

Tempest, fire and flood [^]and pestilence: European Weather of 2007

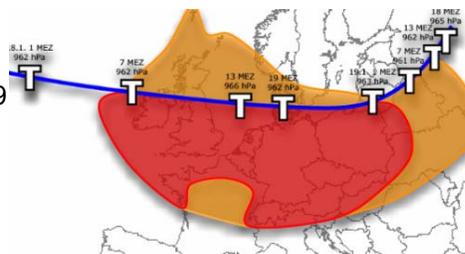
By Roger Brugge

Data Assimilation Research Centre
Department of Meteorology
University of Reading, UK

r.brugge@reading.ac.uk

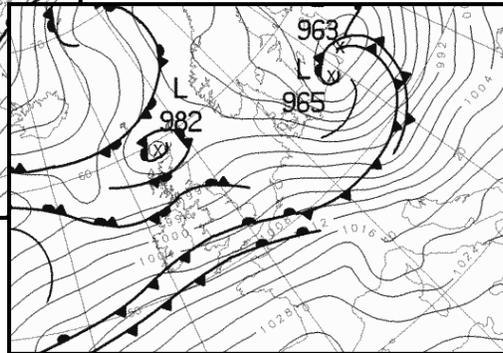
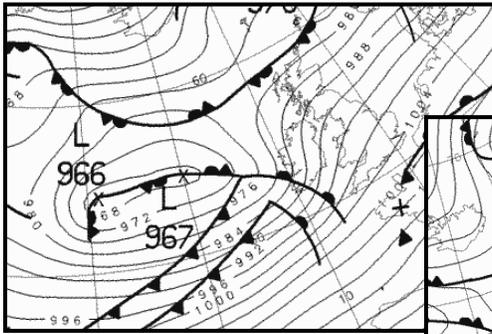
Storm Kyrill

- Formed over Newfoundland on 15 January 2007
 - very cold air from the north of the USA met much warmer subtropical air from the south.
- Reached Ireland and Great Britain by evening of 17 January.
- Moved eastwards toward Poland and the Baltic Sea on the night from 18 January to 19 January and further on to northern Russia.



Storm Kyrill

Strongest winds on the southern flank



UK Met Office 00Z analyses, 18 and 19 January 2007

- 125mph gusts on the Wendelstein mountain (Germany); 132mph gusts on Snezka in Czech Republic.
- The cold front spawned at least 3 tornadoes in Germany
- 14C recorded in Prague (**0.5C normal**)
- January records of 19.7C at Eisenstadt, 19.3C at Vienna and Salzburg (Austria).
- 25C reported in Turin (foehn, **6C normal**) – previous Winter Olympics city!

- The field of hurricane-force winds was very broad
- German weather experts have described the storm as a "once in a decade" event.



- At least 47 fatalities
 - Germany, UK, Ireland, Holland, Poland, Czech Republic, France, Belgium, Austria.
- Insurance cost across Europe - 3.5 billion euros.
- There were 192 flights cancelled at Heathrow.
- All rail services in Germany suspended.

The wreck of the MSC Napoli



- Holed and lost steerage in force 8 gale;
 - Taken in tow
 - Grounded off Devon amid fears she might sink under tow;
- 26 mariners rescued
- Containers later retrieved after much beach-looting:
 - Car parts, wine, motorbikes and nappies (diapers)

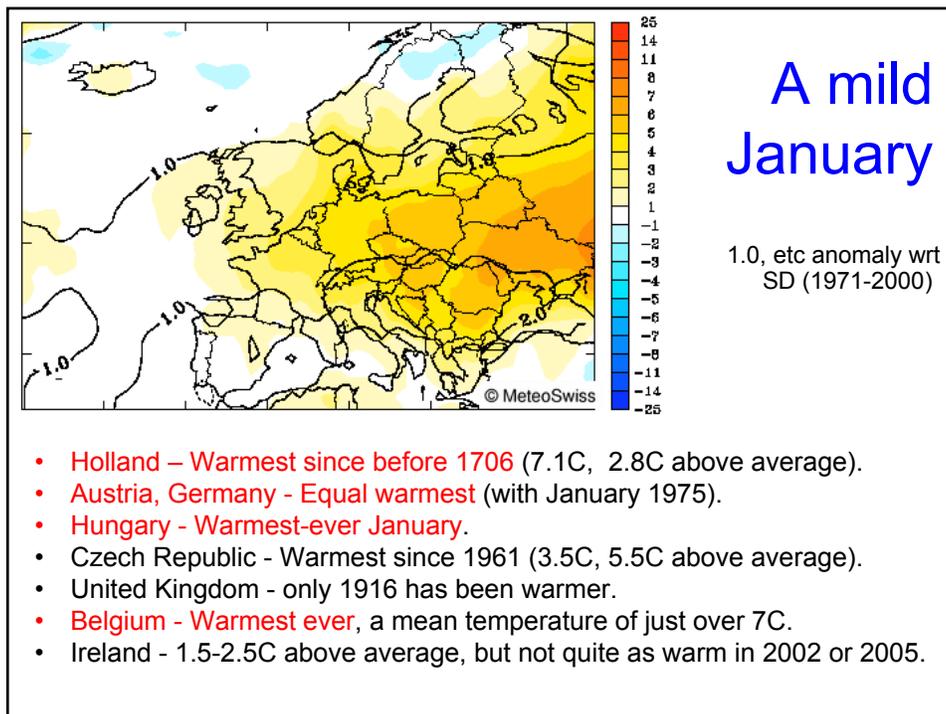


Warm January, with snow in the wrong places...

