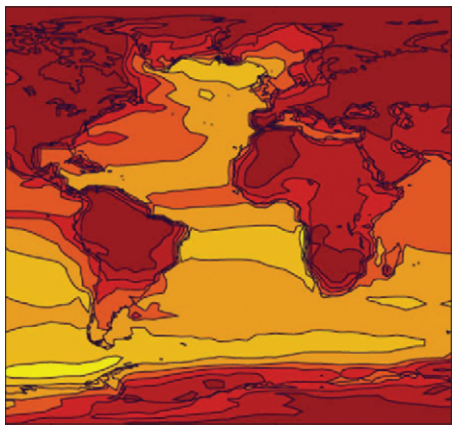
Letters

Letters to the editor can be sent to *Physics World*, Dirac House, Temple Back, Bristol BS1 6BE, UK, or to **pwld@iop.org**. Please include your address and a telephone number. Letters should be no more than 500 words and may be edited

Striking a balance on climate change



"There is strong evidence for the cancerous impact of cigarette smoking, but we should not ignore those who think otherwise." Imagine the outcry if these words were to open an editorial in the flagship magazine of a leading medical society. Yet change "cancerous impact of cigarette smoking" to "human impact on climate change" and you obtain the opening sentence of the *Physics World* editorial in the February issue (p15). You might think I am stretching the point, but the tide of expert opinion really is as strong for human-induced climate change as it is for cigarette-induced cancer.

Of course, it would be wrong for *Physics World* to completely ignore those outside the mainstream. Indeed, advocates of the anthropogenic influence on climate were once a minority. But it is equally wrong to give those outside the mainstream disproportionate space to air their views.

The United Nations' Intergovernmental Panel on Climate Change (IPCC) believes that the evidence for anthropogenic climate change is solid. The IPCC comprises hundreds of climate experts, whereas the number of bona fide climate sceptics can be counted on the fingers of one hand. Therefore, in order for *Physics World*'s climate coverage to accurately reflect the balance of expert opinion, you would have to devote the next 100 editorials to explaining that humankind is dangerously warming our planet.

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Your editorial "Hot topic" on climate change is right to express some caution in accepting climate-change forecasts unreservedly. But it is sensible to conserve energy and limit carbon-dioxide emissions anyway. The continual growth in the world's population leads to a corresponding growth in the consumption of natural resources, including energy. The advantage of conserving energy is that it can help to delay the onset of a climate-change crisis driven by population growth worldwide. Sadly, this is a highly optimistic assumption and a world using mostly nuclear power and renewables seems a very long way off.

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Your editorial makes the valid point that as scientists we should keep an open mind on controversial topics and hear the voices of dissenters, even when the overwhelming majority of opinion supports a contrary view. However, your decision to give Richard Lindzen the opportunity to express his dissenting views on global climate change without challenge or debate is unfortunate (February pp12–13). Balance would have been provided if another climate scientist with mainstream views had also been interviewed.

Lindzen has been the darling of the press as a dissenter because of his scientific reputation. He has never changed his opinions over many years despite mounting evidence to the contrary, and he has never provided experimental evidence supporting his dissenting claims. He has the strange idea that only climate modellers have the right to express opinions about global warming and has confused his views as a scientist with his views about science policy. His arrogance in stating that Lord (Robert) May and Sir David King, among others, deserve a "special place in hell" because they have provided leadership concerning science policy on global warming is unacceptable in civilized debate and particularly from a scientist. Perhaps Lindzen should recall Newton's famous statement about standing on the backs of giants and be more humble. I believe that every citizen, independent of their profession, has the responsibility to engage in the debate on the development of public policy.

We know from a wide variety of different measurements that the Earth is warming, and that this is extremely well correlated with the increasing amount of carbon dioxide in the upper atmosphere. Public policy demands that a careful risk analysis be undertaken to determine what response we should take collectively. We cannot afford to ignore global warming and naively hope it will go away, as Lindzen would encourage us to do.

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While I have to agree that space-borne schemes to deflect solar radiation away from the Earth are far fetched in the extreme (February p10), I do welcome any effort to increase the reflectivity of the Earth's surface. Installing reflectors on the ground may indeed result in unstable microclimates, but this is a small price to pay for the benefit of gaining long-term control of global temperature. An even spread of reflectors across the globe would certainly reduce this risk.

Given the current global population of about seven billion people, a simple calculation based on the atmosphere's mass and specific heat capacity shows that just 1 m^2 of a good reflective surface (80% or better) per person is sufficient to arrest the current global warming of about 2 °C per century. At 3 m^2 per person, global temperature could be reduced by more than 0.5 °C in less than 20 years.

The technical aspects of this are straightforward, the difficult part is publicity. With greater awareness, people can contribute to the control of climate change. Beyond that, with the involvement

of companies or governments, the impact could be greater and the effort better co-ordinated. I for one shall be installing a total of 9 m^2 of reflective surface on my garage and shed roofs this year. If this were taken up world wide there would certainly be a run on tinfoil!

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I was under the impression that authors of articles in *Physics World* were on no account to include – horror of horrors – any equations. What a surprise, therefore, to find the Navier–Stokes equations for fluid flow in the article "A model approach to climate change" (February pp20–25). It is especially perplexing because their inclusion could not possibly assist either the expert reader, who would know all about them anyway, nor the non-expert reader, to whom they would be complete gobbledygook – especially given the condensed form in which they appeared.

There seem to be only three explanations. Either your editorial policy has changed, the authors want to demonstrate how clever they are, or you are offering a prize for the first correct entry in a competition to discover an analytical solution. If the latter is true, could you tell us what the closing date is and how much the prize will be? I assume it will not be very much, given the virtually automatic Nobel prize that would follow!

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Editor's note:
Although we do indeed advise authors to keep equations to a minimum, we felt that physicists reading an article about climate modelling would benefit from seeing the form of the equations for fluid flow in a spherical rotating coordinate system – which form the core of climate models – and how these connect with the measurable quantities in the Earth's climate system shown in the figure on the opposite page.

That sinking feeling

In his article on physics legends (February p17), Robert Crease wonders what is happening in those sinks on the equator used to demonstrate the Coriolis force. I too have seen the demonstration in Quito and, quite simply, it is a trick. Knowing that the Coriolis force could not possibly manifest itself just a metre or two away from the equator, I was watching very carefully.

The demonstration started with an already full sink full of water sitting on a line purported to be the equator. The drain was in the centre of the sink, and the water had presumably been sitting there long enough for any rotation to have stopped. The guide then very carefully removed the plug from the drain and the water ran out of the sink, at first without any sign of a vortex. However, when there was only about a centimetre of water left, a vortex did form, forcing the guide to distract his audience by mentioning other equatorial effects such as shadows.

The empty sink was then moved a couple of metres to one side of the line, water poured in, and the plug removed from the drain. The experiment was then repeated on the other side of the line. Sure enough, the water formed a vortex in both cases, and in opposite directions.

How did he do it? Very simple: on one side of the equator he poured the water into the sink to the right of the drain; on the other side he poured it in to the left of the drain. So the water was already rotating before he removed the plug from the drain! Naturally, I didn't spoil the effect his