Dr. Betsy Pugel interviews Dr. Bob Bindschadler for “Straight from the Scientist’s Mouth”

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Betsy: Yes, there is fire at Burning Man, but of equal importance to our Green Man theme this year is ice. Ice is an integral part of our planet. Its behavior tells us a great deal about our climate.

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Betsy: Today on “Straight from the Scientist’s Mouth,” we’ll learn about ice from Dr. Bob Bindschadler.

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Betsy: Bob is chief scientist in the Hydrospheric and Biospheric Sciences Laboratory at NASA’s Goddard Space Flight Center. Take our listeners out on a journey to Antarctica.

Bob: The sky is blue, but it’s an icy blue. It’s not a deep blue, and you see light, you see snow everywhere you look. The sun can be out; it can be shining, which just makes the snow sparkle. It can be overcast, which makes the sky almost the same color as the snow, and you really don’t even see the difference between the white of the sky and the white of the snow. In fact sometimes you get into a condition called “white out,” and you stumble around because you can’t even see what you’re walking through. The wind often blows. You get accustomed to just turning your back to the cold wind because it’s such a biting wind that your face will feel brittle, like almost [that] it’ll crack if you smile. It’s a very, very intense winter sensation.

[music]

Bob: When we talk about ice, we often apply the term “the cryosphere,” those things that are cold. Generally we break it down into four different categories. We talk about land ice, which includes these really big ice sheets. Most of the ice on the planet is in Antarctica, 90 percent of the ice. Another 9 percent is in the Greenland ice sheet, and then the final 1 percent is just all these little glaciers and ice caps sprinkled all around the rest of the world. So, land ice is one category.

The second category is sea ice. Polar oceans get cold enough to freeze. Their surface layer freezes. It’s still fairly thin, just a few feet thick. [It] grows during the winter, shrinks during the summer, but it’s floating, so it doesn’t affect sea ice directly. Whether it’s bright white, or whether it’s a dark ocean, affects how much heat is absorbed from the sun or reflected from the sun, so it has a strong feedback effect in the Earth’s climate system.

Then there's snow, the seasonal snow, the stuff that comes and goes in the wintertime [that] we shovel off of our driveways and have to drive in, and we toss into that same category lake and river ice, because lakes, many lakes freeze during the [winter] -- and river[s] as well. That's the third category.

The fourth category is just permafrost, where the soil has enough ice in it that it becomes frozen, permanently frozen in many cases. And the whole mechanics of that soil [are] different because it's frozen all the time. [The] great concern in Alaska right now and across the Arctic, where the permafrost is pervasive, is that it's beginning to thaw. Buildings that were built on this are now starting to collapse and fall apart because the soil is thawing out. Trees are falling over. It's quite a dramatic change right now, with the permafrost.

So the cryosphere really contains those four different components.

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Betsy: And why study the flow of ice?

Bob: The reason the flow of the ice is so important to us is that -- that determines how fast ice is being returned to the ocean. The snowfall takes water from the ocean and delivers it to the ice sheet, helping the ice sheet to grow, and it's the flow of the ice back into the ocean that determines how much of that snowfall is returned, and so whether the ice sheet overall is growing or shrinking, and therefore whether the oceans are rising or sinking.

Betsy: It sounds like there's a larger cycle at play here between the precipitation that falls down, formation of the ice itself, the melting of the ice, the return of the melted ice back into the ocean, and then evaporation back into the air, and then as precipitation once again.

Bob: Right. There's that cycle, as you mention, of the snowfall being drawn from the water of the ocean, and then the ice sheet returning that. And the cycle operates on many different timescales. We know that there are these really long glacial and interglacial periods, where ice sheets have grown to three times the size they are now. Right now, we're in what we call a warm period or an interglacial, between two of these large glacial cycles, and it also operates on an annual timescale, where you get most of your precipitation during the wintertime, so the ice sheets will grow a little bit more during the winter and shrink a little bit more during the summer, and then there are many, many timescales in between as the Earth's climate has had oscillations of cold and warm -- not as extreme as the glacial-interglacial cycles.

