the way from radio waves to γ-ray photons.

The results of Burrows *et al.* and Zauderer *et al.* are not, however, limited to being a surprise for astrophysicists — they could also help to shed light on the conditions and physical processes in action in the centre of galaxies. As I write, orbiting satellites and telescopes on Earth are observing Swift J164449.3+573451 at multiple wavelengths to constrain its spectral and temporal evolution. If the outburst of γ-rays was produced by a tidally disrupted star, the new source should eventually fade when all of the stellar material has been swallowed by the black hole.

In addition, future observations are likely to reveal more outbursts of this kind. Knowing the rate at which they occur will allow us to constrain the fraction of galaxies that harbour a massive black hole, the properties of black holes, and the density of stars in the central part of galaxies. Finally, witnessing the birth and early evolution of a new relativistic jet will give us a wealth of information on the jet-formation process itself, as well as on the way in which the jet interacts with the surrounding material as it opens a passage through the interstellar medium of its host galaxy. ■

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ENVIRONMENTAL SCIENCE

Climate for conflict

The idea that climate influences the onset of wars is enticing, but controversial. A study now finds a convincing correlation between global climate and civil conflict in countries affected by the El Niño/Southern Oscillation. SEE LETTER P.438

ANDREW R. SOLOW

The notion that climate can influence the course of a war is a commonplace — think of the armies of Napoleon and Hitler coming to grief in the Russian winter (Fig. 1), or the storms that broke up Kublai Khan's Mongol fleet and the Spanish Armada. But on page 438 of this issue, Hsiang *et al.*[1] go further by suggesting that climate can actually be a cause of war.

A growing body of work explores possible connections between climate and human conflict. In one controversial study published in 2009, Burke *et al.*[2] presented statistical results relating outbreaks of civil conflict in Africa to year-to-year variations in local temperature. This work has been criticized[3–5] — and defended[6,7] — on various technical grounds such as the details of the statistical model, the number of deaths required for classification as a civil conflict, and the sensitivity of the results to the period of analysis.

AKG-IMAGES

Figure 1 | Napoleon's retreat. Bitterly cold winter weather contributed to the failure of France's invasion of Russia in 1812. Hsiang *et al.*[1] now report that global climate can be a cause of war. (Wood engraving, after a painting by Jan Chelminski.)

Burke and colleagues' study[2] focused on the effect of local climate variations on civil conflict. By contrast, Hsiang *et al.*[1] present the first quantitative study linking civil conflict to global climate variations — specifically, those associated with the El Niño/Southern Oscillation (ENSO). The ENSO phenomenon is characterized by quasi-periodic, large-scale shifts in sea surface temperature in the eastern equatorial Pacific. Through its effects on atmospheric circulation, ENSO influences weather patterns around the world. Broadly speaking, during the warm El Niño phase of ENSO, the continental tropics tend to be warm and dry, whereas the opposite conditions tend to occur during the cold La Niña phase.

In light of the difficulty of uncovering a clear connection between civil conflict and local climate, it may seem that looking for a connection to global climate puts the cart before the horse. Hsiang *et al.*[1] argue otherwise. Among other things, they point out that the various economic and social factors underlying civil conflict in one country may be influenced by climate variations in others.

Hsiang and colleagues' study proceeded in two steps. In the first step, the authors used historical climate data to divide the countries of the world into two groups: 93 'teleconnected' countries, which have strong ENSO-related climate effects, including Australia, Ghana, Laos, Sudan and Trinidad; and 82 non-teleconnected ones that don't experience these effects, such as Afghanistan, Greece, Latvia, Sweden and Tunisia. In the second step, they used statistical models to see whether the rate of outbreak of civil conflict each year from 1950 to 2004 correlated with an annual index of ENSO for the two groups.

The analysis identified a statistically significant relationship between the rate of outbreak of conflicts and ENSO among the countries in the teleconnected group, but not among the others. In the teleconnected group, the rate of conflict increased from an estimated 3% in La Niña years to an estimated 6% in El Niño years. By performing a comprehensive sensitivity

analysis, Hsiang *et al*. found that their results were unaffected by modelling choices, including those involving the way in which civil conflict and ENSO conditions are measured. Although this work[1], like other studies in the field, was motivated in part by interest in the effects of global climate change, the authors take pains to note that ENSO-related variability is no proxy for long-term climate change.

