



## Climate change, ESTRO and radiotherapy

### Introduction

It is becoming increasingly obvious that climate change is a very serious issue. We are seeing an increasing number of extreme weather events and rising sea levels around the globe. A graphical summary of how the climate has changed in the last 150 years is shown in Figure 1. This illustrates the average temperature in Europe for each year between 1901 and 2020, compared with the average temperature between 1971 and 2000. The red stripes show temperatures above the average and the blue stripes show temperatures lower than the average. It is obvious that the planet is warming as the amount of red has increased recently, and there has been more dark red since 2000.

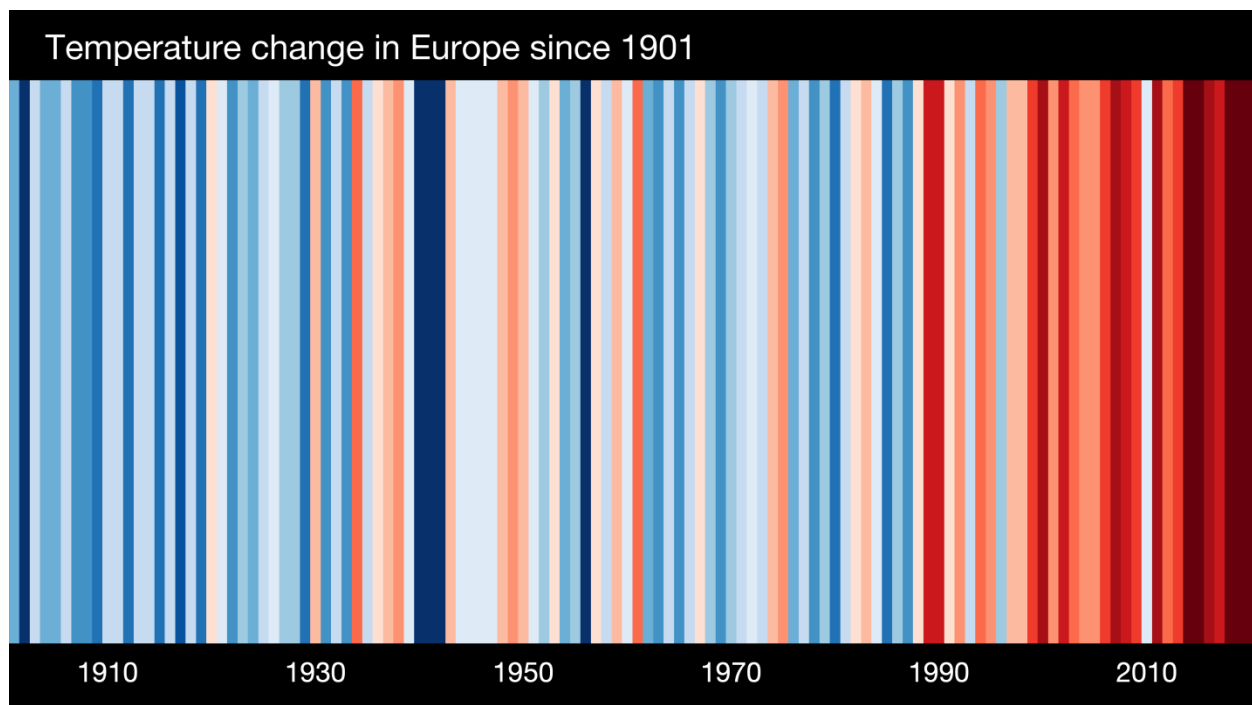


Figure 1: Average temperature in Europe for each year between 1901 and 2020, compared with the average temperature between 1971 and 2000 (from <https://showyourstripes.info>)

This increase in temperature causes more fires than occurred in earlier years and melts snowcaps. The extreme weather also causes more flooding than occurred previously and shortages of food, and it puts a strain on healthcare due to the increasing occurrence of heat waves. Our environment also affects our health in other ways, through for example, pollution, which increases the incidence of lung cancer. Two peer-reviewed papers have estimated the amount of greenhouse gas that is required to cause a climate-change-related death<sup>1,2</sup>, and the results highlight that climate change and our destruction of ecosystems is a huge killer.

### *The carbon footprint of the European Society for Radiotherapy and Oncology (ESTRO)*

Healthcare has a large carbon footprint - for example, it represents ~5% of the UK's entire carbon footprint<sup>3</sup> - and therefore it adds to the climate emergency and creates a positive feedback loop. The carbon footprint of our organisation and its activities are also likely to be large. A back-of-the-envelope calculation of the effect on the climate of a face-to-face ESTRO conference makes scary reading. I used information about where delegates came from when they attended ESTRO 2018 to estimate the carbon footprint of their travel to the conference. I also used an excellent book called *How bad are bananas?* by Mike Berners-Lee<sup>4</sup> to estimate the

carbon footprint of the conference venue and of delegates' accommodation. I then performed a similar exercise to estimate the carbon footprint of an ESTRO conference held entirely online, although I assumed that only 5% of people were working from home and the rest would travel to workplaces to attend the conference which likely overestimates its carbon footprint. The results can be seen in Figure 2, which shows that the in-person meeting had a carbon footprint 75 times higher than that of an online version. The face-to-face conference had a carbon footprint of almost 7,000 tCO<sub>2</sub>e, whereas that of an online conference would have been nearer to 90 tCO<sub>2</sub>e. A more detailed breakdown is available here: <https://twitter.com/IPEMEnvironment/status/1376910556540629000?s=20>

