Atmosphere & Natural Hazards

Helping councils meet air quality standards

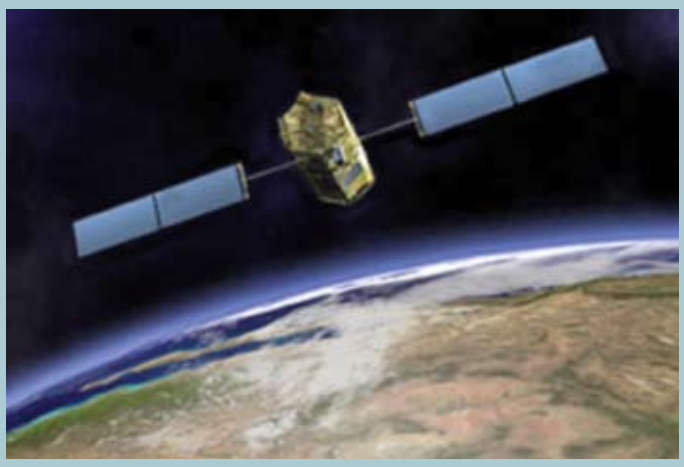
In 2004, the Ministry for the Environment introduced new regulations setting national environmental standards for air quality. NIWA is leading an applied research programme to help local authorities meet standards for particulate air pollution. It is multifaceted, collaborative research, and we outline just one example here.

Fine particles (PM_{10}) are a public health hazard. The regulations require councils to ensure PM_{10} concentrations are at or below a prescribed level by 2013.

PM_{10} are emitted from motor vehicles, domestic fires, and industrial processes. NIWA is working with GNS Science and the Auckland and Hawke's Bay Regional Councils to quantify these sources. Air samples are being analysed for their chemical composition and particle size. This will help councils develop effective pollution mitigation policies, targeted at the correct sources.

This research is funded by the Foundation for Research, Science & Technology.

'Watching the Earth breathe'



That's the catch-phrase of NASA's Orbiting Carbon Observatory, due to be launched in 2008. The satellite will collect global measurements of carbon dioxide in the Earth's atmosphere, looking down from space.

Meanwhile, NIWA is watching the Earth breathe from the ground up. Our atmospheric research station at Lauder is one of five charter sites for the global Total Carbon Column Observing Network (TCCON). Each site uses a Fourier Transform Spectrometer to determine the density of greenhouse gases in a 'column' from the Earth's surface to the sun.

TCCON measurements will provide vital validation of satellite measurements, and will improve inferences about the amount of greenhouse gases entering and leaving the atmosphere. This is important for predicting future greenhouse gas concentrations and, ultimately, better understanding the timing and severity of climate change.

NIWA's participation in the TCCON is funded by the Foundation for Research, Science & Technology, with support from NASA and the California Institute of Technology, and the cooperation of the University of Wollongong.

First regional climate model for New Zealand

How much more extreme could the weather get with climate change? Will there be more droughts or floods, and where would be worst affected?

NIWA has adapted a regional climate model, developed by the UK Met Office, to study the effects of climate change and variability on the New Zealand region, including some islands in the South Pacific.

Modern climate models represent as accurately as possible the conditions and forces which influence the climate. Our regional model is 'nested' inside the UK Met Office's global model, but produces much more detailed results over New Zealand. How complicated is that? Each point in the model's three-dimensional grid is described by hundreds of variables; it takes our supercomputer about one day to simulate a year of New Zealand's climate.

Recently we used the model to simulate New Zealand's climate from 1970 to 2000, and found it accurately reproduced the average regional distributions of temperature and rainfall of that time. We are now running climate change simulations for the end of this century.

Predicting future flooding on the Clutha Delta

Faced with today's extreme weather and future climate change, local authorities need good information to predict flood inundation.

This year, NIWA investigated a range of scenarios for future flooding of the Clutha River, combined with different sea levels, for the Otago Regional Council. The modelled flow of water ranged from a 1 in 10 year (average return interval) flood to a 1 in 500 year event. The sea level scenarios ranged from the present mean sea level to 0.9 metres above the current mean sea level.

To do the work, we used LiDAR (using lasers to scan the topography from a light aircraft), and river bathymetry, as well as high-resolution, 2-dimensional hydrodynamic modelling.

Predicted inundation on the Clutha Delta during a 1 in 200 year flood with sea levels as forecast for the year 2100 (0.5 m higher than the present mean sea level). The water has gone over the top of many banks, and a floodbank on the Koau (western) branch of the river has broken due to overtopping-induced scour.