

# SNOWSTORMS

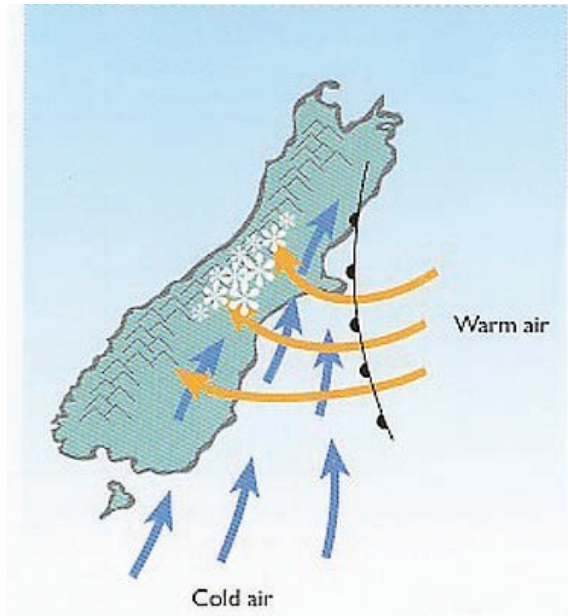
By *Erick Brenstrum*

Lead Forecaster, MetService

**Most heavy snowfalls of recent decades in New Zealand have affected relatively restricted areas, such as half of one province or even less. This is because they have been formed by a process weather forecasters refer to as warm advection. This involves a relatively warm airstream, coming from north of New Zealand, riding up over a colder one, coming from a long way south of the country.**

The key role of the warm airstream is to feed the storm with plenty of water gas - known as water vapour. Warm air is able to contain a lot more water vapour than cold air. Imagine comparing two lots of air approaching New Zealand - one from the tropics and the other from near Antarctica, both with 100% humidity. The amount of water vapour in the northerly airstream would be about three times that in the southerly airstream.

The idea of a warm airstream contributing to snow may seem strange but it is important to



Heavy snow occurred on 8 July and 27 August 1992 when warm humid air from the north and very cold air from the south were brought together over Canterbury by a deepening depression.

remember that as this airstream rises inside the storm, it is cooled considerably. By the time the air is three or four kilometres up, its temperature has fallen well



Motorway mayhem, North Dunedin. Photo: Otago Daily Times. June 1986.



For the kids it was time for some fun in the snow. Photo: Otago Daily Times. June 1986.

below zero. This cooling occurs because the rising air encounters lower surrounding air pressure as it moves higher into the sky. Consequently, the air expands. Whenever air, or any gas, expands, its temperature falls. As the air cools, some of its water vapour condenses into the tiny liquid drops that clouds are made of.

Once the air has cooled some way below zero, the water vapour changes directly into ice crystals without going through the liquid water phase. As the ice crystals stick together to form snowflakes, they become heavy enough to fall. At first, as the snowflakes move through layers of air closer to the ground, they begin to melt and reach the ground as cold rain. However, the melting snowflakes take heat out of the air next to the ground until its temperature falls to near zero. Then subsequent snowflakes can fall all the way to the surface without melting.

The reason the heavy snowfall area is relatively small is because the warm airstream delivering the water vapour to the storm is only tens of kilometres wide.

Two classic examples of warm advection storms occurred over Canterbury in the winter of 1992. In the first storm, early in July, the heaviest falls were in the foothills, where snow accumulated to depths of one metre or more over several days. Roads were closed,

power lines brought down and tens of thousands of cattle and sheep trapped.

The snow stayed on the ground for more than a week on hill country farms and stock rescue became a major operation involving hundreds of volunteers. Tractors and bulldozers were used to reach stock in the more accessible areas, but helicopters had to be used to fly hay and shepherds into more remote places. Sometimes the sheep had to be dragged or lifted bodily to safety, but often it was enough to make a path for the animals by walking ahead of them and stamping down the snow. This exhausting process, called "snow raking", entailed the risk of triggering small but dangerous avalanches if attempted on the steeper slopes. Hard work in the cold conditions could also cause exposure.

