



Research Story

Monday, March 3, 2014

# Ghosts of Climates Past

Research on historical climates could improve predictions for our planet's future.



Shen works to minimize errors in estimating ancient climate data.

**Story Keywords:** 360, Sciences, Faculty, Graduate Students, Ecology, Environment, Geography, Natural Disasters, People

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*This story is featured in the spring 2014 issue of 360: The Magazine of San Diego State University.*

**Sam Shen** knows there's something incongruous in being one of the world's top experts in measuring climate uncertainty while living in one of the most agreeably constant weather environments around.

"It is ironic that I study weather here in San Diego," he said.

But life hasn't always been so sunny for Shen, a San Diego State mathematics and statistics professor whose work focuses on improving the accuracy of climate change predictions.

He grew up poor in a rural Chinese village. His father prioritized his education, though, and he beat the odds to become one of only three village boys in his grade to finish high school and the first one in his village to attend college.

### Full of "errors"

Shen came to the United States in 1983 to earn his master's and doctorate degrees in mathematics at the University of Wisconsin—Madison. In 1989, he began a 17-year stay in Canada, first at the University of Saskatchewan, then at the University of Alberta, where he emerged as a leading expert in finding ways to reduce the uncertainty, or error size, in measuring climate change variables.

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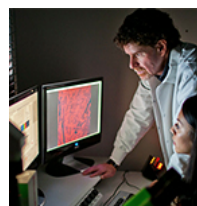
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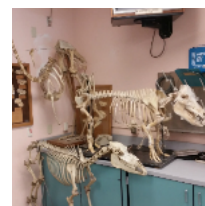
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"My joke is, my papers are full of errors," Shen said.

Recently, he has focused on obtaining accurate information about historical climates in order to make better predictions about the future.

"People say temperatures are increasing, but how do you measure that?" Shen asked. "It's a tricky question when you're trying to predict the climate's future based on its past. One hundred years ago, we didn't have satellites recording all over the world."

More than a century ago, methods used by early climate researchers to collect precipitation and temperature weren't as accurate as today's, and they missed much of the globe. Without knowing what the climate was like in, say, sub-Saharan Africa at the turn of last century, scientists are basing future predictions on an incomplete historical record.

### **Predicting the past**

To fill in the gaps, Shen applies an advanced mathematical method known as spectral optimal averaging to the historical atmospheric data that does exist. It allows him to extrapolate accurate estimates from the patchy, ancient data.

Working with one of his graduate students, **Nancy Tafolla**, Shen looked at rainfall over the United States and its surrounding oceans in the early 1930s—a period defined by lower-than-average rainfall and dusty, arid conditions across the country.

"Looking at that data, you can see why in the 1930s in the U.S., the Dust Bowl was so overpowering," Shen said. "Our work can help to amplify the signal of extreme weather so we can have better detection of weather patterns in our changing climate."

In recognition of his body of work, SDSU has named Shen the Albert W. Johnson Research lecturer for 2014, the university's highest research honor.

Thanks in part to Shen's measurements, the Intergovernmental Panel on Climate Change confidently asserted that no doubt remained over the reality of global warming.

"The IPCC stated that the error estimate is small enough that it doesn't alter the global warming conclusion," Shen said.

While Shen's research often looks to the past, his teaching keeps an eye to the future. Several of the undergraduates and graduate students he mentors will likely be leaders among the next generation of climate modelers.

### **Enjoying sunny climes**

"How lucky I am to be working with such bright students," Shen said. "They take their own initiative and produce first-rate work. If you give them a research problem, they come back, not just with results, but also with additional questions and problems."

For all the uncertainty he deals with in the lab, though, he's happiest when he gets to enjoy San Diego's sunny, predictable placidity.

"This is the only place in the U.S. you can eat outside every day," he said. "You don't have to put on 10 jackets when you go out. Life here is really pleasant."

***The Albert W. Johnson Research Lecture is scheduled for Friday, March 14, at 3 p.m. in room 201 of the Arts and Letters Building.***

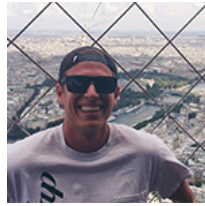
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