

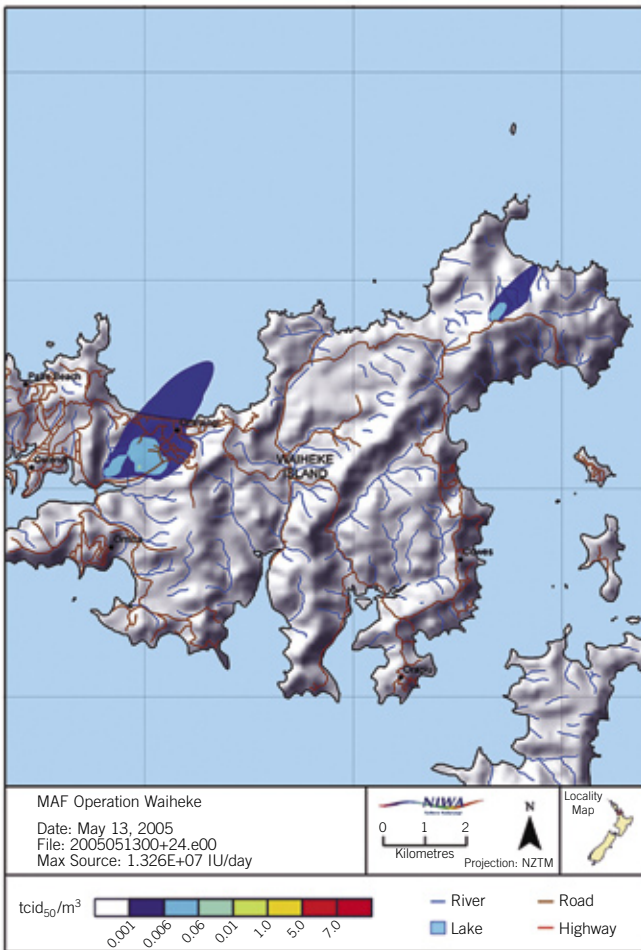
Atmosphere, Natural Hazards, & Energy

Foot-and-mouth emergency

NIWA staff are on call at all times in case of a biosecurity alert from MAF. When MAF called in May about a possible foot-and-mouth outbreak on Waiheke Island, we put our 'Plume Dispersion Emergency Management System' (PDEMS) into operation.

Throughout the alert we fed results from Massey University's model of production of the virus into PDEMS. Our computer model incorporates data on the terrain over which the air passes, wind strength, cloud cover, land use, and other weather features, to predict the wind direction and turbulent state of the boundary layer with as much accuracy as possible. We were always able to deliver our predictions on the spread of foot-and-mouth to MAF within four hours of receiving the virus production data from Massey.

Pigs pose the greatest risk for airborne spread of foot-and-mouth. Given the weather conditions, and the few pigs on the island, our modelling showed the risk of long-range spread of the disease was slight.



Hypothetical foot-and-mouth viral plumes over Waiheke Island for the actual weather conditions on 13 May 2005, assuming that four properties with pigs were infected.



Barbara Smith (AAD) examining an ice core at Law Dome, Antarctica.

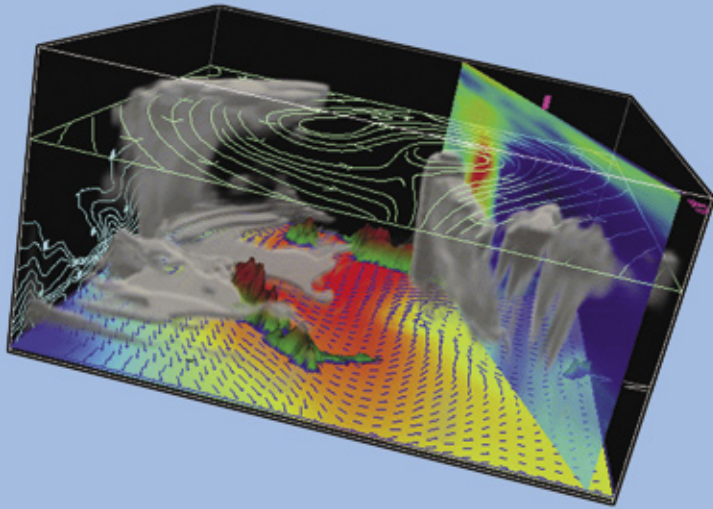
New discovery from pre-industrial methane

In the past, humans may have had a much bigger effect on the atmosphere than previously thought.

In an international collaboration between New Zealand, Australia, and the USA, methane was extracted from tiny air bubbles trapped in Antarctic ice. NIWA scientists have traced the origins of this methane by using atmospheric models and carbon isotope measurements of the extracted methane.

The isotope measurements revealed that over the last 2000 years, much higher than expected levels of methane came from forest fires, and that about 500 years ago these emissions dropped dramatically. The results parallel both natural climate change and, more surprisingly, human land use. Between 0 AD and 1500 AD, the indigenous population of the Americas burnt huge tracts of forests for agriculture and during hunting. But after European explorers arrived, the indigenous population, and emitted methane from their fires, plummeted. The results also indicate that methane emissions from wildfires are likely to be higher during El Niño events and to vary with future climate change.

Today, atmospheric methane concentrations measured at Baring Head, Wellington, are almost three times higher than those found in these ice cores.



A 3 dimensional plot of selected forecast fields from the New Zealand Limited Area Model viewed looking toward New Zealand from the northeast corner of the domain. Mean sea level pressure, surface wind vectors, cloud fraction, and wind streamlines 9 km above the surface are shown. For clarity, the vertical dimension has been exaggerated.

What the weather does

How can we accurately predict the downstream effects of weather and weather-related hazards such as flooding, storm surge, and coastal inundation? First, we need to know accurately what the weather will be. For example, flood forecasting relies on predictions of rainfall and river flow. So NIWA is developing the 'New Zealand Limited Area Model' to run on our Cray supercomputer.

Our model is an application of the most advanced numerical weather prediction model available, the Unified Model from the UK Met Office. It operates at 'high resolution' to take into account how the terrain, especially mountain ranges, affects the air flow in detail. It also operates over one of the largest 'domains' of any model of its type in the world, covering an area from New Caledonia in the north, to beyond Macquarie Island in the south, and from eastern Australia to beyond the dateline in the east. Such a large domain means we can produce accurate high-resolution forecasts for long lead times – up to 48 hours.

Another important feature, and a major research focus, is 'data assimilation', which means that we start with the best possible picture of current conditions, incorporating information from satellites as well as standard weather observing systems.

Smart badges measure UV

It's a clear day, the powder's perfect, the view breathtaking. It's time to pile on the sunblock and hit the slopes.

NIWA has used unique electronic badges in a study of UV exposure at Mt Hutt ski-field. Pinned to ski jackets, they logged the exposure every 8 seconds throughout the day. The results showed that UV exposure was much higher on the ski-field than in Christchurch on that day, but less severe than from sunbathing on a beach in summer.

The badges were designed by Martin Allen of the University of Canterbury to measure how much UV schoolchildren around the country are getting. Over the summer, almost 500 children wore the badges and recorded their activities and sun protection for a week, while we recorded ambient UV levels at each school. This is a joint project with the University of



Otago, sponsored by the Cancer Society. The data are being analysed as part of a PhD study. The resulting database linking children's activities, their UV exposure, and their sunsmart awareness, will be used to develop and evaluate health promotion programmes.