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GUY CARPENTER

Specialty Practice Briefing

An update from the Property Specialty

17 January 2005

Windstorm Erwin / Gudrun – January 2005

On Monday 10 January 2005 Guy Carpenter produced a Cat i report for windstorm Erwin. Now that more information is available, the following report has been produced which gives specific details of the event by territory.

Executive summary

Windstorm Erwin, also known as Gudrun in the Nordic Region, battered northern Europe from Ireland to Russia on 7-9 January 2005, killing at least 17 people and severely disrupting sea, air and land transport (Fig. 1). Floods and powerful winds hit the region, cutting power to around 500,000 homes. The storm ripped roofs from homes and caused widespread property damage. The UK was severely hit as strong winds and floods caused widespread damage. The Nordic Region was the most affected area and meteorologists said the storm was one of the worst to hit the region in years. Forest damage in Sweden was the worst recorded in recent history and caused disruption to power supplies, phone lines and railway traffic. The storm also cut power to households in Norway and hampered oil production at three offshore fields.

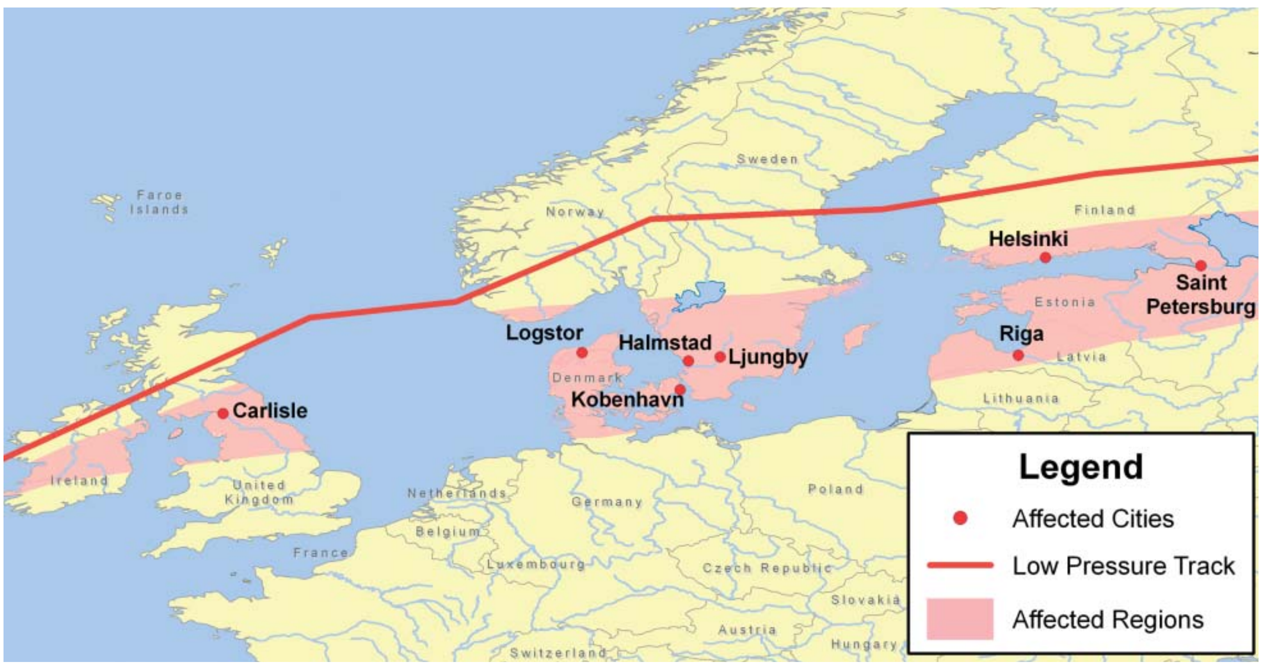

Fig. 1. Map showing affected areas and the storm track of Erwin

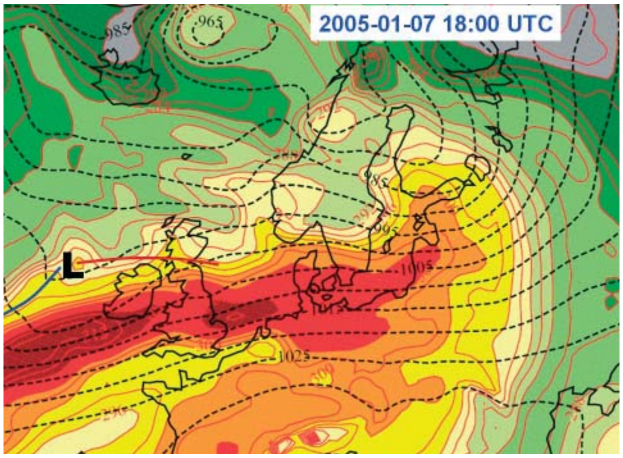

Fig. 2. Surface weather map for 18:00 on Friday 7 January 2005. The black dashed lines are lines of constant pressure (isobars) and the full red lines can be seen as lines of constant temperature at an altitude of about 1500 m. The surface low and fronts of Erwin are also shown (source: Danish Met Office)