Paradoxically, the snow acts as an insulator once it is on the ground. In the clear nights that followed the snowfall, temperatures dropped to minus 16 degrees Celsius at the top of the snow surface, but the ground temperature stayed near zero. Animals trapped under the snow are sheltered from the wind, and their body heat can help form small snow caves.

In mid-winter the sunlight in Canterbury is not strong enough to melt the snow, especially since most of the light is reflected away by the snow surface. Warm winds or rain are needed for a thaw. This finally

came after ten days when warm northwesterly winds developed and the snow began to melt.

Disastrous floods have followed a number of heavy snowfalls in the past. In 1868, for example, the Opihi River in South Canterbury ran 11 km wide when swollen with melt water. This time there was no flood because the northwest wind in Canterbury is a very dry wind and much of the snow and water evaporated directly into the air.

Thousands of sheep and cattle died in the 1868 July storm and many more were left in poor condition. Tragically, when a second storm struck in the last week of August over a million lambs died. This storm was also caused by warm advection, but the snow was heavier in some areas, particularly parts of Banks Peninsula, where drifts of six metres were reported.

More common than these warm advection snowstorms are cold outbreaks where the air has come from the south through the whole depth of the atmosphere. These often bring snow down to sea level in the South Island and to low lying hills in the North Island, but the amounts of snow are much less than in the warm advection events, because the cold air has such a small amount of water vapour.

#### THE 1939 SNOWSTORM

Probably the worst storms of this kind in the last hundred years occurred during the winter of 1939 when snow fell the length and breadth of the country during frequent southerly outbreaks from June through to August.

On 31 July the lighthouse keeper at Cape Maria van Dieman, at the top of the North Island, reported snow falling at the lighthouse. A few days earlier it snowed in Dargaville and Ruapekapeka and snow lasted on the hills behind Kaikohe for several hours.

In Auckland, snow fell in many suburbs just before dawn on 27 July sticking to the clothes of people who were out and about such as milkmen and policemen. Five centimetres of snow were reported lying on the summit of Mt Eden while the Bombay Hills shone white for most of the morning. In the hills around Clevedon, just south of Auckland, snow lasted into the afternoon and numerous snowball fights took place between people who had never seen snow before.

Although snow threatened stock in some North Island hill country areas, over the low-lying areas it was largely treated with joy and amazement. In Gisborne snow fell for nearly three hours covering lawns and gardens, and those people who ventured outdoors enjoyed the novelty of being covered in snowflakes.

The road north of Taihape was blocked as was the Rimutaka Hill Road. Snow fell to sea level at

Castlepoint and the road to Masterton was closed by drifts at Big Saddle on the Whakataki Hill. Snow lay 15cm deep in Masterton, where the town clock was stopped at 0220 am by the weight of snow on its hands.

Further south the snow was heavier. In Canterbury, Banks Peninsula was cut off from Christchurch. Snow lay 30 centimetres deep in Akaroa and southerly gales piled up drifts 10 metres deep in places. Sixty men in a public works camp near Duvauchelle were without food for two days until a launch arrived with supplies from Akaroa. Stock sheltering in gullies were buried in snow drifts and many perished. In other places snow covered the tops of the fences so that sheep and cattle were free to roam.

While roads on Banks Peninsula were blocked by snow, the road around the southwest of the peninsula was impassible at Kaituna where the waters of Lake Ellesmere were driven over it by the southerly gale.

Although snow in Christchurch was only a few inches deep, frost on top of the snow caused numerous road accidents and disrupted the tram service.

Further south in Dunedin, conditions were much worse. Here snow and thunderstorms began during the evening rush hour on Monday 24 July, and by morning snow lay 15cm deep over the city. Only one bus made it out to the north over Mount Cargill, assisted by a gang of men with shovels. Electric trams did not commence running until the middle of the morning, and then only on certain lines on the flat. Buses made some progress over the snow but cars needed chains, although visibility was hampered for those whose windscreen wipers had frozen to the windscreen.

The road to the south was closed, as was the airport. Some trains got through, running silently over the snow-covered rails and only in tunnels making the usual clickety-clack noises. Schools were closed and no work was possible on the waterfront.

