

**“Visualizing and Understanding the Science of Climate Change”- An Update
(IUPAC Project # 2008-043-1-050) (May 2010)**

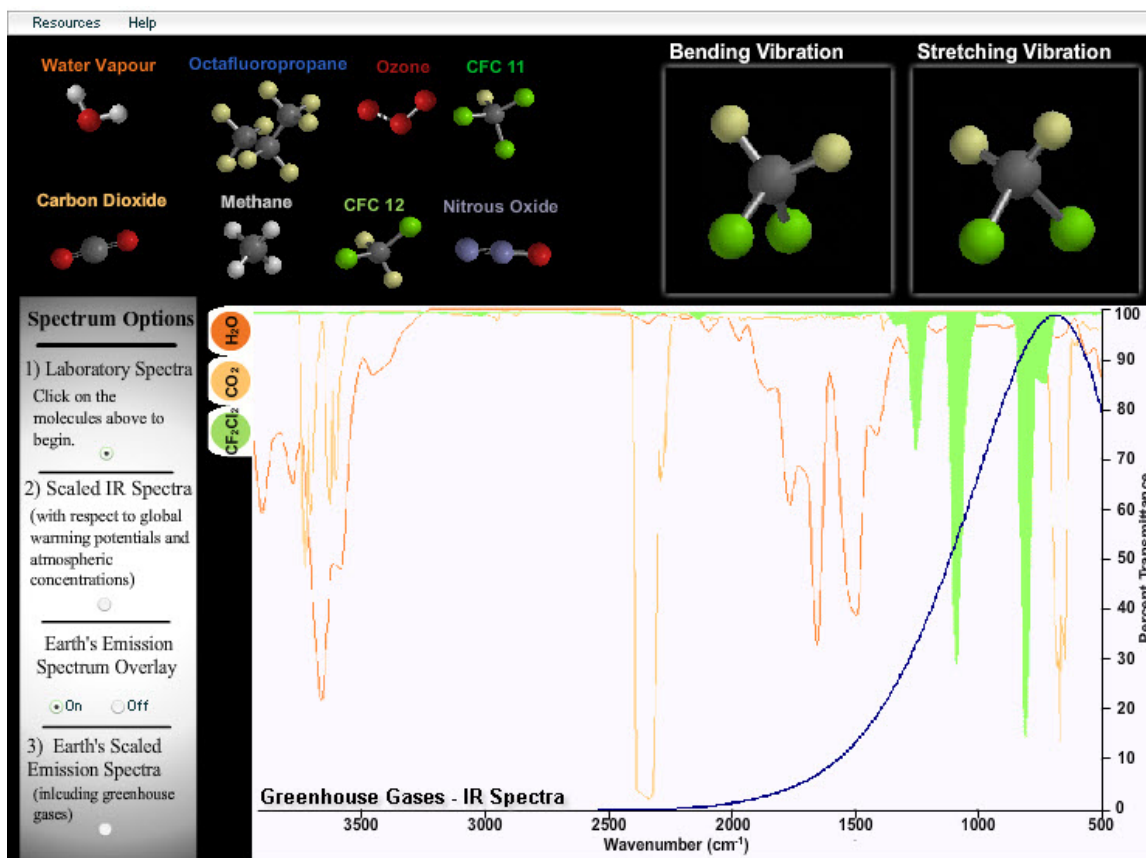
Peter Mahaffy, task group chair

- It's -25° C today in Northern Alberta. Is climate change actually happening? How do we know?
- Our world has gone through ice ages and warm periods in the past – how is this any different?
- Why are CFCs such potent greenhouse gases? I thought they were important in stratospheric ozone depletion, not climate change.
- How does the absorption of infrared radiation by greenhouse gases in our troposphere actually lead to warming?
- Predictions of future climate are just based on models – I need to see data, not models to believe that climate is changing.
- How do we know what the temperature was a half-million years ago?

These and many other questions by students, teachers, and the general public have been asked over the past two years of the task group coordinating the project “Visualizing and Understanding the Science of Climate Change.” People are barraged by contradictory claims in the media about whether our climate is changing, and what is causing the changes that are seen. And at the heart of the answers to many of these questions is a basic understanding of chemistry and physics.

The IUPAC task group is working to produce thirteen interactive lessons for global dissemination that are designed to help students visualize and understand the science underlying climate change. We started with research literature reports of common misconceptions that students have about climate change, and also fundamental principles of climate science needed to create climate literate students and teachers. Digital learning objects are being developed at the King's Centre for Visualization in Science (Canada), and integrated with written materials prepared by The Royal Society of Chemistry (UK) and the American Chemical Society (USA) into a set of critically reviewed interactive lessons for 16-19 year old students. Task group members from IUPAC's Committee on Chemistry Education, UNESCO, and the Federation of African Societies of Chemistry will participate in the review of materials and facilitate dissemination through national and international networks.

To give you a taste of the project, a screen capture from one of the interactive visualizations is shown below:



This interactive flash learning object helps to answer the third question in the list we started this report with – Why are CFCs such potent greenhouse gases? Absorption of infrared radiation in the region between $700 - 1200 \text{ cm}^{-1}$ causes excitation of the C-F stretching vibrational modes of CFC molecules. This happens to occur in a region of the IR spectrum where water and carbon dioxide, the two best known greenhouse gases are transparent (a spectral window). And so thinking of the earth as a giant IR source, CFCs absorb energies of IR radiation which have historically escaped into space, thus cooling our planet. This is also in a region of the spectrum close to the peak of earth's emission band (shown in the screen capture as a blue overlay).

When complete, the set of interactive lessons will provide tools for chemistry educators to make important connections in their classrooms to help students understand climate change, one of the defining challenges of the 21st Century.

The first lessons will be completed over the next several months – meanwhile you can already see some examples of interactive digital learning objects, including the one featured above, at www.kevs.ca.