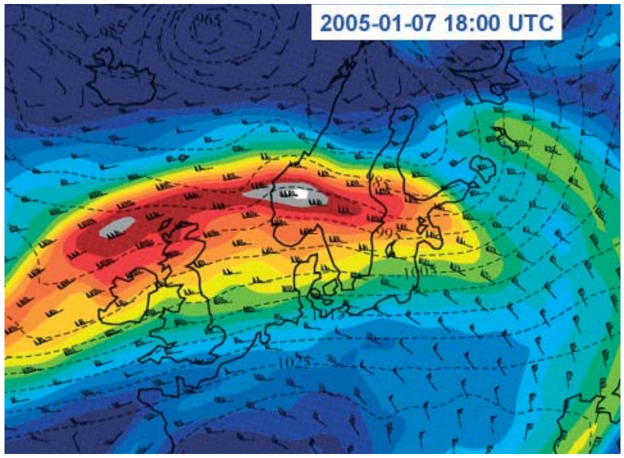

Fig. 3. Weather conditions at an altitude of around 9 km for 18:00 on Friday 7 January 2005. The black dashed lines are again the surface isobars, superimposed for reference. The regions of constant wind are indicated by colouring using the dark red colours to represent areas with wind speeds higher than 80 m/s (source: Danish Met Office)

Meteorological analysis

Erwin began as a perturbation on the polar front in a region just west of Ireland. On 7 January 2005 at 18:00 GMT, the centre of the forming storm was slightly below 995 mb and the system was barely visible on the meteorological maps. Around that time, the cold air masses from Greenland started to move southward colliding with very mild and moist air masses located further south. In Fig. 2 the surface pressure field shows an indication of the low pressure centre, marked with the letter L, while the temperature field shows the large contrast between the cold air masses in the north coloured in green and warm air masses to the south coloured in red. The winds in the upper troposphere, around 9 km up, are shown in Fig. 3. The red area in this figure indicates the position of the jet stream, revealing that the very

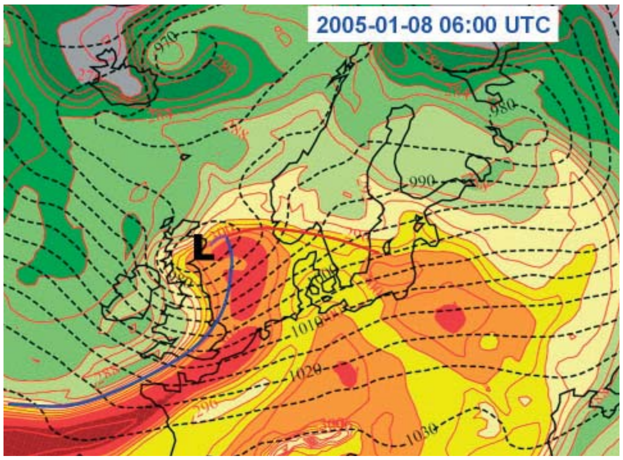

Fig. 4. Surface weather map for 06:00 on Saturday 8 January 2005. The black dashed lines are lines of constant pressure (isobars) and the full red lines can be seen as lines of constant temperature at an altitude of about 1500 m. The surface low and fronts of Erwin are also shown (source: Danish Met Office)

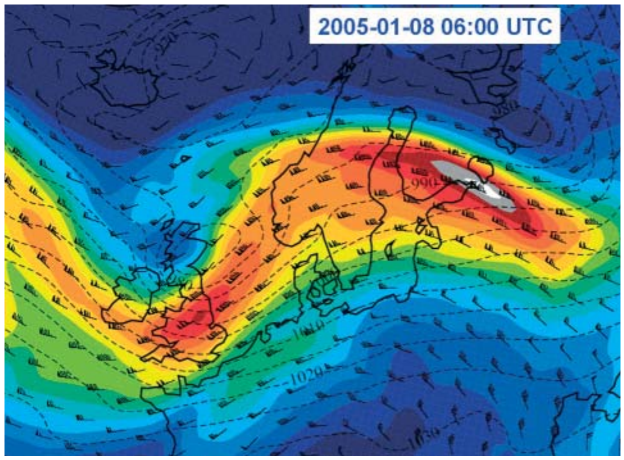

Fig. 5. Weather conditions at an altitude of around 9 km for 06:00 on Saturday 8 January 2005. The black dashed lines are again the surface isobars, superimposed for reference. The regions of constant wind are indicated by colouring using the dark red colours to represent areas with wind speeds higher than 80 m/s (source: Danish Met Office)

strong upper-level winds are further accelerating to the northeast just aloft of the surface storm in its initial phase. In this kind of situation, strong winds aloft draw the air from below, intensifying the pressure reduction at the surface. The resulting upward motions help form clouds and precipitation. The location of the jet together with a very large temperature difference between the air masses allows the storm to generate a large amount of energy, affecting its intensity, speed and direction.

Over the subsequent twelve hours, the storm moved rapidly to the northeast, deepening by more than 25 mb (Fig. 4), indicating an extremely rapid intensification of the storm. On its journey over Ireland and the UK, the storm brought heavy precipitation along with the high winds, especially in the north-eastern part of England. By 06:00 GMT on Saturday 8 January 2005 the pressure in the centre was below 970 mb and was located east of the UK. Figure 5 indicates that although the highest winds within the jet streak (the dark red area in the figure) had moved further to the northeast, the jet was still located right above the low-pressure system, helping its further intensification. Consequently the storm continued to deepen, although at a somewhat slower pace, on its way east and it reached the coast of Norway at noon.

