

## Top researchers defend global warming report

*by Copley News Service*

San Diego's Scripps Institution of Oceanography has been involved in global-warming science for decades. The San Diego Union-Tribune's editorial board recently interviewed Scripps director Tony Haymet and scientist Richard Somerville.

Q: In summary form, tell our readers what is the core message of the Summary for Policy-makers report of the Inter-governmental Panel on Climate Change.

Richard Somerville: I'll say at the start that I'm not speaking as a representative of the IPCC. I have been deeply involved in it, coordinating lead author for this report for three years, but I'm speaking as a scientist for myself only, not as an official representative.

Q: What does 'coordinating lead author' mean?

A: IPCC has a lot of jargon and the report was written by a team of about 150 authors with help from many hundreds of other scientists and with review comments from many others. But the people who did the bulk of the writing was the team of 150 people called lead authors. And of those lead authors, two for each of the 11 chapters of the full report issued in May headed the teams for those chapters and they're called coordinating lead authors.

Q: Back to the summary.

Somerville: Once again I think that this IPCC report, the fourth in the series, the fourth assessment report, will have as its headline statements, first, that warming of the climate's system is unequivocal and second, that it's very likely that - very likely is a calibrated term meaning better than nine chances out of 10 - very likely that most of the (current) warming observed is human-caused.

Q: When you say unequivocal, you mean the knowledge of it is unequivocal, that's what you're saying?

Somerville: That's right. The fact that the climate has warmed is certain. I think aside from those two headline statements what distinguishes this report from its predecessors is first of all it is a reaffirmation of earlier conclusions about the reality and seriousness and it is the first Earth-system report in that it deals, not simply with global average quantities like temperature, but with regional aspects of climate change, what happens to variables other than temperature. So it goes into issues like the likelihood of heat waves and droughts and the effects of climate change on tropical cyclones. It's more comprehensive.

Q: The report presents itself as "nearing consensus on the climate change issue," yet we all know that there are still significant dissenters who dispute these findings or at least question the certainty about them. Why is that?

Somerville: I think we can probably both speak to that issue. I think that, firstly, consensus doesn't do full justice to what IPCC's role is. It's I think sometimes inaccurately portrayed as an organization that tries to hammer out views that everyone agrees on and neglects opinions on the fringe. And I've found now having spent a good part of my life for three years for the first time working inside IPCC and dealing with the discussions, that what IPCC really does is better characterized as an assessment. That where there is scientific agreement, where there is settled science, that's stated. Where there are areas of uncertainty and of research still to be done, which is true in all areas of active science, that's true in medicine, for example, then IPCC identifies those. We understand very well some of the ways in which sea level can rise. There are other ways, including the still mysterious dynamics of the ice sheets in Greenland and Antarctica, certainly there's research to be done, where you can't write the equations and just pull out a number. My answer to your question is that there is a scientific certainty or consensus, whatever term you want to use on the basic physics of global warming. We know the greenhouse effect is real. There's a natural greenhouse effect that keeps the Earth habitable. We understand the physics of how these gases like water vapor and carbon dioxide trap heat, act as a blanket. This is classical physics. It's a hundred years old.

People ask me if I believe in global warming. I say I believe in quantum mechanics. This is solid science. And we know that the real greenhouse affect has been there for a long time. Life on Earth as we know it wouldn't be possible without it. So we know also for a fact that mankind has added greenhouse gases, carbon dioxide and others.

That's Scripps' most famous result, showing carbon dioxide going up, for now. So there is, you might say, a virtual scientific certainty that adding those gases that are responsible for the greenhouse affect, and we've added a lot of them now. One out of four carbon dioxide molecules in the atmosphere today, roughly speaking, is the result of human activity.

The world's going to warm, it's going to warm substantially and what will that mean in terms of San Diego's coastline or California's water supply?

That's where the research frontiers (are). I don't think, even among the respectable contrarian or skeptic, whatever term you use, but the few scientists out there, that you're going to find any significant dispute on the basic science. I think that really is settled science.

Q: There is dispute on how much human activity caused it.

Tony Haymet: And we know exactly the science behind that.

Somerville: Yes. We know, for example, that a lot of ice did melt on Greenland 125,000 years ago and the world was a lot warmer then. And we know the cause of that. You're quite right. It had nothing to do with humans. It had to do with changes in the orbit of the Earth. You have to accept the idea that the natural causes of climate change, the ones that have always been there, volcanism is one, changes in the sun, they're still there. But now humans that have, who have been spectators to this pageant, are actors, too, and that's solid science, in as we cannot account for the climate changes we observe without also including the human causes.

Haymet: I'd like to come back to this issue of how certain we are and the so-called skeptics. I mean I think what's important to read from the IPCC report is that the report is telling us we're as certain as we'll ever get. You can find one in 10,000 scientists who believes that HIV doesn't cause AIDS. There's always in science a residual, a very small residual, and the place that we've reached in the climate debate, the people that just can't bring themselves to come on board.

