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Wobbling on Climate Change

By PIERS J. SELLERS NOV. 11, 2014

GREENBELT, Md. — I'M a climate scientist and a former astronaut. Not surprisingly, I have a deep respect for well-tested theories and facts. In the climate debate, these things have a way of getting blurred in political discussions.

In September, John P. Holdren, the head of the White House Office of Science and Technology Policy, was testifying to a Congressional committee about climate change. Representative Steve Stockman, a Republican from Texas, recounted a visit he had made to NASA, where he asked what had ended the ice age:

"And the lead scientist at NASA said this — he said that what ended the ice age was global wobbling. That's what I was told. This is a lead scientist down in Maryland; you're welcome to go down there and ask him the same thing.

"So, and my second question, which I thought it was an intuitive question that should be followed up — is the wobbling of the earth included in any of your modelings? And the answer was no...

"How can you take an element which you give the credit for the collapse of global freezing and into global warming but leave it out of your models?"

That "lead scientist at NASA" was me. In July, Mr. Stockman spent a couple of hours at NASA's Goddard Space Flight Center listening to presentations about earth science and climate change. The subject of ice ages came up. Mr. Stockman asked, "How can your models predict the climate when no one can tell me what causes the ice ages?"

I responded that, actually, the science community understood very well what takes the earth into and out of ice ages. A Serbian mathematician, Milutin Milankovitch, worked out the theory during the early years of the 20th century. He calculated by hand that variations in the earth's tilt and the shape of its orbit around the sun start and end ice ages. I said that you could think of ice ages as

resulting from wobbles in the earth's tilt and orbit.

The time scales involved are on the order of tens of thousands to hundreds of thousands of years. I explained that this science has been well tested against the fossil record and is broadly accepted. I added that we don't normally include these factors in 100-year climate projections because the effects are too tiny to be important on such a short time-scale.

And that, I thought, was that.

So I was bit surprised to read the exchange between Dr. Holdren and Representative Stockman, which suggested that at best we couldn't explain the science and at worst we scientists are clueless about ice ages.

We aren't. Nor are we clueless about what is happening to the climate, thanks in part to a small fleet of satellites that fly above our heads, measuring the pulse of the earth. Without them we would have no useful weather forecasts beyond a couple of days.

These satellite data are fed into computer models that use the laws of motion — Sir Isaac Newton's theories — to figure out where the world's air currents will flow, where clouds will form and rain will fall. And — voilà — you can plan your weekend, an airline can plan a flight and a city can prepare for a hurricane.

Satellites also keep track of other important variables: polar ice, sea level rise, changes in vegetation, ocean currents, sea surface temperature and ocean salinity (that's right — you can accurately measure salinity from space), cloudiness and so on.

These data are crucial for assessing and understanding changes in the earth system and determining whether they are natural or connected to human activities. They are also used to challenge and correct climate models, which are mostly based on the same theories used in weather forecast models.

This whole system of observation, theory and prediction is tested daily in forecast models and almost continuously in climate models. So, if you have no faith in the predictive capability of climate models, you should also discard your faith in weather forecasts and any other predictions based on Newtonian mechanics.

The earth has warmed nearly 0.8 degrees Celsius over the last century and we are confident that the biggest factor in this increase is the release of carbon dioxide from fossil fuel burning. It is almost certain that we will see a rise of two

degrees Celsius (3.6 degrees Fahrenheit) before 2100, and a three-degree rise (5.4 degrees Fahrenheit) or higher is a possibility. The impacts over such a short period would be huge. The longer we put off corrective action, the more disruptive the outcome is likely to be.

It is my pleasure and duty as a scientist and civil servant to discuss the challenge of climate change with elected officials. My colleagues and I do our best to transmit what we know and what we think is likely to happen.

The facts and accepted theories are fundamental to understanding climate change, and they are too important to get wrong or trivialize. Some difficult decisions lie ahead for us humans. We should debate our options armed with the best information and ideas that science can provide.

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