The satellite pictures at this time reveal a distinct region, termed a 'dry conveyer belt', indicating a tongue of very dry air dragged down by the jet stream from high aloft, appearing as a dark region in Fig. 6. When this happens, the strong winds above the cyclone descend in the dry slot and make the surface beneath it a blustery place. Although further analysis is needed, there are strong indications that the high winds that

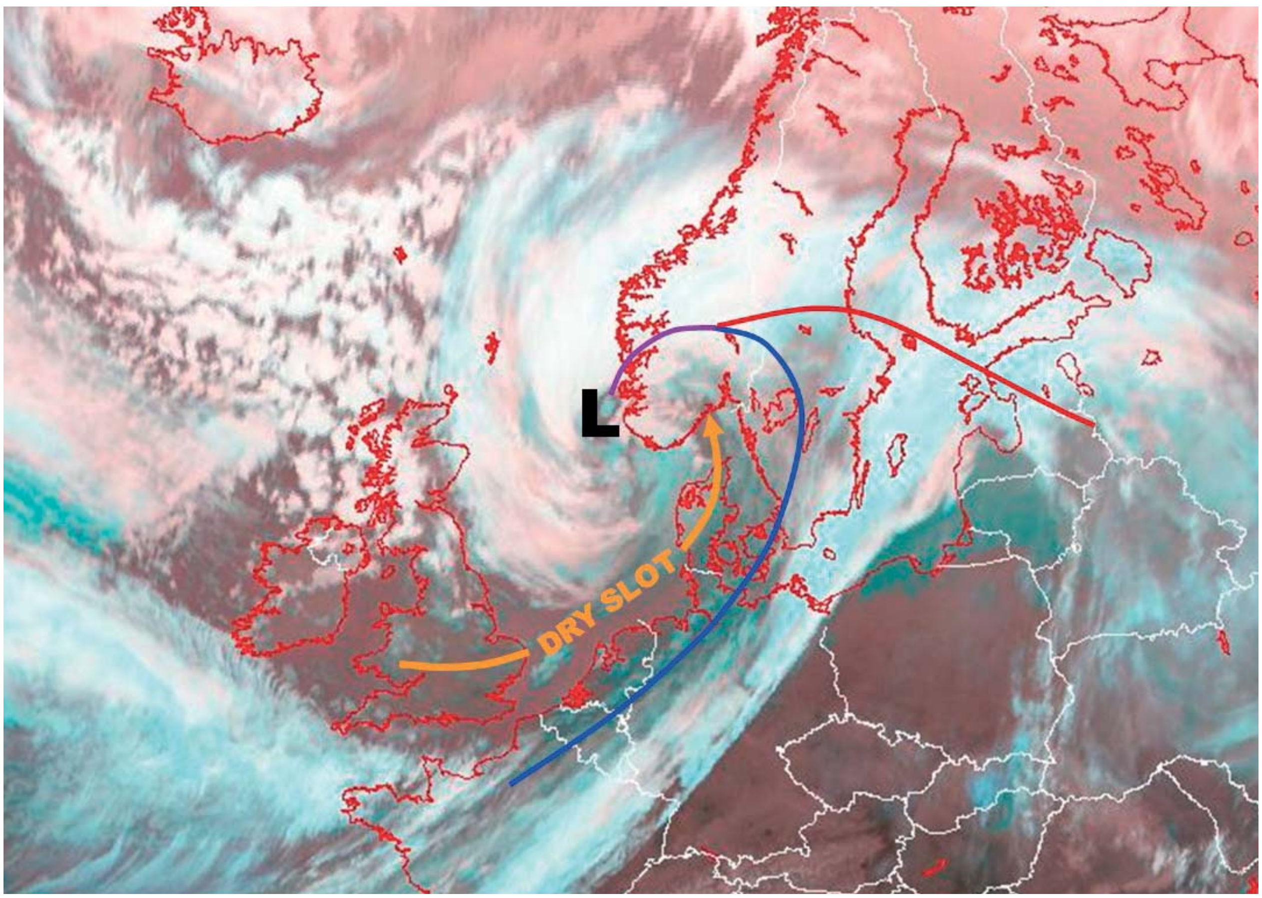

Fig. 6. The satellite picture for 12:00 on Saturday 8 January 2005. The picture is a composite of three satellite channels. The white and the greenish areas show the cloudiness while the brown regions are mostly cloud-free. The surface low and fronts are superimposed for reference (source: Danish Met Office)

battered large regions of Denmark and the south of Sweden as well as the north of Britain should also be blamed on a 'sting jet' within this storm. Sting jets are known to occur in low-pressure systems such as Erwin, when there is a dramatic fall in pressure, and to be the cause of the most damaging winds at the surface. A sting jet occurs when a stream of very strong upper-level winds descends to the ground at the bent-back tip of the weather front at the centre of a low pressure. Viewed from above, this part of the weather system has a cloud feature which looks like a scorpion's tail – hence the name sting jet.

