LETTERS

Edited by **Jennifer Sills**

Weather stations lack forest data

ACROSS THE GLOBE, weather stations record temperatures for numerous purposes, including real-time weather analyses, climatological and biological studies, and agriculture. Yet, virtually all weather stations on land follow the World Meteorological Organization's guidelines that sensors should be installed well away from trees (*1*–*3*). Thus, although warming of the terrestrial macroclimate is clearly evident from weather station data, we actually do not know how temperatures are changing beneath trees.

Weather radar station in Germany.

This is a major concern because forests cover 27% of the land surface on Earth and harbor two-thirds of all terrestrial biodiversity (*4*, *5*). Much of this diversity lives below the upper foliage of trees. The scarce microclimatic data that are available from forest understories record nonuniform and nonlinear responses of subcanopy temperatures to above-canopy warming (and even buffering against temperature changes), due to factors such as canopy structure, season, tree species, and management (*3*). This makes subcanopy temperatures hard to predict from open-field measurements.

The fact that standard terrestrial weather stations are not installed in forests is of paramount importance for climate effects on processes that take place in the shade, such as tree regeneration, biodiversity dynamics, and nutrient, water, and carbon cycling, and thus also for macroclimate modeling (*6*, *7*). To further our understanding of climate change, we urgently need to better quantify how temperatures are changing inside the world's forests.

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Visa rules imperil collaboration

THE TRAGIC EVENTS in Paris, France, and San Bernardino, California, have led to an unfortunate response by U.S. lawmakers. In an amendment to the recently signed omnibus bill, changes to the Visa Waiver Program (VWP) were enacted that will substantially affect global scientific collaborations and exchanges. The program previously allowed citizens of 38 nations to travel to the United States without a visa for up to 90 days—a great boon to scientists and academics who wished to participate in conferences or take part in research projects. Indeed, the goal of the program was to encourage such interactions by reducing barriers to travel.

The changes to this program focus on four countries in the Middle East and North Africa (MENA) region (*1*). Dual nationals of Iran, Iraq, Syria, and Sudan, as well as others who have traveled to those countries since 2011, are prohibited from traveling to United States without a visa by the VWP (*2*). Given the potential for reciprocal restrictions upon American travelers by other countries (*3*), this change will impede global scientific exchanges and dialogue and will obstruct the work of scientists and health professionals who travel to the MENA region, including members of charitable organizations such as Doctors Without Borders, UNICEF, and Save the Children. As scientists, we need to work diligently to create communities that model successful and peaceful collaborations [e.g., (*4*, *5*)], and the changes to the VWP stand in the way of that mission.

During the Cold War, American and Russian scientists collaborated to develop groundbreaking prototypes to the oral polio vaccine (*6*). The danger posed by the Cold War was at least as great and arguably greater than the current danger from terrorism; yet, despite open enmity between nations, scientific collaborations produced a breakthrough that prevented millions of people from dying or becoming disabled due to polio. Are we willing to sacrifice that kind of progress out of fear of terrorism?

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Mechanistic biological modeling thrives

IN THEIR PERSPECTIVE "Systems biology (un)certainties" (23 October 2015, p. 386), P. D. W. Kirk *et al.* may give readers the impression that mathematical modeling and computer simulations of biological systems have fallen on hard times, owing to difficulties in measuring parameter values. The authors write that quantitative modeling in biology is under attack for applying data-driven models whose structure and parameters lack physical meaning. They suggest that such abstract models are necessary because biological parameters are hard to measure. In spite of their intrinsic limitations (*1*), we agree that abstract models can be powerful tools to address systems such as gene networks. We also agree that uncertainties should be reported.

However, we wish to stress that physically motivated, mechanistic modeling of complex biological systems is thriving,

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driven in large part by increasingly accurate measurements of molecular numbers, activities, and organization in live cells (*2*) and even in whole organisms (*3*). Whenever available, such information should be incorporated to constrain the structure and parameters, as it improves the model's ability to identify the mechanism. Thus, it is misleading to write that "fundamental physical laws…often do not provide a good starting point for understanding how biological organisms and systems work" or that "the abundances of all the key players (molecules, cells, or individuals) cannot be measured simultaneously and continuously."

Microscopically realistic modeling, constrained by independent parameter measurement, has driven the physical sciences for centuries. As in these fields, model predictions in modern quantitative biology often motivate new experiments that yield parameter values and structural revisions, and successful models converge on the actual molecular mechanism over time. Only mechanistic models allow physical principles and intuition gleaned from countless previous studies to be called upon to guide model development.

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TECHNICAL COMMENT ABSTRACTS

Comment on "Broken translational and rotational symmetry via charge stripe order in underdoped $YBa_2Cu_3O_{6+y}$"

B. V. Fine

Comin *et al*. (Reports, 20 March 2015, p. 1335) have interpreted their resonant x-ray scattering experiment as indicating that charge inhomogeneities in the family of high-temperature superconductors $YBa_2Cu_3O_{6+y}$ (YBCO) have the character of one-dimensional stripes rather than two-dimensional checkerboards. The present Comment shows that one cannot distinguish between stripes and checkerboards on the basis of the above experiment.

Full text at http://dx.doi.org/10.1126/science.aac4454

Response to Comment on "Broken translational and rotational symmetry via charge stripe order in underdoped $YBa_2Cu_3O_{6+y}$"

R. Comin, R. Sutarto, E. H. da Silva Neto, L. Chauviere, R. Liang, W. N. Hardy, D. A. Bonn, F. He, G. A. Sawatzky, A. Damascelli

Fine questions our interpretation of unidirectional stripes over a bidirectional checkerboard and illustrates his criticism by simulating a momentum space structure consistent with our data and corresponding to a checkerboard-looking real space density. Here, we use a local rotational-symmetry analysis to demonstrate that the simulated image is actually composed of locally unidirectional modulations of the charge density, consistent with our original conclusions.

Full text at http://dx.doi.org/10.1126/science.aac4778

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