The snow continued falling through the Tuesday with gale force winds developing at night. The wind piled the snow into huge drifts completely filling road and rail cuttings and isolating the city from all sides. By the Wednesday morning snow was 35cm deep at St Kilda and half a metre deep at the north end of town but up to a metre deep in the higher suburbs such as Roslyn and Maori Hill. One drift on Mount Cargill was five metres deep and icicles 30cm long were reported on some houses. The weight of the snow caused some roofs and skylights to cave in.

The radio masts at Highcliffs on the Peninsula had been hit by lightning and the staff there were isolated without adequate supplies of food. On Wednesday a rescue mission was launched under





Constable Joe Oswald helps restore order during the big snow in Dunedin in 1939. Photo: Otago Daily Times

the command of the director of 4YA, Mr H. Ninnis, who had been with Shackleton in the Antarctic. Four members of the Otago ski club accompanied him. To transport the supplies they borrowed one of Captain Scott's sleds from the Otago Museum. When they reached the station, one of the men coming out to receive the supplies sank up to his neck in the snow.

Supplies were also running short in many parts of town as no fresh meat, vegetables, milk or coal was coming into the city. The only fatality occurred on Thursday when a man clearing snow from a skylight at Penrose's premises in George Street fell 10 metres to the floor.

By now snowdrifts were up to the roofs of some of the houses in the hill suburbs and many roofs were damaged. Small avalanches of snow destroyed guttering and spouting and some verandahs collapsed under the weight of snow. Most businesses had three days of little or no trade except for places selling gumboots, galoshes, motorcar chains, cameras and films.

However, the abundant snow also provided ample opportunity for people to enjoy winter sports. Snowballing was rife with battles between rival groups of businesses downtown. Any moving target was fair game, including cars and buses, some of which lost

windows, causing the police to intervene. Ambushes from above were common, at least while snow lasted on windowsills. Unsuspecting victims answered ringing doorbells only to have arm-fulls of snow thrust into their halls. Snowmen sprang up all over town and one school even managed to stage a paper chase with Condyl's crystals used to stain the snow red to make a trail. Skiers had a grand time and eagerly assisted in rescue missions including one to a farmer whose barn had collapsed.

Tobogganing was also a popular pastime, often on strips of linoleum or tea-trays borrowed from more sedate occupations. Speeds of up to 70 km/h were reached and there were the inevitable accidents.

Inland the snow was initially lighter but increased on the Wednesday night. The train from Lumsden to Kingston was marooned at Eyre Creek when the engine charged into a drift 2 metres deep and became stuck. The two passengers and the crew of three were forced to spend the night on the train and had to raid the cargo for dinner.

Further north, many places experienced severe frosts overnight. Water pipes burst in Palmerston North and Hastings, while, at Paremata, just north of Wellington, 20 acres of the harbour froze over and seagulls were seen walking about on the ice. Tidal waters also froze at Opotiki in the Bay of Plenty where sheets of ice were left attached to wharf piles and grassy banks as the tide went out and some ice lasted until 1pm.

Flooding occurred in Southland as the thaw set in on Friday, but the situation was relieved by another cold snap with further snow. Nor was that the last event. Invercargill received a heavier snow a week later when the city was covered to a depth of 15 centimetres overnight from Friday to Saturday 12 August. A ski-party set out for Oreti Beach to try out the snow covered sand dunes and the Ranfurly Shield game between Southland and Manawatu took place regardless, with only the lines cleared. Perhaps used to the local conditions, Southland beat the North Islanders 17-3. Snow also fell to sea level along the length of the West Coast, and in New Plymouth.

Up and down the country it was seen as the worst winter for snow in living memory, although one elderly Dunedin resident avowed that inland Otago had suffered worse in 1878 when drifts of 20 metres had occurred.

Although the statistic has not been calculated, it seems likely that this snow was of the order of a once in a hundred year event. Given the warming trend in both New Zealand and global temperatures since 1939, a winter this severe may have become a once-in-500-year event or rarer, and we may never see the like again. ■

