

NIWA Natural Hazards

setting the foundation for a safer future

Remote sensing techniques for collecting environmental data have many applications. In this issue we highlight some of the remote sensing datasets, techniques, and tools NIWA is using to support our natural hazard and risk assessment work.

'Spy in the sky' technology helps reduce cyclone risk in Tokelau

NIWA is routinely using high resolution satellite imagery to support many of our natural hazard and risk studies both in New Zealand and overseas. Typically we use DigitalGlobe® Quickbird multi-spectral imagery with a resolution of 2.44 m sharpened using panchromatic imagery with a 61 cm resolution. This resolution can identify objects less than a metre across.

NIWA is providing assistance to Tokelau, under the auspices of the UN Development Programme, to develop a strategic long-term approach to reducing risks from cyclone-related flooding. As no up-to-date or detailed maps are available for Tokelau's three atolls, the high resolution satellite imagery provided the essential base-mapping for the study.

During community consultations, people were able to locate property and other features on the images and use these to show which areas were inundated during particular cyclones. From this we built up a picture of flooding during cyclone events and identified high risk zones. We also used the imagery in mapping building and community infrastructure characteristics and in presenting future risk reduction initiatives.

In New Zealand, NIWA's use of the Quickbird satellite imagery includes assessing techniques to automatically extract building footprints and infrastructure information, and for making detailed maps of flood, tsunami, and coastal inundation.

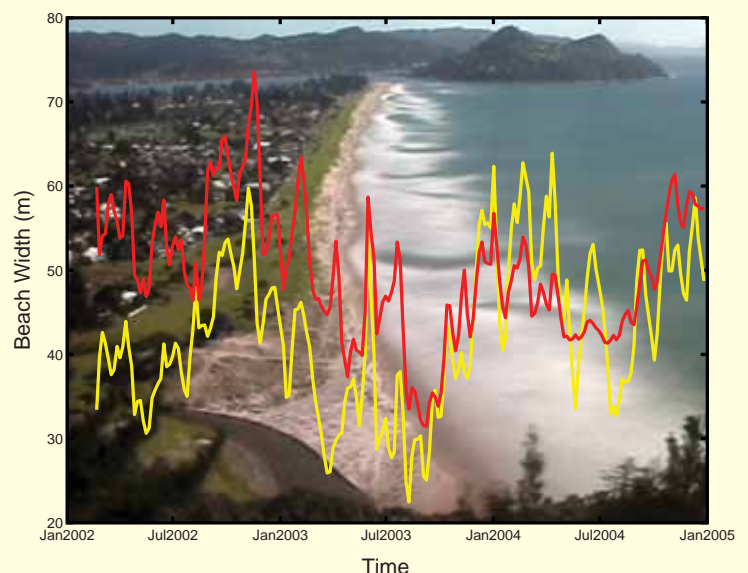


© 2005 DigitalGlobe, Inc.
All rights reserved.

Monitoring erosion at Pauanui Beach

NIWA's Cam-Era system for remotely monitoring beach processes has been in place at some locations for over seven years. This has provided a comprehensive dataset on coastal beach processes at Tairua and Pauanui in the Coromandel.

Recently there has been considerable public concern over perceived erosion of Pauanui Beach. Three years of images taken by NIWA's Cam-Era instrument at Pauanui Beach have been analysed to detect shoreline trends and variability. Despite the public concern, the data show that the beach did not shrink during the period analysed. The graph opposite shows beach width at two selected points. There is a large interannual variability (up to 30 metres) in the cross-shore extent of the beach, but no overall trend can be established. Pauanui Beach appears to be characterised by a strong seasonal pattern, with erosion occurring during the first six months of the year and beach build-up primarily occurring during the last six months of each year.



Space shuttle helps European flood risk modelling

The use of satellite-derived topography has allowed NIWA to map flood risk over large areas of central Europe for the insurance industry.