The nadir point of 960 mb was reached on Saturday afternoon northeast of Oslo, Norway. Very soon after the storm was formed, strong winds developed in large areas south of the centre, bringing gales in the regions of northern Germany, Denmark and western Sweden as well as over the North Sea. The highest winds were observed on the coast of Denmark, reaching mean values of 28–34 m/s (63–76 mph) with gusts of 41–46 m/s (92–103 mph). Similar values were observed in eastern Skåne in Sweden. In addition, gusts reaching 30–33 m/s (67–74 mph) were observed over the whole of Denmark and southern Sweden. After its climax, the storm started slowly to fill out but retained much of its strength for at least another twelve hours, while it continued moving eastward. This is confirmed both in the surface map (Fig. 7), which shows a mature low-pressure system, and also in the height map (Fig. 8), which reveals that the upper level winds had significantly slowed down. On Sunday, when the storm reached the Baltic countries and Russia, the wind speeds continued to decline further.

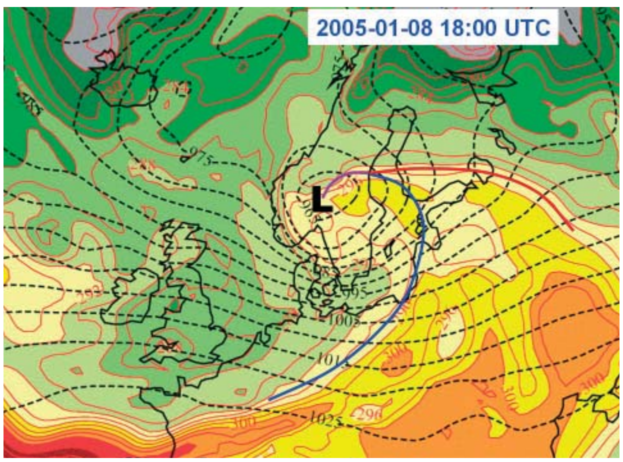

Fig. 7. Surface weather map for 18:00 on Saturday 8 January 2005. The black dashed lines are lines of constant pressure (isobars) and the full red lines can be seen as lines of constant temperature at an altitude of about 1500 m. The surface low and fronts of Erwin are also shown (source: Danish Met Office)

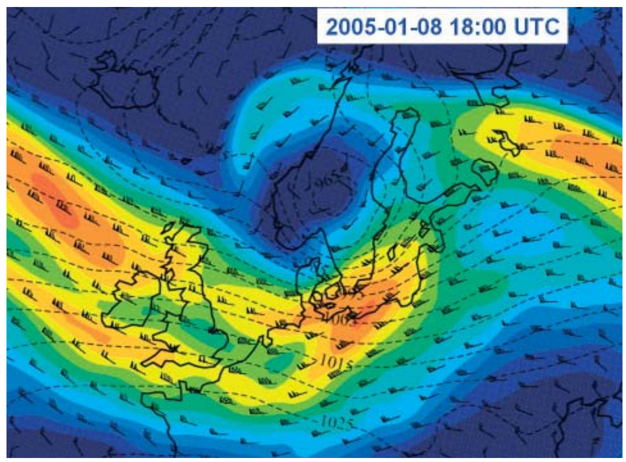

Fig. 8. Weather conditions at an altitude of around 9 km for 18:00 on Saturday 8 January 2005. The black dashed lines are again the surface isobars, superimposed for reference. The regions of constant wind are indicated by colouring using the dark red colours to represent areas with wind speeds higher than 80 m/s (source: Danish Met Office)

Clustering

At the time of writing, another damaging storm (Gero) had just crossed the UK before heading towards the Nordic Region. The storm track is slightly further north compared to that of Erwin and has caused major disruption in Scotland and Northern Ireland, with wind speeds in excess of 54 m/s (120 mph). Such 'twin' events are quite common in European countries and often follow very similar paths, which serve to compound losses from the original storm – for example Vivian and Wiebke in Germany 1990, the 24–25 December 1997 storms in the UK and Lothar and Martin in December 1999.

UK and Ireland

Powerful winds and heavy rain caused widespread damage on 7–8 January 2005, cutting power across many regions and forcing thousands of people to be evacuated from flooded homes.

In Ireland, several rivers burst their banks and flooded roads. The country was pounded by powerful winds that left around 150,000 homes without electricity. Wind gusts of 40 m/s (90 mph) were recorded in Belmullet, County Mayo. The storm also prompted a flood warning for the River Shannon.

In the UK, the worst-hit areas were the north of England, Wales and southern Scotland. The most dramatic events were in Carlisle as the city suffered severe flooding. Around 225 mm (8.9 inches) of rain fell in northern England over the weekend. Further south, thousands of homes and businesses lost power for part of the day. Elsewhere, around 100 passengers and crew were stranded on the P&O *European Highlander* ferry, which ran aground off the south-west coast of Scotland.

Across the country there were reports of flying debris as wind gusts reached 40 m/s (90 mph). Dozens of lorries were overturned and motorists caught by rising water had to be airlifted to safety, prompting the Highways Agency to appeal to people not to drive unless their journey was essential. Many train services were disrupted, particularly in the north of England and in Scotland. The storm also caused rivers in the region to burst their banks. The Environment Agency issued seven severe flood warnings (indicating imminent danger to life and property) and more than 100 flood warnings.

