

◆ NSW Lightning Bolt ◆



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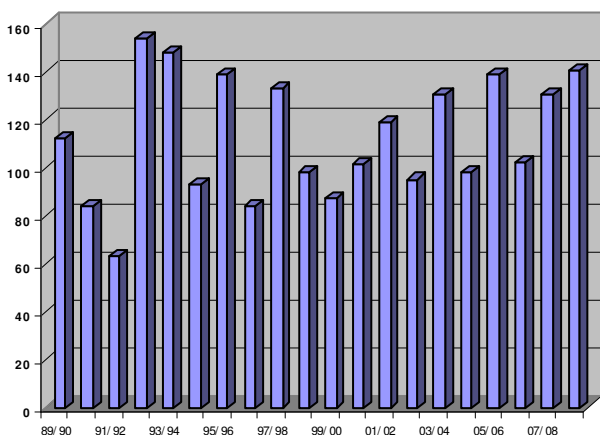
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Hi everyone and welcome to this latest edition of the Lightning Bolt. The current transition through the relatively thunderstorm-free months of winter provides a good time to recap the past thunderstorm season, and to revisit some of the biggest thunderstorm events NSW has experienced over the past 100 years. It will not be long before spring starts to come around and thunderstorm activity increases for another season. The upcoming season will see the launch of the new radar at Terrey Hills in northern Sydney. To help forecasters fine tune their interpretation of thunderstorms on the new radar for this season we would appreciate receiving all reports of hail, not only those that exceed 2cm.

Season 08/09

A total of 140 severe thunderstorm events were reported in NSW and the ACT during last season, which is well above the average (of 113) for the last 19 seasons. A feature of the last season was that the most severe of these thunderstorms generally did not directly impact on major population centers. This did not spare some unfortunate more rural locations from experiencing what would have been some of the most frightening weather of their lives. The Edgeroi storm mentioned later is a perfect example.

No. Severe Thunderstorms reported per year



Notable events during last season:

4 October 2008: Strong winds associated with a thunderstorm tore the roof off a house at Bourke. The 24 hour rainfall to 9am in the 5th of 54.8mm was the wettest October day on record in Bourke since records began in 1871.

26 November 2008: A severe hail storm at Coonabarabran damaged houses, motor vehicles and broke windows and skylights. Both the Coonabarabran hospital and police station were damaged. At Burren Junction in the North West Plains 2cm hail and strong winds did considerable damage to the town where hail was 3cm deep on the ground.

28 November 2008: Widespread severe thunderstorms occurred across northeast NSW. The most damaging was at Glen Morrison, south of Walcha on the Northern Tablelands. Up to 105mm of rain in 1 hour caused major local flooding and destroyed fences. The highest 24 hour rainfall total was 163.6mm at Weabonga, (Stoneleigh), near Walcha, their wettest day since records began in 1913. Trees were uprooted or snapped off in a narrow strip by strong winds, roofs were damaged, sheds flattened and stock was lost. A similar storm hit Ballangarra, near Telegraph Point on the Mid North Coast, destroying grain sheds, uprooting trees and knocking out power lines. Other reports included 5cm hail at Upper Horton on the North West Slopes.

29 December 2008: At Edgeroi, north of Narrabri on the North West Plains, a supercell thunderstorm produced giant hail. Photo evidence showed hailstones to at least 11cm in diameter, some of the largest recorded in NSW. A severe thunderstorm with 3cm hail hit the Goondiwindi-Boggabilla area of the NW Plains. Strong winds uprooted trees, crushed a grain silo, brought down power lines and fences and damaged 11 houses. Heavy rain caused flash flooding in the town. A dust storm was reported just before the storm hit. A thunderstorm with hail to 5cm, heavy rain and strong winds was reported near Comboyne on the Mid North Coast.

14 February 2009: A complex of near stationary thunderstorms brought torrential rainfall to the Bourke area. 195.8mm fell in the 24 hour period, with over 180mm falling in the 12 hour period overnight. This is Bourke's highest daily rainfall for any time of year since records began in 1871.

21 February 2009: A supercell thunderstorm left a swathe of damage to trees along the highway near Singleton in the Hunter Valley. 6cm hailstones were also reported from this storm. Wittitrin, near Kempsey on the Mid North Coast recorded 82mm of rain in 30mins, the equivalent of a 1 in 100 year short term rain event.

