TRU Environmental Science Seminar Series

Thursday, February 25 - 4 to 5 pm

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TITLE

Connections Between Air Pollution, Weather and Climate

SPEAKER

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ABSTRACT

Air pollution is usually thought of as a "short term" phenomena, lasting days to weeks for a typical pollution episode, up to a few months for a severe event such as widespread biomass burning (aka forest fires). However, atmospheric particles emitted anthropogenic or natural sources (primary particulate matter) or created by in-situ chemical reactions post-emission (secondary particulate matter) are known to have an effect on both weather and climate. These impacts result from the particles absorbing and scattering incoming solar radiation, a process known as the aerosol direct effect, and from the particles providing sites upon which atmospheric water may condense, leading to cloud formation, also altering the atmosphere's radiative balance (aerosol indirect effect). These aerosol effects also describe a "feedback" between particles and the atmosphere, in that changes to weather and climate resulting from the particles' presence in the atmosphere may in turn change the atmospheric conditions, such as temperature, humidity, etc., giving rise to the particles' formation. The aerosol direct and indirect effects are known to be key factors in predicting future climates, and hence their inclusion in climate change computer models.

More recently, the impact of the aerosol direct and indirect effects on the shorter time scales of weather forecasting have been studied at Environment and Climate Change Canada, and at other laboratories around the world. The increasing consensus is that these impacts are sufficiently strong that improved weather forecasts may result from mimicking the known feedbacks between particles and the atmosphere within a weather forecast model. The findings to date from this research will be summarized, including high resolution coupled air-quality/weather modelling for western North America, in which a significant improvement in both weather and air pollution forecasts were achieved through the use of the "feedback" version of ECCC's Global Environmental Multiscale-Modelling Air-quality and Chemistry model (GEM-MACH).

Predicting further into the future, climate change is expected to in turn influence atmospheric chemistry. Simulations conducted by ECCC have shown that, if air pollution emissions activities do not change, air pollution is likely to become worse, with increased acute human health risks, under a future warmer climate. However, changes to activities carried out to reduce greenhouse gas emissions may also reduce the emission of precursors to air pollution. We have shown that the latter changes, even when taking place under a future, warmer climate, lead to significant reductions in both air pollution and air pollution's impact on acute human health outcomes. That is, a potential co-benefit exists, in which activity changes designed to reduce greenhouse gas emissions may also result in improved human health. These findings, more recent work on the impacts of the same pollution emission changes on chronic human health, and their potential implications, will be discussed.

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