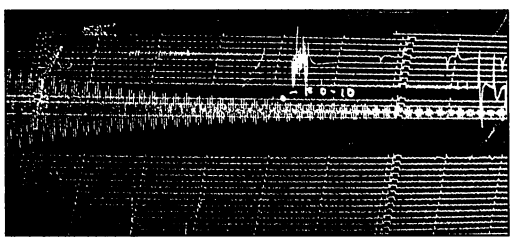
tions in gravity" inside the crater. At the time, he attributed them to instrument problems, but in retrospect these signals were probably related to near-surface bubbling or fluid pressure fluctuations in the magma below the dome that plugged the crater. Two other warning signs were a small ash emission from a small vent in the crater floor and a large number of rock falls from the crater walls in the "final minutes before the eruption."

In the months after the disaster, Williams was widely featured in the media, coverage that, he admits, "fed my not inconsiderable ego." Others in the crater that fateful day were increasingly concerned about how his version of the story tended to diminish their roles, and they were dismayed when Williams was referred to as "the sole survivor." To his credit, Williams is disarmingly frank in admitting an error of judgment on this issue. He speculates that his severe head injury may have affected his memory and subsequent actions.

Many volcanologists, including myself, strongly disagree with Williams's claim that "the best work...comes from those of us who walk into the crater." The 20th-century transformation of our discipline from a descriptive endeavor to a true science stemmed from the meticulous geologic observations and deductions of outstanding field geologists like George P. L. Walker on volcanic deposits from past eruptions and from the application of such observations by physics-minded volcanologists like Lionel Wilson to develop numerical and physical models of volcanic processes. None of these advances, nor our progress in understanding the origin and evolution of magmas, required setting foot in an active crater.



Unrecognized warnings. Small numbers of *tornillos* were recorded at Galeras in the weeks before the fatal eruption.

Does a young and evolving science learn from a tragedy like Galeras? As a result of the disaster, in 1994 the International Association of Volcanology and Chemistry of the Earth's Interior issued the first safety recommendations for scientists and the public. These guidelines encourage volcanologists to approach active volcanoes with greater caution and better preparation. But the deaths continue. On 27 July 2000, a large party of volcanologists was visiting the summit crater of Indonesia's Semeru volcano when an early-morning explosion killed two scientists and badly injured five others. Like the tragedy at Galeras, this incident reminds us that we know a lot about the workings of volcanoes, but clearly not enough to judge when an active volcano can be safely trodden on. Do we need to continue to take such huge risks? Let us hope that we can instead bring the concept of "telepresence" to bear on the world's most dangerous volcanoes. By developing and using robots and remotely controlled unmanned vehicles (for scientific instrumentation and for direct observation) we can better protect the public and those whose research may help reduce volcanic hazards.

BOOKS: CLIMATE AND HISTORY

The Shadow of Droughts' Deaths

Vaclav Smil

Mike Davis's latest book is a peculiar hybrid, and my task as a reviewer would have been easier had *Victorian Holocausts* simply been ideological and misleading. It is both, yet most of it is actually also objective, accurate, and revealing. The book's very title hints at these frustrating dichotomies. There is no doubt that the large-scale famines that repeatedly swept late-19th-century India and China and also severely affected parts of Africa and Brazil, added up to one of the greatest tragedies of modern era, with the combined (and never to be accurately quantified) toll of tens of millions. Many historians have documented these events with widely differing degrees of exactitude and detail. Davis—relying extensively, and skillfully, on their work—provides a comprehensive, comparative account of these tragedies. Most of these famines were obviously tied to prolonged droughts, and perhaps the key contribution of Davis's book is to demonstrate that these natural disasters represented the worst imaginable climatic teleconnections arising from the El Niño–Southern Oscillation (ENSO). But were these famines "Victorian holocausts"?

Late Victorian Holocausts
El Niño Famines and the Making of the Third World
by Mike Davis
Verso, London, 2001. 474 pp. $27, C$38, £20. ISBN 1-85984-739-0.

