

ATMOSPHERIC SCIENCE WITH PROFESSOR BRIAN TOON

TALKING POINTS

KNOWLEDGE

1. What is nuclear winter?
2. What is a climate model?

COMPREHENSION

3. How did science play a part in the de-escalation of the Cold War?
4. Why do many countries have, or aspire to have, nuclear weapons?

APPLICATION

5. Why do you think smaller creatures were more likely to survive the mass extinction event 65 million years ago?
6. Why do you think nuclear testing was banned in 1963?
7. Brian says that very few scientific groups are working on modelling the effects of nuclear war. Why do you think this is? How could more groups be encouraged to take it up?

ANALYSIS

8. Brian also works on modelling the effects of forest fires on the atmosphere. What similarities and differences do you think these effects have compared to the effects of nuclear war?
9. Modern computer models have found that even regional nuclear wars could bring about significant cooling and agricultural losses, whereas Cold War-era models only considered global nuclear wars. Why do you think these models focused on global wars?

EVALUATION

10. Do you think countries should have nuclear weapons, given their devastating impacts if used? Are they necessary to stop hostile nations attacking?
11. Do you think humanity could survive a nuclear winter? What do you think would happen to society?

MORE RESOURCES

- Brian explains the principal findings of his 35 years of research into nuclear war in this TEDx video:
https://www.ted.com/talks/brian_toon_i_ve_studied_nuclear_war_for_35_years_you_should_be_worried?language=en
- This article from How Stuff Works explains what nuclear winter could be like: <https://science.howstuffworks.com/nuclear-winter.htm>
- On YouTube, Kurzesagt (In a Nutshell)'s 'Existential Crisis' playlist uses animation to explore cheerful topics like, 'What if we nuke a city?' and, 'What if we nuke the moon?' https://www.youtube.com/watch?v=qEfPBt9dU60&list=PLFs4vir_WsTxontcYm5ctqp89cNBJKNr
- You can use Alex Wallersteins web-based simulator to see the damage a nuclear weapon would cause if it exploded in your city:
https://nuclearsecrecy.com/nukemap/?t=d7638b279957ef91eade5ab570ec29b9&lite=city,yield_preset,b_other,b_note,permalink,faq,nm3d,options,classic,footer,social,otheroptions,small

ACTIVITIES YOU CAN DO AT HOME OR IN THE CLASSROOM

India and Pakistan are both nuclear nations and frequently clash, principally due to disputes over territorial ownership of the Kashmir region that both nations, along with China, partially control. Although they have far fewer nuclear weapons than the US or Russia, Brian's models find that a nuclear conflict between the two nations could bring about significant climate change for the whole world. Therefore, for everyone's sake, it is essential that they do not engage in nuclear war, but instead negotiate a solution to their conflict.

A paper that Brian recently co-authored on the subject can be found here:

<https://advances.sciencemag.org/content/5/10/eaay5478>

Imagine you are a scientific advisor in the USA. Rather than performing science yourself, you take evidence from researchers (such as Brian) and use it to advise the Secretary of State, who oversees the USA's foreign affairs. Your role in this scenario is to convince the Secretary of State that the India-Pakistan nuclear issue is a serious global matter, based on the best available science.

Use Brian's paper and other information you find online to write a brief to the Secretary of State on the issue. The brief should:

- outline the issue at hand
- give a concise and readily digestible description of the scientific background
- note any uncertainties in the science, and what they mean
- explain why the issue has consequences for US citizens, and the rest of the world
- offer some suggestions for how the US and the world could respond to the issue.

If you wish, you can use diagrams, tables and infographics within your work to make it more easily readable. The brief should be 1-2 pages in length.