Q: So should they shut up?

Haymet: We're a very open community. People should do their research. But I would encourage those people to do primary research and to not just write literature but actually get out there and measure things in the lab that would disprove what's in the IPCC report. So, you know I'm saying very clearly to you today, the sea level is rising at 3 millimeters a year. If someone wants to dispute that, let them go out and measure it. But there are 150 scientists around the world who've measured all these things with satellites and tide gauges and shown that sea level is rising. My scientists have measured for close on 50 years, the concentration of CO<sub>2</sub> in the atmosphere, going from 280 parts per million we know back in 1850 to 380 we passed last year. We know three out of four of those molecules trap sea because that's what keeps the water, the Earth, warm. It would be a miracle if the other quarter of CO<sub>2</sub> molecules didn't equally well trap sea. These are testable scientific experiments. They're not hypothesis.

Somerville: The IPCC reports, in the past - this one's just fresh, brand new - have been vetted by the National Academy of Sciences, they've been looked at critically by the National Academies of other countries, by the professional societies, they do this vetting. This represents the mainstream scientific view. I can't tell you for sure. We don't have certainty in this universe. I can't tell you for sure that an opinion that's not assessed by the IPCC might not have truth to it, just as we can't be utterly sure of anything. But you're making a great big bet it seems to me, to give equal credence to a handful of outliers who exist in all fields of science. Tony Haymet mentions the Berkeley retro virus expert who doesn't think that HIV causes AIDS. I think the likelihood, not my field, but I gather is pretty small. You don't begin a story on AIDS by starting, 'HIV, which some scientists think causes AIDS.' And I think that this, we have a similar reason for not giving people credence to outliers here.

Q: Within the legion of scientists who worked on this report and are members of the international panel, the Intergovernmental Panel on Climate Change, was there dissent, disagreement, if not in total, at least in part?

Somerville: I don't think dissent is what I would characterize. Firstly, the Summary for Policy-makers was approved word for word unanimously by the governments, something that a government wasn't willing, any one government wasn't signing onto, did not appear in that Summary for Policy-makers. And we scientists were there, recorded lead authors from all the chapters were there to be sure that what was said in the summary was consistent with the science of the full report, so the science wasn't torqued or altered or spun in any way. The wording was that of the governments but the science was that that the scientists had come up with.

Q: I'm talking about dissent from the science.

Somerville: I think within the science community the, again, not dissent so much than the way I put it is in the areas of active research such as the dynamics of the ice sheet on Greenland, some scientists thought it was more likely we'd have rapid sea level rise from that source, some scientists thought it was less likely. They all recognized there's a lot of research still to be done and the report says that. The report expresses numerical estimates and how much sea level rise we'll get from thermal expansion and melting ice, and it has words saying essentially the scientific literature does not yet provide a firm basis for saying what the chances are from ice sheet dynamics.

Q: Why don't you talk about the regional effects and this region, the western half of North America. What is the state of the science on what we can expect over the next century?

Somerville: That's a wonderful question, a big question, and a lot of it is actually locally generated knowledge. Scripps Institution of Oceanography has been at the forefront of this. We know for sure, for example, that rising sea level is a consequence of a warmer climate. The ocean expands like many substances do as it gets hotter and in addition there's more water added to the ocean as ice on land melts. Both of those things have been rising on global average at a rate of about 6 or 8 inches a century.

We expect that rate to pick up. Another big consequence is that we depend upon, a large part of our water supply on water from the Sierra snow pack.

We drink in summer what nature's stored in winter. Once again, this is straightforward, there's more rain and less snow and there's earlier melting and we see signs of both of those. As that trend continues one can look to a greater chance of water shortages, more competition, and there are downstream effects, too. For example, there's Scripps research relating water shortages to greater wildfire danger.

Q: Talk a little bit about the pace at which these climate changes will occur.

Somerville: I'll speak to that. I think a useful analogy, a metaphor for your readers especially is to think of changing odds, of loading the dice or tilting the roulette table. Thus the natural variability that we've always seen will continue. They'll be wet years and dry years. We are below average for rainfall this year, for example, but some years are wet. Thus, it's like a lot of climates, there are years with lots of hurricanes and years with very few. But as the climate warms you'll see the odds tilt toward a greater fraction of dry year so the likelihood of water shortage, for example, likelihood of drought, for that matter, will increase. You get ordinary folks in the street who say, 'What's this global warming stuff? We just had a blizzard.' And you can still have blizzards in a warming world. It's the trends (that count).

Q: The question of pace is so crucial here because the policy debate is being driven by the idea that we have to do something in 10 years and I was struck by the fact that your folks' report talked about a maximum of 17-inch increase in sea level for Greenland, while (Al Gore's) 'An Inconvenient Truth,' newly anointed best documentary, predicts 20 feet. Whom do we believe?