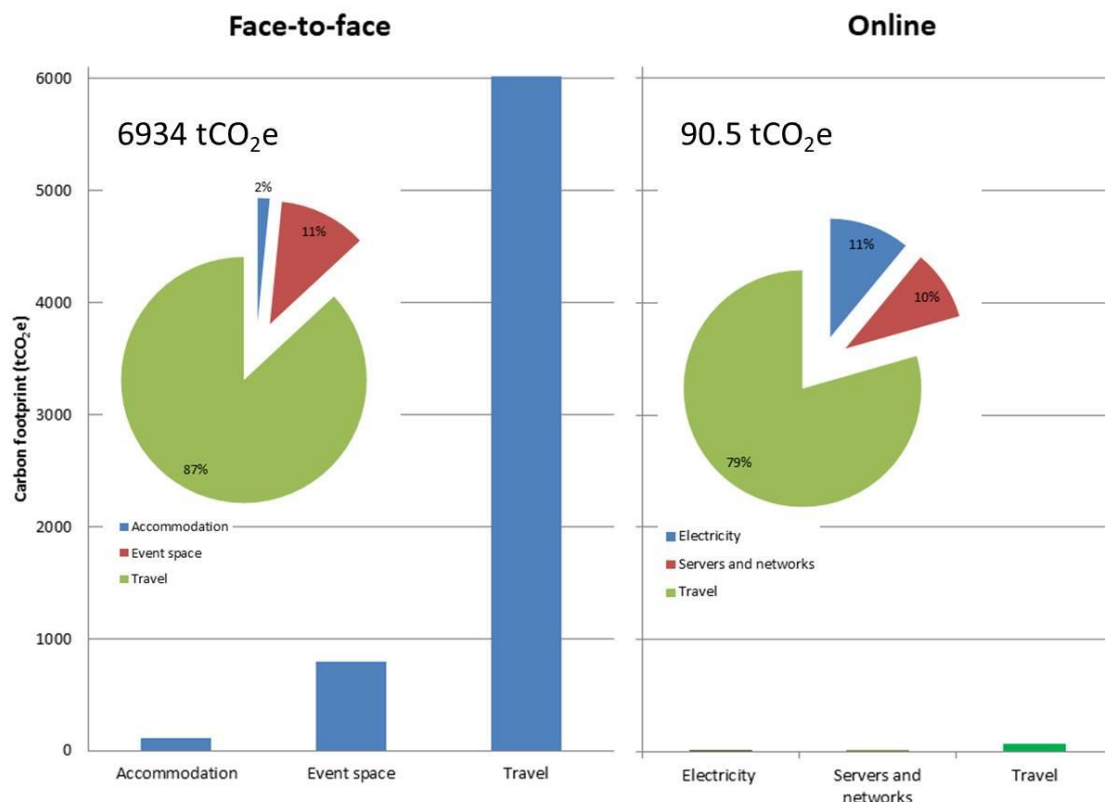


Figure 2: The carbon footprint in tCO<sub>2</sub>e for a face-to-face conference and for the same conference held online. The bar charts show the absolute values on the same y-axis and the pie charts show what makes up the total carbon footprint as a percentage.

## What could we do instead?

These calculations illustrate that moving a conference online can vastly reduce its carbon footprint and that of its delegates - and this ignores all the lunch boxes that go to waste! What's more, a recent study has highlighted how online conferences broaden access, because more early-career researchers and women are enabled to attend<sup>5</sup>. However, I love an ESTRO party as much as the next person - unless that person is Marcel van Herk - and online conferences do lack a sense of community and the feeling of being part of something.

So, what could we do? Here are a few potential options.

1. We could take a hybrid approach so that delegates, speakers and faculty could choose whether to attend physically or online.
2. We could switch between the two; for instance, we could hold the conference online for two years and face-to-face in the third year.
3. We could hold a distributed ESTRO, such that each country or region puts on a face-to-face ESTRO that links to all the others.
4. We could simply hold the conference less frequently; for instance, once every three years.

## Estimating the carbon footprint of the radiotherapy pathway

The radiotherapy that we use to treat patients also has a carbon footprint. I and other members of the environmental sustainability group of the Institute of Physics and Engineering in Medicine (IPEM) sought to estimate this previously ignored figure. As part of



this I was fortunate enough to be awarded nearly £10,000 by the NHS Greener Innovation Fund to perform this study with a few others at The Christie. The project will begin with consideration of two common treatment sites, prostate and breast, in order to make the results widely applicable. Additionally, we are considering figures for before and during the Covid-19 pandemic, so that we can look at any differences in practice that have occurred over this period. We are estimating the carbon footprint of:

1. patient travel;
2. pre-treatment and online imaging;
3. treatment delivery;
4. machine resources;
5. additional medications required as a result of radiotherapy; and
6. consultations.

This does not cover extra considerations such as data storage, building of the bunkers, manufacture of the machines etc., but it aims to cover most of the patient treatment pathway.

The project is on-going. However, so far it has become clear that the move to hypofractionated treatments during Covid has significantly reduced the carbon footprint of radiotherapy treatments as the amount of patient travel has been reduced and the energy use by the linear accelerators has also been cut. The project is due to conclude at the end of April. We hope that the results will provide a focus for considerations of where initial reductions in carbon footprint could be aimed, to motivate further studies and to start the conversation in general.

If you are interested in this work then please follow and/or message @IPEMEnvironment on Twitter. As far as we are aware, the IPEM environmental sustainability group is the only one of its kind within oncology. If this is not the case, please contact us as it would be good to join forces. If it is the case, we are more than willing to help other groups to start!



**Dr Robert Chuter**

Principal clinical scientist  
The Christie NHS Foundation Trust  
Chair, IPEM environmental sustainability group  
Manchester, UK  
robert.chuter@nhs.net

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