The adjective is justified when looking at India's suffering. A great deal of British and Indian research (much of it mined by Davis) has demonstrated the terrible long-term consequences of some colonial policies and the incredible blunders and obtuseness of many British officials confronted with these human catastrophes. But Davis uses the adjective in a deliberately global sense. His book implies that nearly every poor person who died of hunger during the closing decades of the 19th century was a victim of a "new world order" devised by that most despicable of all species, a "liberal capitalist" resident in London. Indeed, Davis concludes that many of these poor people "were murdered...by the theological applications of the sacred principles of Smith, Bentham and Mill." And the thrust and the tone of his arguments make it possible to go one step further, as Immanuel Wallerstein has in a dust-jacket endorsement of the book, and to claim that Davis shows "how capitalists used the vagaries of the climate to create underdevelopment in the late-nineteenth-century world." Here is a mind-boggling conspiracy of London mega-criminals, men who not only ran the world but also used adverse weather to their advantage.

And then there is the key titular noun: holocausts. Is it not clear, without engaging in definitional minutiae, that the term implies at least a large degree of premeditation, if not an entirely conscious design to inflict unimaginable suffering on entire populations? Davis clearly believes so, as his culprits are not called just "liberal capitalists" and worshippers of "the Gold Standard and the New Imperialism," but are bluntly labeled "El Niño's murderous accomplices." And finally, what are we to make of the dubious term "the Third World"? Only in a naïve perspective are the complexities of today's economies neatly divided into three "worlds."

Davis's view of the late-19th-century world as a vast stage peopled by millions of passive, innocent victims preyed on and deliberately destroyed by a small band of theologically zealous and murderously scheming Londoners is particularly inappropriate for analyzing the fate of Chinese peasants. During the late 18th century, Qing emperors felt confident to dismiss any Western overtures. A century later, they succumbed surprisingly easily to limited foreign intervention, while the neighboring (and poorer and weaker) Japan not only did not dissemble when faced with Western pressure but commenced its impressive rise toward modernity. I cannot imagine any moral justification for selling opium to China, and hence I would never defend the 19th-century British taipans whom Davis gives a decidedly modern label of narcotraficantes. But China's late-19th-century miseries (including the famines in a state that only a few generations earlier had possessed excellent capacities to moderate the impact of droughts and floods through distributions from well-maintained imperial granaries) were much more the result of a domestic collapse—of an imploding, spent, and irresolute civilization—than of any

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CREDIT: STANLEY WILLIAMS

grand Western design aimed at dismembering its empire and murdering its peasants.

Careful reading of the book shows that Davis is actually well aware of these—and many other—social, cultural, and political complexities. Sprinkled through the text are explanations and judgments that apportion the blame much more realistically. This awareness of complexity is even more exemplary when Davis traces the mystery of monsoons, narrates the discovery of the ENSO phenomenon (he knows there is "no canonical ENSO event"), and explains El Niño's fascinating dynamics and its vagaries and consequences (which are felt far beyond the Pacific realm of its periodic occurrence). These are the best chapters of the book.

Thus, *Victorian Holocausts* can be read very profitably by historians, economists, nutritionists, and climatologists, and by environmentalists of any stripe. All will learn more about the effects of climatic teleconnections on the 19th-century famines, colonial mismanagement in India, the demise of imperial China, or the plight of Brazil's arid Nordeste. And none need subscribe to theories of murderous global conspiracies planned and executed by a small number of zealots from the smoggy capital of Victorian England.

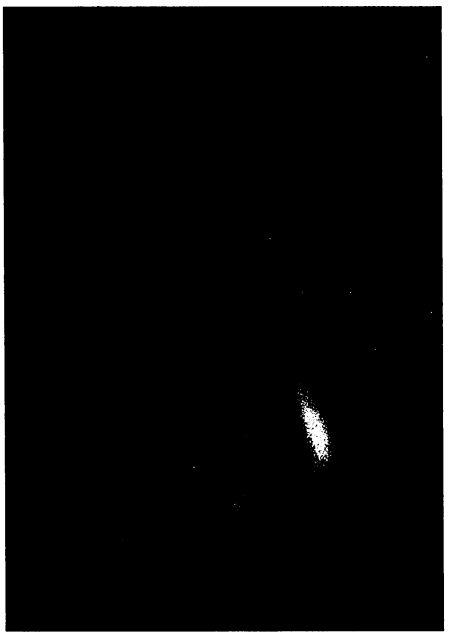
The book ends abruptly, without any recapitulation or conclusion. As a coda it would have been nice to acknowledge what common-sense policies and, yes, freed markets can do to combat ENSO in the modern world. In 1980, after decades of Maoist misery, China began disbanding its communes and privatizing its farming. Does Davis know that just a few years later, when the powerful 1982–1983 El Niño was affecting its climate, the country had two years of record grain harvests, which made it possible to abolish the food rationing that had lasted since 1954? Anybody out there willing to credit this to a Wall Street conspiracy?

