by Shannon McCallum

Climate changes, that's a fact. Twenty thousand years ago, Victoria was covered by kilometre-thick ice and the average global temperature was four degrees colder.

Now, with overwhelming evidence that human activities are increasing global temperatures, University of Victoria climatologist Andrew Weaver is asking a key question: can the study of past climate changes help us predict future ones?

Understanding Earth's climate system is no trivial task. Climate is incredibly complex, involving interactions between the atmosphere, ocean, biosphere, and cryosphere (snow and ice surfaces).

One approach researchers can take is to design sophisticated computer models to simulate past, present and future climates. These models act as virtual laboratories, allowing researchers to perform climate experiments that can't be done in the real world.

At UVic, Weaver has built one of the most sophisticated climate modelling facilities on the planet, featuring one of the world's fastest supercomputers. Several years ago, he and his climate modelling group developed an Earth system climate model, now used by researchers around the world to study long-term climate change.

One climate puzzle that Weaver is investigating with the model is how past climate changes are linked to the global carbon cycle. Carbon dioxide and methane are continuously exchanged between the atmosphere, oceans and biosphere. Understanding this exchange is essential to predicting how increasing carbon emissions will affect future climates.

"We know that carbon dioxide and methane have amplified climate change during glacial cycles," says Weaver. "We're using our model to study how the ocean and land plants absorb atmospheric carbon, and to investigate how changes in the carbon cycle have interacted with climatic changes over the last 650,000 years."

One of the key missing links in the carbon cycle is permafrost, which is basically a huge frozen carbon reserve. "It's an important part of the carbon cycle and global climate system," notes Weaver, "yet it has received little detailed attention in the climate modelling world."