In February 2000, NASA's space shuttle Endeavour conducted the shuttle radar topography mission (SRTM). This collected data over 80% of the Earth's land surface, for most of the area between latitudes 60° N and 56° S. NIWA can access the data at a resolution of 1 arc second (about 30 metres) over the United States and its territories, and 3 arc seconds (about 90 metres) over non-US territory. We heavily reprocessed the SRTM data to remove imperfections before using it in our European flood modelling.

The flood model developed by NIWA predicts water extent and depth at high spatial detail for over 1500 flood scenarios and covers Austria, Hungary, Poland, Slovakia, and the Czech Republic. The development of this model merged very large geographic information system databases, including the SRTM data, with pragmatic water routing routines. Other members of the project team used the flood model results to calculate 'damage functions' for different lines of business, with the final results mapping loss estimates by postcode areas on a probabilistic basis and for specific events. The work was done under contract to the UK company HydroGIS.

NIWA is also using remotely sensed topographical data sets derived from LIDAR (Light Detection and Ranging) surveys to assist with flood, coastal, and tsunami inundation modelling, to identify past catastrophic coastal inundation events, and to map coastal erosion processes.



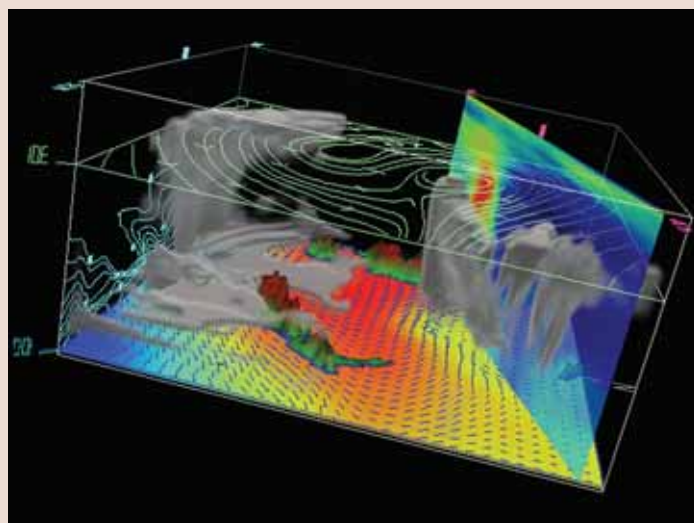
Photo courtesy of NASA

Remote-sensing essential for hazard forecasting

Sophisticated use of remotely sensed data is at the heart of NIWA's efforts to accurately predict weather-related hazards.

For example, we use radar data to estimate rainfall, and then use those estimates to validate the predictions of computer weather models. The resulting rainfall forecasts are an essential input into our river flow and flood forecasting.

One major research focus is 'data assimilation'. The more advanced techniques are conceptually and computationally challenging, and few organisations in the world are attempting them. In essence, by using satellite data as well as standard weather observing systems, which in turn improves forecast accuracy, our computer models start with the best possible picture of current conditions. In more detail, data are 'assimilated' by examining the differences between the most recent forecast and the observations, then the differences are used to move the model's view of the weather back towards reality before we begin to generate forecasts again.



A 3-dimensional plot of selected forecast fields from the NZ Limited Area Model being developed by NIWA to run on our Cray supercomputer. Satellite data assimilation is a key to the accuracy of the model's predictions. This plot shows mean sea level pressure, surface wind vectors, cloud fraction, and wind streamlines 9 km above the surface. The vertical dimension has been exaggerated for clarity.

We have also used satellite altimetry, showing significant wave heights, to validate our 20-year hindcast of wave conditions around New Zealand. NIWA's 5-day wave forecasts, covering the southwest Pacific and Southern Ocean, are available at www.niwascience.co.nz/ncco/forecast

For more information, contact:

Doug Ramsay

hazards@niwa.co.nz
0-7-859 1894

or call free on

0800 RING NIWA
(0800 746 464)