Carlisle

The north-western city of Carlisle in Cumbria (Fig. 9) was hit by its worst floods in 100 years and more than 2,900 homes in the city were flooded, according to the Environment Agency. Other areas of

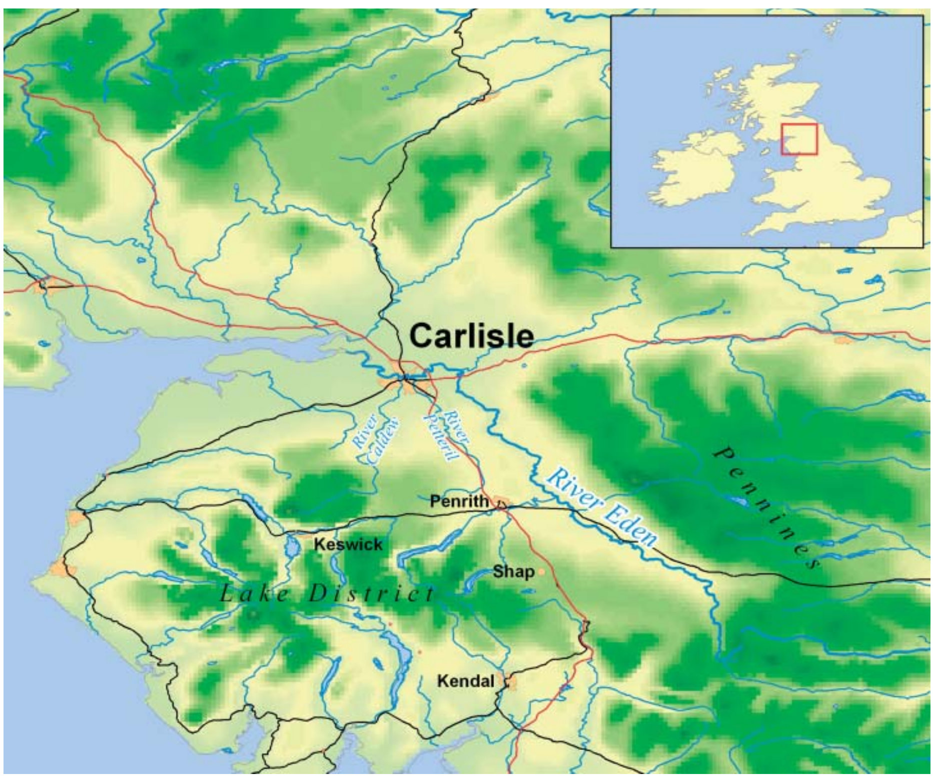

Fig. 9. Carlisle in northwest England was hit by the worst floods in 100 years

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Cumbria hit by flooding included Keswick, Kendal and Penrith, while houses were evacuated in Appleby, Longtown and Shap. Torrential rain swelled the River Eden along with its tributaries, the Petteril and the Caldew. The Environment Agency said that 8 km (5 miles) of Carlisle's flood defences were breached. The city was cut off by the River Eden and thousands of people were forced to move into temporary accommodation. At Shap, high on the River Eden catchment, 227 mm (8.9 inches) of rain fell in 72 hours and, of this, 120 mm (4.7 inches) fell on 7 January alone. In Keswick, meanwhile, 137 mm (5.4 inches) fell in 72 hours and 95 mm (3.7 inches) on 7 January.

Three people were reported dead in Carlisle and around 100 people were injured. Power was cut to approximately 30,000 homes and around 3,000 people were evacuated. In parts of Carlisle, water levels reached a height of 1.8 m (6 feet) although they receded on 9 January. At the height of the storm, people were rescued by helicopter from the rooftops of their homes or picked up in boats as cars floated down streets. Around 150 people were evacuated from Warwick Road, one of the worst hit areas in Carlisle. Staff at a Tesco store on Warwick Road were also trapped inside the building by rising waters. Schools across Carlisle were closed and hospital operations cancelled. The entire local Stagecoach fleet of 87 buses was put out of action by floodwaters up to 1.2 m (4 feet) deep at the Willowholme depot. Reports also said that two large industrial estates in the city were flooded.

Residents face many challenges in returning normality to their everyday lives. Insurance loss adjusters and disaster restoration companies such as ServiceMaster and Munters were quickly on the scene to take an inventory of the damage and provide equipment to assist in the clean-up process. Once the water receded, the first task of the restoration process was to pump out the remains of the polluted waters, remove damaged contents and spray homes with decontaminants.

Local utility companies have been working long hours to restore electricity to enable dehumidifiers and other such equipment to expedite the drying-out process.

Having stripped the houses of their contents, the plaster on the walls is then removed up to at least 1 m above the highest point the flood waters reached. The drying-out process and restoration work is slow and it will usually take 4–8 months before residents can return to their homes. As many of the homes in the worst-affected area in Carlisle are older properties, specialists in some instances will be required to take air quality readings, as there is a risk of asbestos, which would slow down the renovation process and increase the restoration costs.

Figs. 10–12 show scenes in Carlisle after the flood waters started to subside.

As residents wait for their homes to be repaired, they are in need of alternative living accommodation. Meeting the surge in demand for available furnished homes in the local area creates other difficulties and in some cases families may find themselves having to live in hotels, which in turn will escalate insurance claims.

Transportation is also an issue for the residents, as many vehicles in the area have also been written off.

The River Eden's catchment covers around 2,300 km^2 (888 square miles) of northwest England and transports water away from the Lake District (Cumbrian Mountains) to the west and the Pennines to the east. The river flows 145 km (90 miles) to the northwest from its source in the Pennines and passes through Carlisle, before entering the Solway Firth and the Irish Sea. The Rivers Caldew and Petteril, which are two smaller tributaries from within the same catchment area, also join the River Eden in Carlisle.

