John Mica (R–FL), is asking HHS to respond to criticisms from its own Office of Inspector General. Testifying before Mica's subcommittee on 3 May, HHS Deputy Inspector General George Grob called for "a greater sense of urgency" in improving the oversight of clinical research. He said that IRBs, in particular, need more resources.

"There's going to have to be a much greater investment in IRBs," agrees LeRoy Walters, director of the Kennedy Institute of Ethics at Georgetown University in Washington, D.C. "We have not modernized the research oversight system in the same way that we have modernized the research itself." Creating the new office at HHS and establishing an outside advisory panel is "a step in the right direction," says Walters. But he cautions that even this may not be enough: Ultimately, he says, an independent clinical research monitoring agency may be necessary.

Ralph Snyderman, president and CEO of the Duke University Health System, agrees that reform is needed, even if it costs more initially to beef up the IRBs, because "protecting human subjects may be the most important thing we do." He hopes the federal government will help pay for the cost. But he's "not passionate" about the idea of creating a new independent agency. His advice to the new czar: Begin by taking stock of OPRR's existing regulations and methods and consider "whether they are doing what they're supposed to do." —**ELIOT MARSHALL**

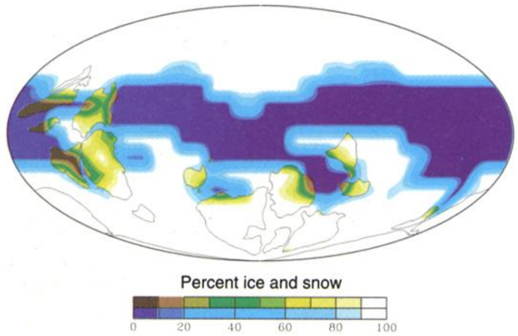
CLIMATOLOGY

A Refuge for Life on Snowball Earth

When a small group of geoscientists recently revived the snowball Earth hypothesis—the idea that the planet froze from pole to pole 600 million years ago—some scientists raised serious doubts. Although geologists have found evidence of extreme glaciation at that time, the paleontological record shows that complex life passed through unscathed. How could early life have weathered such a horrendous environmental catastrophe without suffering a mass extinction (*Science*, 10 March, p. 1734)? How could algae and perhaps even early animals have survived 10 million years sealed off by globe-girdling ice? Now climate modelers say that their most realistic models offer a possible resolution of the conundrum: In the tropics, climatic amplifiers built into clouds, winds, and currents may have counteracted the chilling effect of ice and snow.

Modelers trying to simulate the world of the Neoproterozoic era 600 million years ago are finding that the more realistic the climate model, "the harder it is to create climate change," says Mark Chandler of NASA's Goddard Institute for Space Studies (GISS) in New York City. "We've used the most realistic [model] boundary conditions to date, and we have not been able to freeze over the planet."

Work by Chandler and other modelers contradicts the so-called "White Earth solution" that climate modeler Mikhail Budyko of the Leningrad Geophysical Observatory came across in the 1960s. Working with the simplest possible climate model—a one-dimensional rendition of incoming solar radiation and Earth's outgoing radiation—Budyko found that if the planet's ability to retain heat through its carbon dioxide greenhouse were to weaken for any reason, then white, highly reflective snow and ice would creep toward the equator. The farther it got, the more solar radiation it would reflect back into space, further cooling the planet. If the sun were dimmer than today (it was about 6% dimmer in the Neoproterozoic), this albedo feedback effect would eventually take over, the ice and snow would rush across ocean and continent to the equator, and Earth would be locked in a snowball.



Not quite a snowball. A climate simulation of Earth 600 million years ago ices over low-latitude continents but not the tropical ocean.

SOURCE: M. CHANDLER AND L. SOHL/NASA GISS AND LAMONT-DOHERTY EARTH OBSERVATORY

In a paper appearing this week in *Nature*, paleoclimate modeler William Hyde of Texas A&M University in College Station and his colleagues report results for the Neoproterozoic from a more complex, two-dimensional version of Budyko's energy balance model. The model is coupled to a second one that can grow ice sheets on land, which in turn can affect climate. When greenhouse carbon dioxide is cut to half its concentration today—say, because unusually severe weathering of continental rocks sucked carbon dioxide out of the atmosphere—Hyde's model planet ices over, just as Budyko's did.

Albedo, however, is not the only feedback in the real world. Some loops work the other way, resisting cooling rather than reinforcing it. So Hyde and his colleagues had their model mimic one negative loop previously missing: the tendency for cooler temperatures to reduce the cloud cover and let in more warming sunlight. Even with the negative feedback, some tropical continents still iced over—consistent with geologic evidence of continental glaciation at low latitudes in the Neoproterozoic. But open water remained in the tropical oceans—a potential haven for life. "You could have open water," says modeler Thomas Crowley, Hyde's A&M colleague, "but we want to do more simulations" to tease out just which feedbacks are most important.

Simulations by other scientists confirm that the more realistic the model, the harder it is to freeze over the planet. Chandler and geologist Linda Sohl of Columbia University's Lamont-Doherty Earth Observatory in Palisades, New York, will soon report in the *Journal of Geophysical Research* that a GISS general circulation model (GCM) also leaves tropical waters open while icing over tropical continents. Unlike the A&M energy balance model, a GCM has an atmosphere as realistic as those used in weather forecasting as well as a simplistic ocean. "We kicked the model very hard" with a faint sun and greatly weakened greenhouse, says Chandler, "and it doesn't even come close to freezing over. The geologic record is doable with reasonable conditions for this time period."

Using an even more complex model, Raymond Pierrehumbert and Christopher Poulsen of the University of Chicago found that the model's ocean can also be crucial. "We can get Earth to freeze easily with a slab ocean," he says, referring to a model ocean devoid of currents. "But when we have a real ocean model, it transports enough heat [in currents] to the ice margin to hold the ice off."

Although these early modeling results are far too preliminary to prove that life would have had a refuge in any Neoproterozoic ice age, they offer some comfort to paleontologists. They're only models, says Guy Narbonne of Queen's University in Kingston, Ontario, "but what I find exciting is that [the A&M model] explains the geological relationships [such as low-latitude glaciation] and permits some of the things we see in the paleontological record." On the other hand, snowball proponents remind modelers that open ocean waters shouldn't be carried too far. "You can't have the whole tropical ocean open," says geochemist Daniel Schrag of Harvard University. "There's good evidence in the geological record that the ocean was sealed off or close to it." Even guessing how close will take more runs of more sophisticated models with more accurate Neoproterozoic conditions. —**RICHARD A. KERR**