Two Mathematicians on the Politics of Climate Change

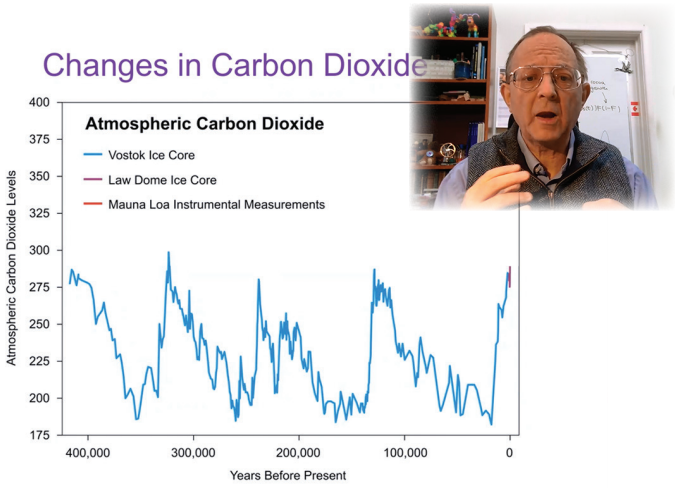
It will not have escaped the attention of any of the members of the IMA that there is a huge concern about the state of our changing climate. Not only do the changes in our climate affect all mathematicians, it is mathematics above all that can help us to understand our changing climate and give informed advice to our policymakers about both its impact and also how to mitigate against this. Indeed without careful mathematical models, informed by equally careful statistical data, we really have no way at all of predicting the climate with any degree of certainty into the future.

It is good to know that many mathematicians, including IMA members, contribute to the regular reports made by the Intergovernmental Panel on Climate Change. See [1] for more details.

Recently, we have seen two big conferences on climate change, namely COP26 on 31 October – 12 November 2021, followed by COP27 on 6–18 November 2022. These were each attended by around 200 countries. All of the news reporting on these centred on the actions of the politicians and of climate activists. So where were the mathematicians? Well we were there (both face to face and online), making the case for using modelling and data-driven methods to inform the climate debate.

Chris Budd at COP26

I went up to Scotland in 2021 to take part in the scientific part of COP26. I say Scotland, because although the main part of COP26 took part in Glasgow, much of the scientific activity took part in Edinburgh. I didn't mind this as Edinburgh is a fine city, and the security was much less obvious there. I took part in four COP26 related events, travelling by train to the events.



Chris Budd speaking on climate change

One was a purely scientific meeting at the International Centre for Mathematical Sciences on the mathematics of tipping points and how this relates to climate change. (My own interest is the prediction of tipping point behaviour in the warm water/saline circulation of the North Atlantic.) We sent a 'runner' every day to the main event in Glasgow, who both reported on the meeting to us and was able to interact with the COP26 events.

After that I took part in an extended meeting in the COP26 Virtual Zone which ran alongside the Blue Zone where the politicians and press were, and the Green Zone at which there were youth groups, civil societies, academia, artists, exhibitions, cultural performances, workshops, and talks. Part of the Virtual Zone was organised by the Knowledge Transfer Network in Industrial Mathematics, which ran an excellent event on the impact of climate change on our energy landscape. This was attended online by the former US vice-president Al Gore.

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Protesters in Glasgow for COP26

My own contribution to this was to give a presentation on a collaboration between Bath and the National Grid ESO on using forecasts from the Hadley Centre to help predict demand, supply and possible failure, of the National Grid as our climate changes over the next 50 years. This was followed by a panel meeting. This event led to a number of mathematically-related projects with the ESO on the (two-way) link between climate change and energy production.

The third event was a well attended Virtual Study Group, which was a collaboration between the Bath Institute for Mathematical Innovation, and the Virtual Forum for Knowledge Exchange in Mathematical Sciences, and looked at three climate related problems in carbon-zero energy production.

Finally I was proud to take part in a massive online Maths Inspiration event run by Rob Eastaway, which presented a series of climate talks to around 20 000 young people. Notably one of these was given by Hugh Hunt (Cambridge) from the foyer of his hotel in Glasgow, as he was also attending COP26.

So did I see any politicians? Well the nearest I got to that were the police motor cycle escorted black limousines that I saw driving through Edinburgh. Did I meet any climate activists? Again, the nearest I got to that was my daughter, who took part in the big public demonstrations in Glasgow and saw Greta Thunberg in the distance.

Chris Budd at COP27

My attendance at COP27 in Egypt was more distant. Not being keen to add any more carbon dioxide to the atmosphere, I decided not to travel in person. Instead I took part in a number of related, and simultaneous, online events.

One of these was not in Egypt at all, but was the Hong Kong Laureate Forum. This was a high profile event in which early career researchers from many nations came together to discuss many topics, including climate change. It was an honour to be asked to speak at this meeting. A key topic of interest in Hong Kong is the impact of climate change on rising sea levels. This is quite undeniable, and is something which will have a major impact on island populations.