100 Years of Severe Thunderstorms

2008 was the centenary of the Bureau of Meteorology which started operation in January 1908. As part of the celebrations, NSW Bureau staff have been looking back through weather records and publications to build a list of severe weather events in NSW over the last 100 years. Here is a selection of notable severe thunderstorm events, one from each decade, from this period of our history. A copy of the full publication can be obtained by visiting <http://www.bom.gov.au/weather/nsw/sevwx/facts/stormy-weather.shtml>

25 November 1914 - A severe thunderstorm unroofed buildings in Lindfield and caused further wind damage at Middle Head, South Head, and at Watson's Bay where a large tree was uprooted and a 16 ft skiff carried 50 ft into the air. The narrow nature of the damage path and the sighting of a "whirlwind" suggested a tornado was possible.

25 May 1925 - In Sydney, very heavy rain was accompanied by frequent vivid lightning and hail. Streets were flooded, disrupting traffic and there was some structural damage to buildings. The storm was more severe in northern suburbs where Manly Town Hall recorded 191mm of rainfall (in the 24 hrs to 9am on the 26th). The official Sydney site at Observatory Hill recorded 101mm.

25 January 1937 - This storm was reported as one of the most disastrous in Sydney's history. Four people died and many more were injured as houses and factories were wrecked by hurricane force winds. The storm started in Castle Hill and moved SE leaving a trail of destruction through Marrickville, Mascot, Botany and Matraville.

8 June, 1941 - A tornado, swept through Orange and caused thousands of pounds' worth of damage. It was said to be the fiercest storm ever known in the district up to that time.

20 February 1956 - A tornado moved across areas surrounding Richmond during the mid-morning accompanied by torrential rain. An eyewitness, Harry Jasprizza, reported "It was one of the most marvellous sights I have ever seen. The water seemed to be sucked out of a lagoon in a column about 15 feet in diameter, rising to about 2000 feet."

9 July 1962 - During the afternoon, two small but intense tornadoes accompanied by torrential rain, hail and a single clap of thunder, left narrow damage paths through the town of Port Macquarie. The tornadoes claimed three lives and caused damage estimated in excess of £60, 000 at the time.

26 November 1971 - Severe thunderstorms dumped record torrential rain on Canberra, ACT, causing severe flash flooding in the Woden Valley area with the loss of seven lives. Most of the deaths involved cars being swept from the road into the raging torrent of an overflowing creek.

22 January 1986 - A severe hailstorm in the Orange district destroyed apple orchards and caused much damage to cars and property. Some hail was estimated to be at least 6cm in diameter. The hail dented an estimated 500 cars, with the damage estimated at \$10-\$15 million. About 50 to 70

percent of the apple crop was wiped out.

29 September 1996 - A severe thunderstorm moved through Armidale depositing an intense band of hail 2km wide and up to 15km long. Wind gusts up to 156km/h and hailstones up to 8cm in diameter damaged 5000 buildings and 4000 motor vehicles. Insured losses exceeded \$100 million making it one of the most damaging storms in rural NSW up to that time.

14 April 1999 - An intense, long-lived thunderstorm moved over eastern Sydney during the evening hours producing hail measured at 9cm diameter, although larger hail would certainly have fallen in the more severely-damaged areas. This hailstorm was of a magnitude seldom seen in Australia, or the world. It stands as Australia's most costly natural disaster (in dollar terms) to date, with total insurance claims of \$1.7 billion dollars. Over 20,000 properties and 40,000 vehicles were damaged in the storm.

9 December 2007 - A severe thunderstorm left a trail of hail damage across Sydney's western and northern suburbs stretching from Blacktown to Wahroonga. The largest confirmed hail size was 8.5cm at Blacktown. The SES had over 6,000 requests for assistance with Blacktown declared a natural disaster area. The insured loss exceeded \$400 million.

Australian Weather Calendar—2011 Photo Competition

Did you know that you can submit photos for consideration in the next Bureau Weather Calendar? Entry for the 2010 calendar has recently closed, however the 2011 competition has just opened. If you have taken a truly spectacular photo of a severe storm, or any other interesting weather phenomena, you should consider entering them. The competition for the 2011 calendar opened on 1 July 2009 and will close on 31 March 2010. For details see <http://www.bom.gov.au/calendar/call.shtml>, phone (03) 96694668, or email librarypic@bom.gov.au

Figure 2. Strongly structured shelf cloud wraps around the



core, (at right of picture), of a supercell thunderstorm. This storm produced seven-centimetre hail stones in the western suburbs of Adelaide, 22 January 1991. Photo courtesy of Peter Geytenbeek.

