Climate science

Frequency of long La Niña events expected to rise

Xian Wu

La Niña events involve a cooling of the tropical Pacific Ocean, and can last for two years or more, prolonging their impact. Climate simulations reveal that global warming could cause multi-year La Niña events to become more frequent. **See p.774**

Sea surface temperatures in the equatorial Pacific Ocean undergo episodes of cooling called La Niña events, which strongly influence global climate and weather patterns through atmospheric pathways that transmit climate signals over thousands of kilometres. A three-year-long La Niña event beginning in 2020 had a key role in triggering consecutive seasonal droughts in parts of the United States and the Horn of Africa, and in causing floods in eastern Australia. This rare 'triple' La Niña sparked worldwide discussion about how global warming could change the duration of these formidable events. On page 774, Geng *et al.*[1] suggest, using climate-model simulations, that multi-year La Niña events will be more frequent this century than they were in the last century.

Both warm (El Niño) and cold (La Niña) phases of the El Niño/Southern Oscillation (ENSO) system typically develop in the Northern Hemisphere summer, and peak in winter. Whereas El Niño events usually decay by the following summer, La Niña events tend to persist for two to three years[2]. Strong El Niño events drive these multi-year La Niña events, mainly by inducing an intense discharge of heat from the upper layers of the equatorial Pacific[3–5]. However, not all multi-year La Niña events follow strong El Niño events, and these exceptions can be influenced by variability in distant oceans[6–9], including the subtropical North Pacific and the tropical Atlantic and Indian oceans.

Geng *et al.* investigated how global warming might affect the frequency of multi-year La Niña events by looking at a set of climate models drawn from phase 6 of the Coupled Model Intercomparison Project (CMIP6; see go.nature.com/3garyzc). From this set, the authors selected the 20 models that best reproduce ENSO characteristics and found that most of them project a higher likelihood of multi-year La Niña events in this century relative to the last century.

An average of all 20 projections suggests a statistically significant increase of 33 ± 13% in multi-year La Niña frequency under a warming scenario brought on by high greenhouse-gas emissions (Fig. 1). The low-emissions scenario still puts the increase in frequency at 19 ± 11%. In the high-emissions scenario, 75% of the models predict that the frequency will increase, whereas only 59% of the models project an increase for low emissions. These statistics suggest that reducing future emissions could help to mitigate the risks of more-frequent multi-year La Niña events.

Geng *et al.* argue that strong El Nino events will not be solely responsible for the predicted frequency increase of multi-year La Niña events. Pronounced warming trends in the subtropical northeastern and eastern equatorial Pacific Ocean are also likely to have a role, because this warming enhances the way in which the subtropical Pacific responds to ENSO perturbations. Specifically, decaying El Niño events induce easterly winds over the northeast Pacific that span a wider north–south range than they would without global warming, and increase the probability of a La Niña event after El Niño. The northward expansion of these easterly wind anomalies also reduces twisting of the wind near the Equator in the first year of La Niña events. This further slows the refill of heat in the upper layers of the equatorial Pacific Ocean, prolonging the La Niña event and pushing it into a second year.

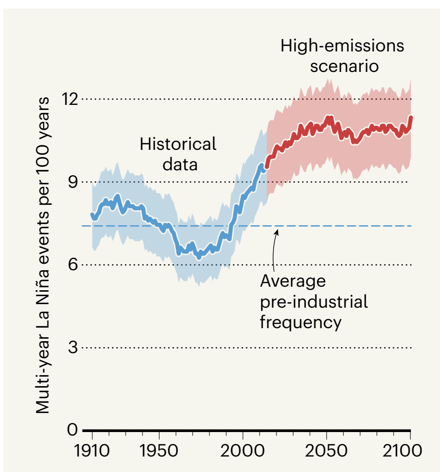

Figure 1 | Projected increase in the frequency of multi-year La Niña events. Climate phenomena known as La Niña events can last for two to three years. Such multi-year events occurred an average of 6 to 8 times per 100 years from 1850 until the end of the twentieth century (years on the horizontal axis mark the end of a 60-year sliding window for calculating this average). Geng *et al.*[1] studied a set of climate models, many of which predict an increase in this frequency, especially under a warming scenario involving high greenhouse-gas emissions. The solid line indicates the average over all the models and the shading shows 95% confidence intervals. The dashed blue line indicates the average pre-industrial frequency calculated with a control simulation. (Adapted from Fig. 2b of ref. 1.)