My virtual attendance also brought home to me the fact that academics can burn up a lot of carbon dioxide by flying to conferences, and the positive impact on the environment of running meetings (at least in part) online.

Martine Barons at COP26

I was fortunate to be awarded a COP26 Fellowship in Climate Risk by the COP26 Universities Network, now renamed UK Universities Climate Network, to work on Climate Risk Communication with colleagues from strategic foresight, digital humanities and graphic design. As someone who works on evidence-informed decision support – typically probabilistic models, networking data and other evidence to aid decision making in complex scenarios and systems – I understand that communication is vital in order to translate our mathematics into policy and action from governments to communities.

Martine Barons speaking at a Met Office COP26 event

In addition to the planned workshop, which attracted a large number of policymakers, we produced a publication 'Communicating Climate Risk – a Toolkit' (bit.ly/CommunicatingClimateRisk) drawing together best practice on the effective communication of climate information from across STEM, social sciences, and arts and humanities. We were invited to launch this toolkit at COP26 in the Science Pavilion of the Blue Zone in Glasgow. Security, including COVID security, was very tight and I shared the shuttle train to the venue with large numbers of young people and their banners, heading for the demonstrations and discussing how to reduce their risk of arrest.

We won further funding for a second edition of the toolkit, published November 2022, adding a climate finance section, as well as expanding and updating the other sections. Despite hard-copy handouts being banned at COP26, our personal copies were eagerly taken by participants and many hundreds of downloads and thousands of reads have been recorded over the year.

In a broad sense, we know what needs doing on climate risk, it's communicating and incentivising all stakeholders to have the will to act that is missing.

So what was achieved in either COP?

The advertised main goal of COP26 was to secure global net zero by mid-century and keep a maximum of 1.5℃ of warming within reach. There was a lot of manoeuvring around different positions as different nations negotiated about the targets for reducing the emissions of greenhouse gases. After nearly two weeks of negotiations, the Glasgow Climate Pact was signed, and the Paris Agreement's Rulebook was completed, which is mainly a protocol for agreeing how to do things in the future.

What did this mean? Unfortunately in the end not much was achieved on carbon dioxide reduction, but commitments were made in a range of other areas such as methane, forest and car emissions. This included a commitment from 137 countries to 'halt and reverse forest loss and land degradation' [2] by 2030. In addition, 190 countries agreed to phase down coal power, resulting in a 76% decrease in planned new coal power plants.

Since COP26 a lot of things changed. On the negative side, the unprovoked invasion of Ukraine by Russia has precipitated an energy crisis in many nations. This has resulted, in part, in a reversal of the progress in the phasing out of coal. On a more optimistic note we have seen a much more positive attitude in the USA to dealing with climate change, and also a big increase in the use of renewable energy in China.

As for COP27, it is early days yet, but to quote Tim Benton (Leeds/Chatham House) [3]:

> Overall COP27 was a hectic, sometimes chaotic, event. The COP advanced some matters but on others failed to drive ambition towards the sort of climate action required to keep alive the possibility of restricting climate change within the envelope of the Paris agreement.

However, what did come out of COP27 was an agreement on the Loss and Damage Fund, which is a significant achievement for climate-vulnerable developing countries.

What can mathematicians do?

There is much that mathematicians in general, and IMA members in particular, can still do to tackle climate change. Mathematical modelling lies at the heart of all climate prediction and how climate change will impact on our lives. So, a big contribution we can all make is to work on developing data-driven models for climate change and its impact. Areas that need such models are, for example, understanding extreme events (including the impact of flooding or heatwaves), food security, water provision, transport, and energy. These areas all require careful mathematical skills from across the whole range of mathematics, statistics and operational research. Skills that IMA members (in academia, industry, and education) have in abundance! We should all seriously consider doing research work in these fields.

Secondly, many IMA members are in a position to influence and train, students and others, in the importance and techniques (and limitations) of mathematically and data-driven climate models. This includes making sure that policymakers, and the media, are aware both of the predictions that these can make, and also of the quantifiable levels of uncertainty that they have. We all have a responsibility to the next generation to make sure that the power of mathematical modelling is not forgotten. The IMA Modelling and Algorithms Group is considering a number of ways of supporting IMA members to do this, and you will hear news of this in future announcements in *Mathematics Today*.

And finally, we can all make a very practical contribution, by using our mathematical skills to monitor how much carbon dioxide, and other noxious gases, we are putting into the atmosphere. This includes looking at how much travelling that we do, and making a decision about whether we can afford to attend our next conference online, or by train, instead of flying there.

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References

1 Budd, C. (2023) *Climate, Chaos and COVID; how mathematical models describe the universe*, World Scientific Press.

2 Carver, D. (2022) What were the outcomes of COP26? , House of Commons Library, tinyurl.com/Carver-COP26.

3 Åberg, A. et al (2022) COP27: What was achieved, and what needs to happen now, Chatham House, tinyurl.com/Chatham-COP27.