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Figs. 10–12. Scenes in Carlisle after the flood waters started to subside

The precipitation which triggered the flood in Carlisle was caused by warm, moisture-laden air, which originated out in the mid-Atlantic, being forced upwards over the Cumbrian Mountains and the Pennines. The air cooled as it rose and the moisture condensed resulting in heavy rainfall. It is very unusual to receive large amounts of precipitation simultaneously on both the Lake District and the Pennines. On this occasion, the River Eden and its tributaries were not able to cope with a whole month's rainfall in just 36 hours onto already waterlogged ground and this resulted in severe flooding in parts of Carlisle.

Other factors also contributed to the floods. According to the chairman of the National Association of River Trusts, up to 80% of the traditional wetlands of the Eden catchment have been lost since the 1950s. These areas have been drained to improve the grazing potential of the land. Consequently, heavy rainfall is no longer absorbed into the ground and slowly released into the river. Instead rainfall is drained quickly into the Eden, causing problems further downstream when it arrives in the river over a much shorter period of time. In addition, since 1968, substantial building has taken place close to the River Eden, including some construction on the actual floodplain itself. Building on a floodplain increases the amount of property at risk from flooding and the impermeable surface created reduces the storage capacity of the floodplain making any flooding even worse.

An Environment Agency spokeswoman said that the floods in Carlisle had been the worst for over 100 years. The last major flood to affect the city was in 1968 and, in comparison, the recent event was far more severe with water levels approximately 1 m above those seen then.

Flood coverage in the UK

According to the Environment Agency, 10% of the UK population lives on natural floodplains. It estimates that 1.8 million homes, 130,000 commercial properties and 14,000 km^2 (5,405 square miles) of agricultural land (12% of the total) are at risk from flooding. Of these, 65% are at risk of coastal flooding (including erosion) and 35% from river-related flooding.

Unlike most other countries, flood cover has been a standard part of UK household policies since the 1960s. Although a small number of properties have always been uninsurable because of the high risk of flooding, following the 2000 floods it was recognised that this number would increase as flooding became both more frequent and more severe.

This is the third major UK flood event over the last ten years and the details of the last two are as follows:

Date	Location	Details	Insured loss
October – November 2000	Widespread	10,000 properties flooded, wettest autumn in 270 years	£1.3 billion (£860 million domestic, £440 million commercial)
April 1998	Central England	More than 5,000 buildings flooded	£138 million

The most recent Association of British Insurers 'statement of principles on the provision of flooding insurance' has indicated that insurers should continue to provide flood cover to properties in flood-risk areas that are protected to 1-in-75 year levels as well as to the renewal of higher-risk properties where improvements in flood defences sufficient to meet the 1-in-75 year standard are scheduled for completion by 2007. The ABI has indicated that 400,000 properties in the UK are at a greater than 1-in-75 year risk of flooding.

In its turn, the UK Government agreed to increase spending on flood defences by more than the 13% p.a. it had originally set out in its 2002 public spending review, to improve the planning of flood defences (there is a big difference in the quality of flood defences in different parts of the country) and to implement planning guidelines that require flood risk to be taken into account (nearly a third of all planning applications in 2000/1 were for sites located on flood plains).

Nordic Region

The Nordic Region and the Baltic states were hit by the storm during 8–9 January with Denmark and southern Sweden the most severely affected areas (Fig. 13).

All areas of Denmark were affected with the strongest wind speeds occurring in the north-western part of Jutland, where winds of more than 45 m/s (101 mph) were recorded. Because of strong winds and high tides the sea level rose to more than 2 m above normal, causing heavy flooding in western Jutland and Limfjorden.

In Sweden, the gust wind speed reached 42 m/s (94 mph) at the southeast coast. The most severely affected area was a corridor going east between Ängelholm and Varberg, with gust wind speeds inland of 33 m/s (74 mph) causing a record damage to the forests.