How fast does hail fall??

Being one of the major contributors to damage caused by severe thunderstorms, hail is a phenomena that we at the Bureau are very interested in. Receiving reports of observations of hail and its size greatly assists us in monitoring severe storms and passing on warnings to other communities and organizations such as the SES.

Hailstones form in a thunderstorm when updrafts carry water droplets up into extremely cold areas of the atmosphere where they freeze into ice. Not all of the droplets freeze at the same time. Some droplets become what is known as super-cooled, which means they still remain a liquid but have a temperature below freezing. Ice particles that have already formed collide with the super-cooled water droplets, which freeze on contact and grow the ice particle or hailstone further. A hailstone falls when the thunderstorms updraft can no longer support the weight of the ice. Larger hailstones therefore generally form in clouds with more intense updrafts. Updrafts at the centre of some severe thunderstorms can have vertical velocities of more than 150km/hr.

The velocity a hailstone will fall at is dependant on many factors including: hailstone diameter, the density of the ice de-

posit, the density of the surrounding air, the shape, the surface roughness and the way the stone tumbles during the course of its fall. As a general rule the larger the diameter and the denser the ice, the faster a hailstone will fall. The denser the air the hail falls through and the greater the drag (due to shape, roughness and tumbling), the slower it will fall. Hailstones bump into other raindrops and other hailstones inside the thunderstorm, and this bumping also slows down their fall speed. If the wind is strong enough, it can blow the hail so that it falls at an angle, rather than straight down.

It has been estimated that a 1cm hailstone can fall at 32 km/hr, a golf ball sized stone at between 110 to 130 km/hr and an 8cm hailstone, weighing 0.7kg can fall at around 175km/hr. These estimated speeds are terminal velocities, however factors such as drag, collisions, horizontal wind, melting, and the fact the hail is generally not a perfect sphere, mean a hailstone is not likely to reach terminal velocity.

By understanding how different hail sizes fall at different speeds it becomes clear why the strength of the updraft at the core of a thunderstorm is one of the factors considered when predicting hail size. The huge difference in fall speeds shows that it is a combination of the size of large hail and rapid fall speeds that makes it so dangerous and damaging.

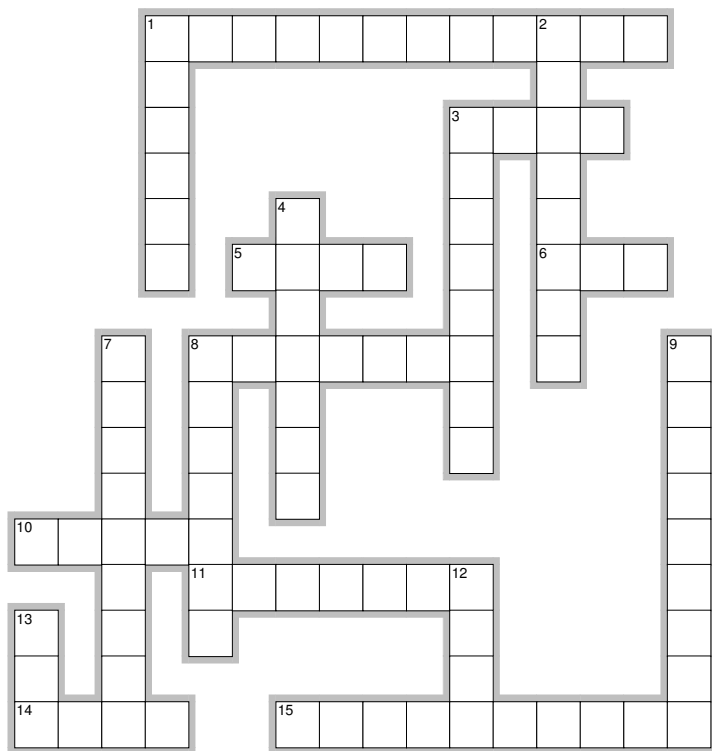
Weather Words Crossword

Across

1. heavy, puffy, heaped, dark cloud of great vertical depth.
3. precipitation of particles of ice.
5. a sudden increase of wind of short duration
6. gas and particles making up the atmosphere
8. a series of waves travelling across the ocean with extremely long wavelengths
10. precipitation that evaporates before it reaches the ground
11. fairly uniform precipitation comprising very small water droplets very close to each other.
14. wind 34-47 knots
15. device used to measure wind speed