BOOKS: ASTRONOMY

More Than a Mass of Incandescent Gas

J. R. Jokipii

The Sun has fascinated mankind for eons, and must surely have been one of the earliest objects of human veneration. Who cannot but fear and wonder about such a powerful object, which governs so much of what we do. Although the Sun was one of the first objects of scrutiny as the methods of science were brought to bear on understanding nature, until recently solar studies were limited to observations from beneath Earth's atmosphere. But the Sun's radiations include many different wavelengths of light and energetic particles, which are distorted or much diminished before reaching the ground. Therefore, many important solar processes remained unknown until scientists found means to surmount the obstacles presented by Earth's atmosphere and magnetosphere. Initially, balloons and rockets and then satellites and space probes were used to study the Sun from vantage points that minimized or even removed these obstacles. Each methodological advance revealed unsuspected and fascinating solar phenomena. The new insights have greatly increased our understanding of solar processes; the Sun we now know is vastly more dynamic and complex than it seemed 40 years ago. As instrumental development continues, future observations will undoubtedly produce changes equally dramatic.



Sun sparked. This aurora over Fairbanks, Alaska, was produced by the intense solar activity of late March.

The Sun from Space
by Kenneth R. Lang
Springer, New York, 2000. 373 pp. $64.95, DM129. ISBN 3-540-66944-2.

In *The Sun from Space*, Tufts University astronomer Kenneth Lang presents a lucid and coherent view of the perspectives opened up over the past decade by three spacecraft: Yohkoh, the Solar and Heliospheric Observatory (SOHO), and Ulysses. Yohkoh and SOHO use sophisticated detector systems to monitor and image a wide range of solar radiations from near Earth but beyond its atmosphere and magnetosphere. Ulysses is in a near-polar orbit around the Sun, which enables it to observe phenomena far above (and below) the ecliptic plane for the first time. Findings from these three spacecraft have combined to change considerably our view of many aspects of the Sun and its effects on Earth. Other spacecraft, such as the Advanced Composition Explorer (ACE) and the Voyagers are also contributing much to this story, although on a broader scale. Lang focuses more closely on the Sun and the inner solar system.

The author begins with a short overview that introduces the Sun and the roles of Yohkoh, SOHO and Ulysses in solar research. The subsequent six chapters each examine a different aspect of the physics of the Sun and the space around it. They also highlight how our understanding has been enhanced—and, in some cases, revolutionized—by these three spacecraft. For example, the chapter on the solar wind discusses the existence of two distinct kinds of wind, the fast and the slow, with dramatically different characteristics.

The book is quite well-written and is organized to make the material accessible and useful to readers with a range of backgrounds. Most of the discussions contain charts or graphs but no mathematics. In addition to this self-contained presentation, each chapter includes one or more "focus" sections, which dig a bit deeper into the topic at hand and which contain some elementary algebra. Although these supplementary sections are helpful to readers with the proper background, they are not necessary to follow the author's main arguments. Each of the six chapters concerned with solar and space physics ends with a list of major events in the development of our understanding of their topic. One could quibble with a few specific choices for these lists, but I found no serious faults or omissions in the areas where I was familiar with the history. Clearly, Lang is knowledgeable and has done his homework.

In the midst of heightened fears concerning changes in Earth's atmosphere and climate, it is appropriate that the book's final chapter focuses on the effects of solar processes on our environment, over both the short and the long term. This is a significant part of the new discipline of space weather. Improving our understanding of the Sun's effects on weather and climate will help us separate out anthropogenic effects and, thus, enable rational decision-making. In this context, Lang provides an important book.

I can recommend *The Sun from Space* to anyone interested in a coherent and accurate account of recent advances in our understanding of the Sun and the many ways in which it affects our lives.

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