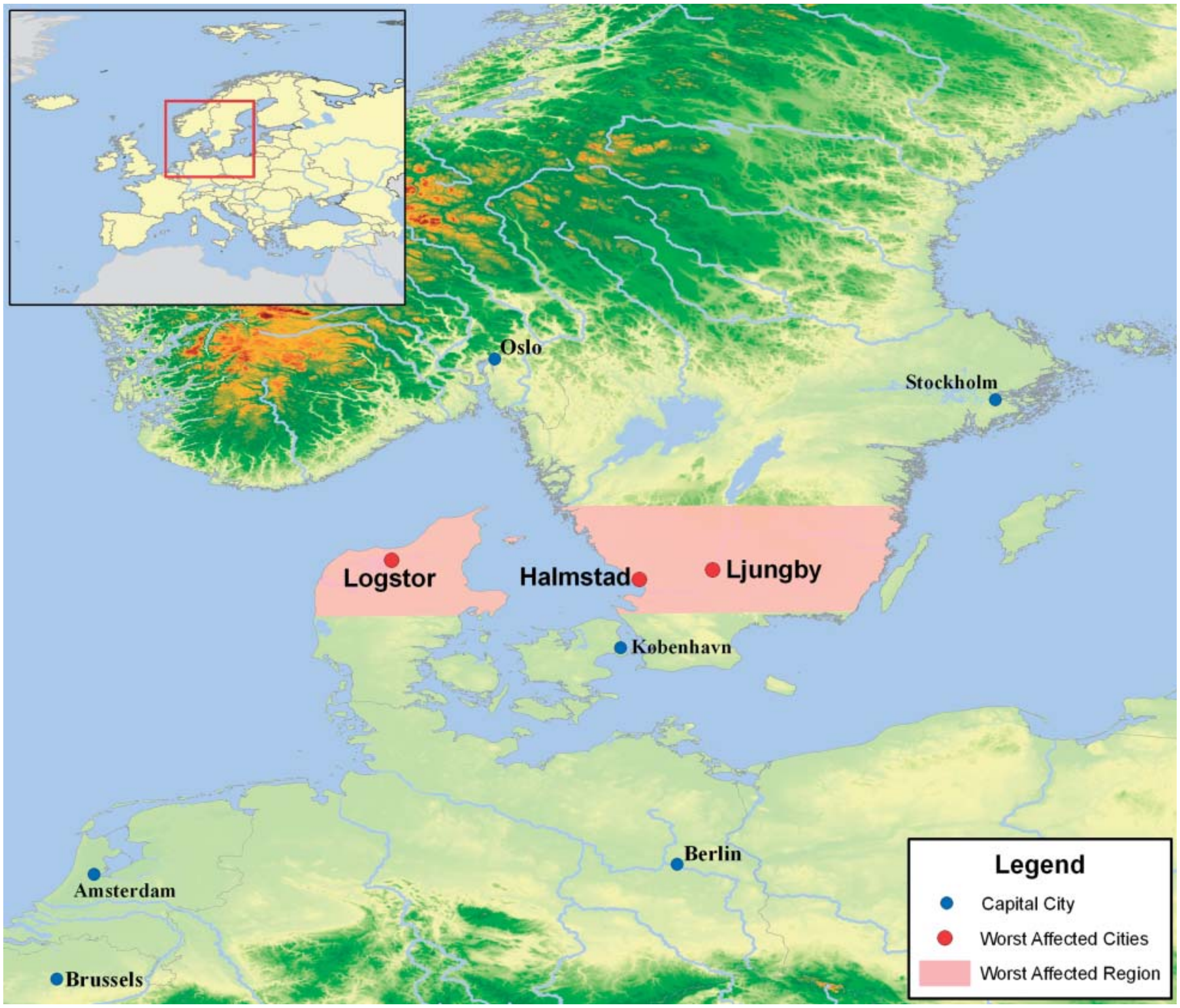

Fig. 13. Worst-affected areas and cities in the Nordic Region

As the storm moved across the Baltic Sea towards the south of Finland and the Baltic states on Sunday morning, it caused flooding in the coastal area with a record of 1.5 m above sea level in Helsinki.

Airports in Denmark and southern Sweden were temporarily closed, the ferry traffic in the south Baltic Sea was suspended and rail and road communications were badly disrupted.

In Denmark four people were killed, around 60,000 households lost power in northern Jutland and heavy damage to property was reported. The Danish forests were affected with 20–30 km^2 (8–12 square miles) of lost woods with an estimated value of DKK 300 million (£28 million).

In Sweden the storm was the most serious in 35 years with nine people being killed. Five nuclear power plants were forced to close when saltwater was blown into electricity distribution plants and all rail

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Fig. 14. Example of forest damage in Småland, southern Sweden *(source: Smålandsposten)*

communications to and from the south were stopped. Travel by road was also disrupted because of fallen trees and flooding. The storm caused heavy damage to property and to forests (Figs. 14 and 15).

The damage to the forest industry was devastating with far more trees fallen than ever before recorded. It is estimated that around 75 million m^3 (2,648 million cubic feet) of trees fell with an estimated total value of SEK 20–30 billion (£1.6–2.3 billion). As a comparison, the total yearly production in Sweden is 85 million m^3 (3000 million cubic feet) and in the affected areas, three to four years of production were lost. The net loss to the industry after recovery of the timber will be several billions SEK (SEK 1 billion = approximately £77 million). Only a portion of this is covered by insurance.

More than 400,000 households lost power and phone lines in Sweden due to falling trees.

Fig. 15. Storm damage to a residential building in Växjö, southern Sweden *(source: Smålandsposten)*

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It is expected to take several weeks before the power is back in all of the affected areas. In some areas, elderly people were evacuated because of unheated houses. The railroad and power industries are estimating the recovery cost and compensation to consumers to be at least SEK 600 million (£46 million).

Norway was affected by the storm but little damage has been reported.

In Denmark the storm was not as severe as Anatol in 1999. However, according to the Danish Meteorological Institute, it is among the ten largest storms ever experienced.

In Sweden the wind speed was about the same as for Anatol but the area affected was larger due to a more northerly track causing more widespread damage. The forests were especially heavily hit due to unusually strong winds inland. In 1969, Sweden was hit by two storms, causing damage to the forests of 25 and 10 million m^3 (883 and 353 million cubic feet) of fallen trees. Since then, the population of spruce has increased. The moist ground due to the mild and wet winter is a factor that has contributed to the damage.

Germany and the Baltic states

The storm also caused widespread disruption elsewhere in Europe. In the north German state of Schleswig-Holstein, strong winds damaged houses and shut down trains, ferry links and highway bridges. Two people were reported missing in the state after their kayak overturned in strong winds.