Projecting ENSO's future behaviour remains a challenge, owing both to model deficiencies and to ENSO's inherent variability. Observations over the past 40 years suggest that the eastern equatorial Pacific is cooling[10,11], and that this trend has been accompanied by frequent multi-year La Niña events. However, climate models have trouble capturing the cooling trend[10,11], as well the long-term climatic state of the tropical Pacific Ocean and the observed behaviour of ENSO[12]. It therefore remains unclear whether the observed cooling and concurrent La Niña changes have arisen from the inherent variability of climate or as a forced response to climate change. Further study of the uncertainties associated with both of these factors will be needed to support Geng and colleagues' prediction of more-frequent multi-year La Niña events, and to inform future risk assessments.

Geng *et al.* focused mainly on the second year of multi-year La Niña events, and found no consensus among models about projected changes in the frequency of a third year. Obtaining statistically significant insights into triple La Niña events requires long-running simulations or a large number of them, as well as palaeoclimate data, because records spanning short periods in Earth's history are limited by sampling error. The authors' results shed light on the complex influence that global warming has on ENSO and on long-term trends in the tropical Pacific. A projected increase in multi-year La Niña events underscores the importance of investigating the potential effects on global climate, particularly for those regions that are most susceptible to their impact.

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The author declares no competing interests.

Public health

A sustainable solution for infectious-disease control

Nathan C. Lo & Benjamin F. Arnold

A trial in Senegal has tested an innovative method for tackling a common human parasitic disease. The approach reduced infection numbers and also offered agricultural and economic benefits. **See p.782**

Schistosomiasis, one of the most common human parasitic diseases, is a global menace because of its high rates of infection and contribution to poverty. Over the past two decades, global campaigns using antiparasitic medication have been carried out to combat the scourge of the disease. In 2022, the World Health Organization released guidelines[1] to further expand the scale of these mass-treatment campaigns, with the goal of eliminating schistosomiasis as a public-health problem by 2030. Although this strategy has yielded clear public-health benefits[2], the following key question remains: what solutions can be devised to further combat schistosomiasis and forge a sustainable future? On page 782 , Rohr *et al.*[3] identify an innovative and transdisciplinary solution to reduce cases of schistosomiasis.

The authors took the approach of removing invasive freshwater vegetation to dismantle the habitats of the snails responsible for transmitting the parasite. The intervention not only reduced parasite prevalence in humans, but also improved agricultural and livestock yield by making use of the vegetation. This is therefore potentially a win–win approach for human health and economic development.

The parasitic worm's life cycle includes an intermediate stage in a freshwater snail host of the genus *Biomphalaria* (Fig. 1) or *Bulinus*. Human infection, caused by worms of the genus *Schistosoma*, occurs with freshwater exposure (such as in a lake), when skin-burrowing juvenile parasites enter and migrate through the human body. The worms produce eggs that are excreted from the body in urine or stools. If these eggs reach areas of fresh water, hatch and find a snail, and then infect a human host, their complex life cycle is completed.

Because of the parasite's requirement for snails as part of its life cycle, there is a long history of public-health interventions aimed at reducing the snail population. Such approaches have focused on chemically treating freshwater bodies[4]. These interventions have shown public-health benefits, but their adoption rates have been low, partly because of ecological concerns about the use of chemicals. This underscores the need for transdisciplinary research to develop holistic solutions for snail control that also consider key social and economic factors.

Rohr and colleagues carried out a trial (a three-year cluster randomized controlled trial) in 16 communities in Senegal. The authors tested an intervention that removed invasive underwater vegetation (*Ceratophyllum demersum*) from key water points. The vegetation supports a high density of snails, and the authors hypothesized that removing this habitat would reduce the snail population and, in turn, parasite infection among children.

During the trial, the study team removed a remarkable 433 tonnes of aquatic vegetation over multiple trips. In the communities that received the intervention, the authors found an eightfold reduction in the snail population and, more importantly, a 32% reduction in *Schistosoma mansoni* infection in schoolchildren (although there was no clear effect on *Schistosoma haematobium* infections) compared with those in control communities.

A key novelty of this study is what the authors did next: they hypothesized that farmers could use this removed aquatic

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Figure 1 | *Biomphalaria pfeifferi*. This species of snail can host the parasite that causes the human disease schistosomiasis.