## Solving the Puzzle of the Sky

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**By Roger Witherspoon**

For Warren Washington, a lifetime of researching the heavens began with a relatively simple question posed by a high school chemistry teacher: Why are egg yolks yellow?

"Instead of explaining the answer," recalled Washington, "she asked me to find out, which stimulated me. The answer lay in their diet. I looked up what chickens ate, and most of the time, they ate seeds and corn. I looked for the compounds that had yellow in them, and it turns out that they were compounds that had sulfur.

"Pure sulfur is bright yellow, and certain sulfur compounds are found in seeds. When chickens ate those things, it concentrated the sulfur in the yolk. I found the answer to that, and never looked back."

He has been posing questions and seeking answers ever since. But his intellectual gaze has been focused on the heavens, rather than the terrestrial world, and becoming one of the world's foremost authorities on climate modeling. ( **http://www.ncar.ucar.edu/** )

Washington, who says he was always intrigued with mathematics, earned his bachelor's degree in Physics at Oregon State University, and got a summer job in 1959 at the Stanford Research Institute as a mathematician making computer models of the atmosphere. At the time, Oregon State had one of the earliest major computers, the ALWAC, and "it seemed like an exciting prospect to have a computer model that could predict and simulate the atmosphere.

"Physics has certain laws which govern the motion of things like how fluids flow, and the atmosphere could be considered a fluid. Some of the basic equations on forecasting the fluid flow of weather were known as early as 1904, and you could write them down, but couldn't solve them until the electronic computer became available. It was always intriguing that you knew the equations but could not solve them."

Washington earned a masters degree in meteorology at Oregon State and then went to Penn State, which was attempting to develop accurate computer models of the atmosphere, and became the nation's second African American (after Charles Anderson) to earn a PhD in meteorology. Upon graduation, Washington joined the National Center for Atmospheric Research, and began a career developing the world's primary modeling techniques for long range, global climate forecasting.

In the early 1960s, he said, computers were "fairly primitive" compared to the super computers of today, and the major problem for Washington and his four colleagues was just getting them to work at all. "Now we run these models on the world's fastest computers, and have large groups of people all over the world.

Washington's specialty was long term climate modeling – noting patterns over decades and centuries rather than dealing with individual storms lasting a matter of days. These models incorporate the earth's atmosphere, the oceanic interaction, land processes such as vegetation and terrain, heat generation from deserts as opposed to cities, and the impact of sea ice, to name a few. Washington developed models which accurately accounted for the observed past and present climate events, and then forecast long term climate changes.

Perhaps Washington's greatest contribution to the science of climate change was the development of the concept of parallel climate modeling. With funding from the Department of Energy, Washington put together a team in 1964 which began developing computer systems which would allow analysis of separate3 climate inputs from different parts of the world simultaneously. With parallel processing, he said, 1,000 computers could each be working on a different problem in a different part of the globe, and each received constant updates from the other computers. Eventually, the inputs from the entire globe are incorporated to some degree in every computation.

It is this development which made the international calculations of climate change possible and, he said, "We shared in getting the Nobel Prize, along with the other groups around the world."

Washington now heads the Climate Change Research Section of the Climate and Global Dynamics Division of the National Center for Atmospheric Research. His book, "An Introduction to Three-Dimensional Climate Modeling" written with Claire Parkinson, is the standard text on the subject.

From 1978 to 1984, he served on the President's National Advisory Committee on Oceans and Atmosphere. He has served on the Secretary of energy's biological and Environmental Research Advisory Committee since 1990. In 1995 he was nominated by President Clinton to the first of two six-year terms on the national Science Board, which oversees the national Science

Foundation. And while he is not an engineer, in 2002 he was inducted into the National Academy of Engineering “for pioneering the development of coupled climate models, their use on parallel supercomputing architectures, and their interpretation.”

At age 71, Dr. Washington is still at work refining models on the changing global climate picture. He is also an adviser to President Barak Obama and the Congressional Black Caucus on the impact of climate mitigation projects — especially those in the climate bill now wending its way through Congress — on Black communities.

“Especially in places like Mississippi and Louisiana,” said Washington, “you’ll find that coal plants are disproportionately located within Black communities. You have to make sure that mitigation efforts do not further contaminate the water and land around these facilities.”

The world-wide research on the issue is a far cry from the situation a half century ago, when he work with just a handful of scientists on climate modeling.

“I was one of those early canaries in the mine who was ignored back then,” Washington mused. It is nice to know that the world is paying attention now.”