The Baltic states of Latvia, Estonia and Lithuania also suffered badly, with flooding in many coastal towns. In Latvia, powerful winds hit the country's coastal regions, toppling up to 5 million m^3 (176 million cubic feet) of wood and tearing roofs off houses. Meteorological officials said the storm was the worst to hit Latvia in 40 years. Reports said properties in Ventspils, Liepaja, Valka and Jekabpils suffered the most damage. Although no deaths or injuries were reported, wind gusts of up to 38 m/s (86 mph) were recorded. The country declared a national energy crisis after thousands of electricity poles were downed, depriving 1.4 million people (60% of the population) of power at the height of the storm. Extensive flooding was also reported in Riga, prompting the military to evacuate people from the capital. Authorities in Riga said the damage caused by the storm would be in the tens of millions of euros and released €2.9 million (£2 million) for emergency relief measures.

The severe weather also forced the evacuation of 600 people in Estonia and left tens of thousands of people without power. Fourteen people were injured and needed hospital treatment in Estonia. Reports said damage was greatest in the western coastal region of the country. The storm also downed vast tracts of timber in the country. Estonia's state forestry service estimated the storm toppled nearly 1 million m^3 (35 million cubic feet) of timber, which could total around €30 million (£21 million) in damages.

Although Lithuania was the least-hit of the Baltic states, flooding was reported and there were widespread power cuts.

In the Russian city of St. Petersburg, six subway stations were closed as rising water levels threatened the city. The water levels reached 2.5 m (8.2 feet) above normal levels at one point.

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Loss estimates

UK

Although no official UK insured-loss figure has been released, early reports suggest a market loss of £150–250 million. According to the Association of British Insurers, the average household claim for flooding in the UK is £15,000–30,000 (no figure exists for commercial property as the figures vary so much). Conversations with loss adjusters in the field indicate average losses of nearer £50,000–65,000 per residential property in the Warwick Road area of Carlisle (including buildings, contents and extra living expenses). Although the majority of affected properties are residential, there are some potentially significant commercial property losses with one of the largest reported so far being United Biscuits. The UK loss is expected to fall within the retentions of most insureds' catastrophe programmes although some risk excess programmes could be impacted.

The vast majority of the losses in the UK from this event are from flooding. Flood losses following windstorms are not included in industry loss estimates from commercial catastrophe model vendors. The losses in continental Europe, however, are mainly from wind damage.

Sweden

In Sweden early estimates indicate that the insured loss could exceed SEK 3 billion (£232 million) where losses from forest and agricultural insurance will be the largest part. The Anatol loss was about SEK 1 billion (£77 million) affecting the southern tip of Sweden, causing heavy losses to agricultural and residential buildings with limited losses to forest insurance. RMS estimates the loss for Sweden at SEK 500 million (£39 million). EQECAT has identified seven scenarios in its stochastic event set which look similar to the Erwin storm. Running these scenarios through an industry database gives an average loss estimate of approximately SEK 1.5 billion (£116 million). Neither of these estimates includes damage to forest, cargo and pleasure boats.

Initial reports suggest that this event could substantially impact some Swedish catastrophe programmes.

Denmark

The total number of losses in Denmark is estimated to be between 150,000 and 200,000 and the total loss could exceed DKK 3.5 billion (£325 million). At this early stage a lot of damaged properties are not reported, especially summerhouses. The total market loss for Anatol was DKK 13 billion (£1.2 billion) with about 350,000 individual losses. However, the wind speeds from Anatol were stronger, causing a historically large average loss. Flood losses in Denmark are covered by the state through the Danish Flood Pool that was started in 1991. RMS is projecting the insured loss in Denmark at DKK 4.6 billion (£433 million). Using the same EQECAT methodology as before implies an average loss estimate of approximately DKK 2.5 billion (£236 million).

Initial reports suggest that this event could impact the lower end of some Danish catastrophe programmes.

Norway and Finland

Insurance losses in Norway and Finland are reported to be limited except for a large cargo loss in the Helsinki harbour where imported cars were damaged by saltwater with an estimated loss of €5 million (£3.5 million). A similar loss is reported from the harbour of Halmstad in Sweden with 1,000 damaged cars worth more than SEK 100 million (£7.7 million).

Reinsurer losses

Most reinsurers are yet to publish loss estimates, although Munich Re has said the storms could cost the company between €50 million (£35 million) and €100 million (£70 million).

Sources

BBC, Reuters, *Daily Telegraph*, Eden River Trust, Cumbria Online, RMS, Met Office, Associated Press, Agence France Presse, *Irish Independent*, *Herald-Sun*, *The Irish Examiner*, CNN News, Environment Agency, ABI, SMHI, DMI, DN, SVD, SR, *Smålandsposten.*

Short meteorological glossary

Air mass – a large body of air that has similar temperature and moisture characteristics.

Cyclone – a body of air in which the pressure is lower than that of the surrounding air; low or low-pressure area.

Front – the boundary or transition zone of two air masses. If cold air advances and replaces warmer air the front is a cold front, and if warm air advances and replaces cooler air, the front is a warm front.

Gale – in general, and in popular use, an unusually strong wind. In storm-warning terminology, a wind of 28–47 knots (32–54 mph).

Isobar – a line drawn through all points of equal atmospheric pressure along a given reference surface.

Jet stream – a zone of strong winds concentrated in a narrow band in the upper atmosphere. These winds are often referred to as the storm track since the jet stream often 'steers' atmospheric storms.

Jet streak – same as jet stream core, the region of a jet stream with the greatest winds.

Nadir – the lowest point.

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