Careful statistical analyses such as this one[1], which relate complex human behaviour to environmental factors, can be invaluable, but they need to be complemented by more detailed studies focusing on the underlying human dynamics. Hsiang *et al*. clearly understand that any effect of climate on conflict is likely to be indirect — people do not start wars simply because they are hot. One plausible hypothesis to explain the authors' findings is that the warm, dry conditions during El Niño years reduce agricultural yields, leading to conflict related to food availability.

However, as Hsiang and colleagues note[1], their analysis hints at an alternative hypothesis: civil conflicts do not originate with climate variations, but they do wax and wane, possibly as part-time fighters move in and out of agriculture. Interestingly, the same possibility was proposed[5] to explain the earlier work of Burke *et al*.[2]. Whether global climate variations give rise to new civil conflicts or modulate existing ones would seem to have somewhat different implications for improving the situation. For example, if the first theory is correct, then efforts could be made to address simmering problems that might erupt into conflict. But if the second suggestion is true, then peace-keeping efforts should focus mainly on situations that have already boiled over. Hsiang and colleagues' results should encourage a deeper look into this issue. ■

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DENGUE FEVER

Mosquitoes attacked from within

Infection with a harmless bacterium makes the mosquitoes that transmit dengue virus resistant to viral infection. The resistant population can rapidly replace the natural, susceptible population. SEE LETTERS P.450 & P.454

JASON L. RASGON

Dengue fever is the most prevalent mosquito-borne viral disease in humans. The virus is transmitted mainly by the mosquito *Aedes aegypti*, and so targeting this insect has been considered a viable option for controlling the incidence of the disease. In two papers in this issue (Walker *et al*.[1] and Hoffmann *et al*.[2]), a team of researchers reports an unusual approach for making *A. aegypti* almost completely resistant to infection, and thereby blocking transmission of dengue virus. Moreover, when the authors released their dengue-resistant mosquitoes into the wild, the insects replaced nearly 100% of the natural, susceptible mosquito population within a matter of months.

Around 40% of the world's population is at risk of infection with dengue virus. Every year, the virus infects 50 million to 100 million people, causing classical dengue fever as well as more severe symptoms such as dengue haemorrhagic fever and dengue shock syndrome. In the absence of an effective vaccine, controlling dengue is limited to targeting the mosquitoes that transmit the virus[3]. Many mosquito-control strategies are based on suppressing or eliminating the insect population. By contrast, population-replacement strategies aim to replace the pathogen-susceptible mosquito population with a resistant one[4].

The bacterium *Wolbachia* is a common endosymbiotic associate of many insects, including mosquitoes, and lives inside their cells. It is maternally inherited, and manipulates the reproduction of its invertebrate hosts in various ways to maximize the number of infected females in the next generation; this allows *Wolbachia* to spread rapidly

50 Years Ago

Repeated investigations by the Medical Research Council have shown no evidence of a higher incidence of lung cancer or respiratory disease among persons exposed to increased amounts of Diesel exhaust fumes … Mr. Freeth [the Parliamentary Secretary for Science] also said that the Warren Spring Laboratory of the Department of Scientific and Industrial Research has examined methods for removing smoke from the exhausts of Diesel-propelled road-vehicles, but no device yet tested has proved satisfactory. The British Internal Combustion Engine Research Association is undertaking fundamental work on the combustion process in Diesel cylinders which it is hoped may lead to remedial measures. Mr. Freeth said it is a fact that correct setting of the injectors and their proper maintenance and operation provide a simple and effective remedy.

From *Nature* 26 August 1961

100 Years Ago

As a supplement to the literary and historical Biblical exhibition which has been arranged at Bloomsbury for the tercentenary of the Authorised Version, an exhibition of the animals, plants, and minerals mentioned in the Bible has been arranged in one of the bays of the Central Hall of the Natural History Museum, South Kensington … The collection, and the guide to it, will be of special interest to those to whom the Bible plants and animals are rich in picturesque associations; but it is, of course, part of a liberal education to know that the "unicorn" was probably the extinct wild ox or aurochs, "behemoth" the hippopotamus, the "coney" the hyrax, and the "leviathan" of Job the crocodile.

From Nature 24 August 1911