And right now, we're concerned about how this interglacial is going to more and more extreme ends, with even warmer temperatures now. And the concern for is us how are the ice sheets going to respond. We expect they'll shrink, because they always shrink when the Earth gets warmer, but how much they're going to shrink, how fast [they're going to

shrink] is important because it determines directly how fast sea level is going to go up, and its that sea level connection that is of most concern to people, because so many people around the world live close to the ocean.

Betsy: Can you talk a little bit about how you'll be monitoring those changes over time?

Bob: There are a number of different ways that we can monitor the changes in the ice sheets. One is with a satellite that measures the mass underneath the satellite. The satellite is called Grace. It measures gravity. It essentially determines very precisely how much mass there is in the ice sheet, and [Grace] has been collecting data for about three years. And we see the ice sheet get larger during the wintertime and shrink during the summertime, so we know the measurements are quite precise, and we see a gradual shrinking of the ice sheets. We can also just measure the height of the ice sheets, and again watch it increase in height during the wintertime and shrink during the summertime -- a completely separate measurement, so we get confidence from measuring the same characteristic of the ice sheet two different ways, and we can also measure the flow of the ice from other satellites, and that tells us right now that there are a number of places around the edges of the ice sheet that are accelerating, going much faster than they were just a few years ago. And we're trying to understand those, what the causes are for that kind of recent behavior.

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Betsy: I'm told that you and your team of scientists have been looking at a network of waterways that affect this growth and decay of ice sheets. Can you tell us a little bit more about this system?

Bob: Yeah. We're learning more and more about this underground plumbing system all the time. It's really fascinating. It allows the ice to slide and therefore move much faster returning ice to the ocean, raising the sea level. what we're learning is that water is much more pervasive than we thought, there's a lot of it down there, and it collects in subglacial lakes and these lakes will fill and drain on fairly short timescales, just weeks or months. You'll see huge amounts of water sloshing around underneath the ice sheet. [We] don't know the details of the plumbing system; we're still trying to sort that out, but we're only just now surprising ourselves with how active a system it is. We know it's fundamental to how fast the ice can go, and we're just now in the process of understanding some of the fundamental aspects of how rapidly it moves, how much water is moving around, and ultimately how it affects the flow of the ice.

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Becky: What can our listeners do on a daily basis to either help maintain or improve the health of our planet?

Bob: When I'm asked, "What can people do?" what I keep coming back to is the aspect of stewardship, for people to recognize that what they do matters, even as an individual.

It will be an effect that is small enough that they won't detect it, but because there are so many of us on this planet, the more responsibly we act, the more gentle will be our impact on the climate. And I think especially for the next generation [that is] kind of emerging into adulthood now, they will be living with the consequences of our actions as well as their own actions, and [those consequences] will be amplified. They will sit on top of the actions of my generation. I'm in the older generation. But the internalization of it, that awareness that what they do matters ….

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Becky: One last thing before we go. I have to know about Polar-Palooza!

Bob: [laughs] Polar-Palooza is a energy-infused activity, and it is intended to help communicate the importance, the energy, the excitement of polar research to the general public. Polar research is very exciting, very satisfying, very rewarding, but also very important. So if we can effectively communicate that -- and Polar-Palooza is intended to do that -- with sort of a high-energy presentation of the people and what they do and why they do it, it will be a fantastic success, because it is important for people both to be informed about how important polar research is, but hopefully for the younger generation, enthused and interested in conducting it, because we need more and more polar research. The polar regions are changing so fast; we have a fairly limited number of scientists studying it, and I think the issues will become more important, and we'll need more people ….

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Becky: Thank you for joining us for another episode of "Straight from the Scientist's Mouth." If you'd like to hear more about ice, Antarctica, or Polar-Palooza, check out our link on the Burning Man Web site [www.burningman.com]. You can find the same information at www.nasa.gov/goddard. G-O-D-D-A-R-D.

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