Haymet: You believe both. We've moved away from the IPCC report to Scripps Institution of Oceanography research so we're happy to talk about both but obviously the events we've been planning try and explain what it means to San Diegans in sea level, in global warming. So I want to emphasize that IPCC doesn't do research, it assesses research and tries to look at all the published records here that have been peer-reviewed and reach a consensus. Now the sea level rise issue, there are two components.

There's an inexorable component that has been going on, we see for the last hundred years, rising as Richard said about 6 or 8 inches and we expect that rate to increase and it has increased by about 50 percent recently. That, as Richard said, arises from two sources, just the thermal expanse of the ocean, the warming that's there slowly seeping into the ocean, in the deep ocean. There are also ice sheets that are melting that are currently on land. That's the part which is addressed fully in the IPCC report. There's a second potential component

which we know much less about and that is the more catastrophic melting of ice sheets in Greenland and the Antarctic that are currently sitting on land. So without going into Archimedes in the bathtub, that any ice that's currently sitting in the ocean, if it melts it's actually not going to increase the sea level because it's already displaced its volume. There are very large quantities of water tied up in ice sheets in Greenland and in Antarctica that appear to be melting very quickly. But we don't know how quickly they will melt and we don't know when they might slide into the ocean and cause a dramatic sea-level rise.

Q: One of your fundamental conclusions was that buildup of CO<sub>2</sub> and global warming in general will continue for thousands of years. Now I want to know what you think about what impact man can have on this. I mean is it inevitable? You know your conclusions seem to be that this process has begun and it's going to continue regardless of what happens.

Somerville: What humanity as a whole gets to do is decide how much more CO<sub>2</sub> to put in the atmosphere, OK. What's in the atmosphere, a large part of it will stay there for a long time. Some of it will stay there for centuries.

Furthermore, Tony Haymet mentioned the large amount of heat that's built up in the ocean. The ocean has a very long time scale. So the sea level rise, even if you could somehow magically fix the carbon dioxide in the atmosphere today, that sea level rise will continue slowly, inexorably for a long time.

Q: When you say a long time, what time?

Somerville: Centuries.

Q: Can we go back to the question of scientific dissent on all this. Was there dissent or disagreement among the scientists who worked on this?

Somerville: I would say there's a spectrum of opinion of emphasis and of wording on the topics where current research is still ongoing, for example. So there are quite a few areas where the scientists will frankly say, we don't have enough data yet. We don't have complete enough models. Good example is hurricanes. Hurricanes can have an affect from a warmer world.

Hurricanes get their energy from the warm ocean but hurricanes are rare, thank God. The record of them doesn't go back very far. You're dealing with a phenomenon that takes a long time to build up enough data to come to a clear enough understanding. There are lots of areas where we still have science to do. That doesn't take away from the fact that there's lots of areas where the science is really settled.

Q: What about the premise, advanced by some, that global warming is occurring no matter what and that human action can only have an effect on the margins?

Haymet: As Richard said, we get to decide how much more CO<sub>2</sub> goes in the atmosphere. We've essentially gone from 280 to 380 parts per million so we've gone from having three molecules of CO<sub>2</sub> in the air to four molecules. We get to decide now how much more we put in. And so that's, moving away from the IPCC report, which, as Richard said, is carefully constructed to be policy neutral. We're saying that further global warming is going to be dangerous, that further increase of temperature, business as usual, we just burn all the fossil fuel there is, we believe that will be disastrous for humanity.

Q: One part of the debate has been barely talked about, the idea of geo-engineering. (Climate change) is just such a massive, huge problem and when we can directly address it through ambitious geo-engineering things, the science seems to be credible; why not do that rather than go after it, you know, a gallon of gas at a time.

Haymet: Well, our job is to bring the sort of science and the policy options to the table. You're talking about a sort of magic bullet solution where we just go on burning it, we somehow bury it or we invent some other energy source. I think we have to sneak up on this 3 percent at a time. I mean there's conservation measures we can make. There's sensible things we can do in terms of renewable fuels, which at the same time give us energy independence as well as starting to wean our souls from Middle Eastern oil. There are opportunities to do further research in capturing energy from the sun and yes, some countries will have to have the nuclear option on the table. I learned yesterday that China opened 138 coal-fired plants last year in calendar year 2006.



That (is) a question for all of us. Do we want them to be making that much CO2 or do we want to give them the safest, best French technology for having nuclear reactors. Our message from Scripps is that we're perfectly placed to respond to this issue. Yes, we have inadvertently over the last 150 years changed our atmosphere and it's not good. It's not good for California let alone countries that don't have our wealth and skill in adapting to it. But it's by no means a forgone issue. We can control this problem in the same way that nations got together and addressed the ozone point.

Haymet is director of the Scripps Institution of Oceanography, vice chancellor for marine sciences, dean of marine sciences and professor of oceanography. Somerville is distinguished professor at the Scripps Institution of Oceanography. Both are closely involved in the institute's research on climate change.

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