Down

1. high cloud, delicate and wispy
2. violent and very cold wind, laden with snow.
3. a measure of water vapour in the air
4. clouds with a woolly, heaped appearance that often produce rain
7. persistent, single, intense updraught and down-draught coexisting in a thunderstorm
8. whirlwind or mass of rotating air with high wind speeds at its center
9. instrument that measures air pressure
12. El Nino Southern Oscillation
13. Suspension of very small water droplets in the air, reducing visibility



Online Spotter Report Form

The online spotter form has been successfully used by spotters throughout the season. There have been instances where forecasters have used online spotter reports during an event to add to their understanding of the situation. A link to the online form can be found on the Bureau's Storm Spotters network page at:

www.bom.gov.au/storm_spotters/index.shtml

Username: bomg0007 Password: Xy27mEne

It is very important that only those people who are registered Storm Spotters have access to these features so please don't share these details around with anyone not part of the Spotter network.

If you've moved, changed phone number, email address etc...

Please let us know of any change in your details so we can keep our spotter database up to date, and if you know anyone who hasn't got the Lightning Bolt for a while please pass this information on to them. Anyone who suspects they may have been removed from our database but wishes to continue as a spotter should call or email us, or send in a new application form stating on it that they have already registered but are sending new details on the form. That way we'll know we don't need to send a new spotter kit but we need to update our database. Thanks to everyone who has notified us in the past of changes to their details. It is a tremendous help to us.

Spotter training

Spotter training is planned to be run in conjunction with community radar workshops after the opening of a new radar at Terry Hills in Sydney's northern suburbs in the coming months. Until opening dates for the Terry Hills radar have been finalized training dates cannot be set. Dates are likely to be in August or September.

The Lightning Bolt is produced by the Bureau of Meteorology's NSW Severe Weather Section. Please address correspondence to:

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The friendly members of the NSW Severe Weather Team are: Michael Logan, Andrew Haigh, and Sarah Hicks.

email: nswstormspotters@bom.gov.au

What to Report

Spotters are asked to report to the NSW Bureau of Meteorology if they observe :

- ◆ Hail 2 cm diameter (\$2.00 coin size) or larger
- ◆ Damaging winds (90 km/h) or greater (eg. trees snapped, uprooted, large branches down; roofing tiles / iron lifted; structural damage to well constructed buildings)
- ◆ Tornadoes (rotating funnel clouds)
- ◆ Very heavy rainfall with "flash" flooding of low lying areas (around 30mm in 30 min or 40mm in one hour)

As soon as it is safe, phone your report to our "freecall" number:

1800 060292

This greatly assists the Bureau in monitoring severe storms and passing on warnings to other communities.

Please post us your spotter report card by mail or via the online form even if you do call. This ensures that our record of your event is correct. The information you provide helps us build a better picture of severe thunderstorms across the State.

Answers:

ACROSS

1. **CUMULONIMBUS**—heavy, puffy, heaped, dark cloud of great vertical depth.
3. **HAIL**—precipitation of particles of ice.
5. **GUST**—a sudden increase of wind of short duration
6. **AIR**—gas and particles making up the atmosphere
8. **TSUNAMI**—a series of waves travelling across the ocean with extremely long wavelengths
10. **VIRGA**—precipitation that evaporates before it reaches the ground
11. **DRIZZLE**—fairly uniform precipitation comprising very small water droplets very close to each other.
14. **GALE**—wind 34-47 knots
15. **ANEMOMETER**—device used to measure wind speed

DOWN

1. **CIRRUS**—high cloud, delicate and wispy
2. **BLIZZARD**—violent and very cold wind, laden with snow.
3. **HUMIDITY**—a measure of water vapour in the air
4. **CUMULUS**—clouds with a woolly, heaped appearance that often produce rain
7. **SUPERCCELL**—persistent, single, intense updraught and downdraught coexisting in a thunderstorm
8. **TORNADO**—whirlwind or mass of rotating air with high wind speeds at its center
9. **BAROMETER**—instrument that measures air pressure
12. **ENSO**—El Nino Southern Oscillation
13. **FOG**—Suspension of very small water droplets in the air, reducing visibility

