in the NH, especially during pronounced events such as the LIA and the Younger Dryas (Bird et al., 2011; Haug et al., 2001). A more southerly position of the ITCZ triggers a moisture flux into the tropical lowlands, which enhances convective activity in the Amazon basin. As the main source of moisture in the tropical/subtropical Andes is the Amazon basin, it is suggested that the SASM intensity and central Andean precipitation are very sensitive to changes in NH temperatures (Vuille et al., 2012).

The position of the ITCZ is robustly dependent on the interhemispheric temperature gradient (Schneider et al., 2014), triggered by solar forcing. The cooling of the LIA led systematically to a southward shift of the ITCZ and hence a strengthening of the SASM, resulting in an intensification of precipitation over the Peruvian Andes.

Quelle: Schittek et at., 2025

Link: https://notrickszone.com/2025/03/13/new-study-identifies-a-millennial-scale-striking-link-between-solar-forcing-and-climate-patterns/

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