- 11 January
 - 8.6C in Moscow, 4C above the day's previous record of 1957 (normal -6C). First fortnight of January 2007 - the mildest in Moscow in 130 years.
- 16 January
 - Romanian snowboarders blocked traffic in front of the country's weather institute, and would only disperse when weather officials would agree that their complaints of a lack of snow "would be passed on to a higher authority".
- 21 January
 - Bulgaria: 20C in some areas with Vratsa hitting 22.5C (5C normal).
- 19 January
 - Lack of snow: Hundreds of ski races in Europe - half the season's schedule – cancelled/disrupted (Alpine and Nordic).
 - Race organisers in Kitzbuhel had to use helicopters to obtain over 100,000 cubic feet of snow.
- 20 January
 - Israel: 5,000 people evacuated from the resort of Hermon during a blizzard.

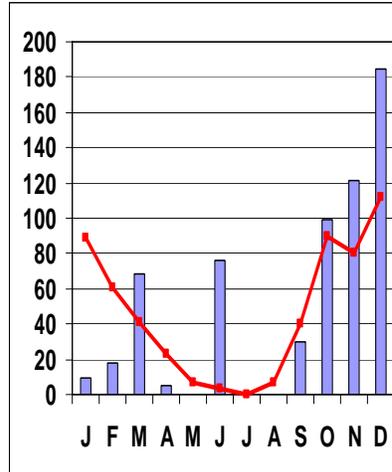
...but it finally arrived in the Alps

- 23 January
 - Up to a metre of snow fell overnight in Austria, which also left many thousands without power.
 - Heavy snow closed the main highway between Prague and Brno.
- 24 January
 - Snow and ice led to travel disruption and fatalities across Europe.
 - In Germany three people died and dozens injured in weather-related incidents.
 - Airline flights were grounded at Stuttgart Airport.
 - Temperatures dropped to -10C in parts of France.
- 26-27 January
 - Temperatures plummeted in south-east Spain.
 - Granada (Andalucia) -6C and Malaga +1C. (Normal values 5-10C)



Malta prays for rain

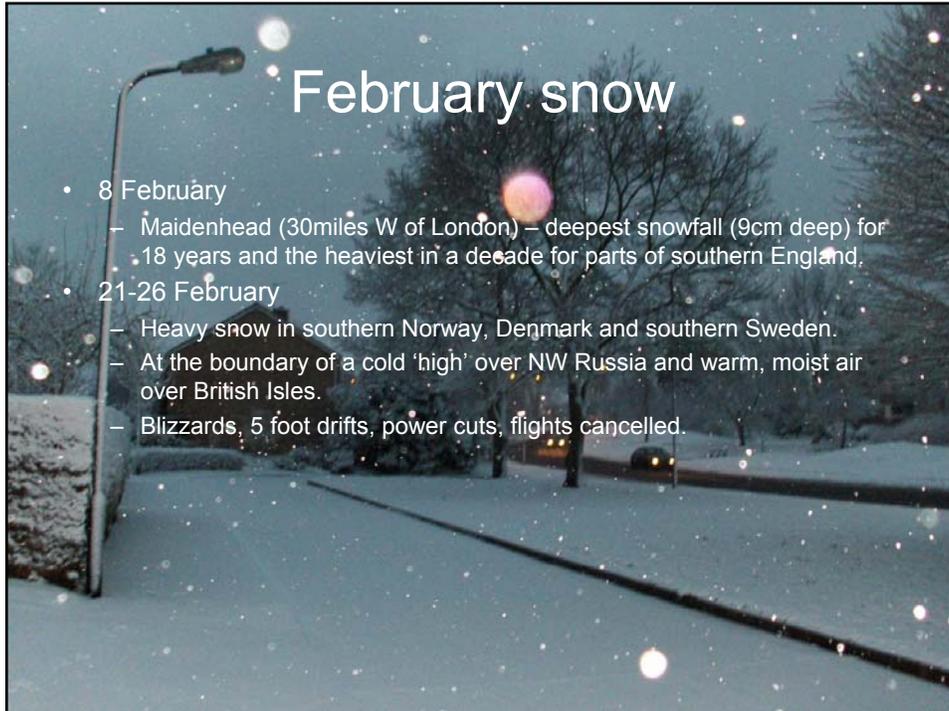
- 6 February
 - The Maltese Curia has instructed churches to pray for rainfall.
 - According to meteorologists, recent weather conditions closely resembled those of a typical April.
- Did the prayers work too well?
- 4 June
 - It rained more in 24 hours (57.6mm) than it has ever done previously for the whole month of June (28.2mm).



Luqa, Malta: 2007 and climatological rainfall (mm) – 553mm annual average

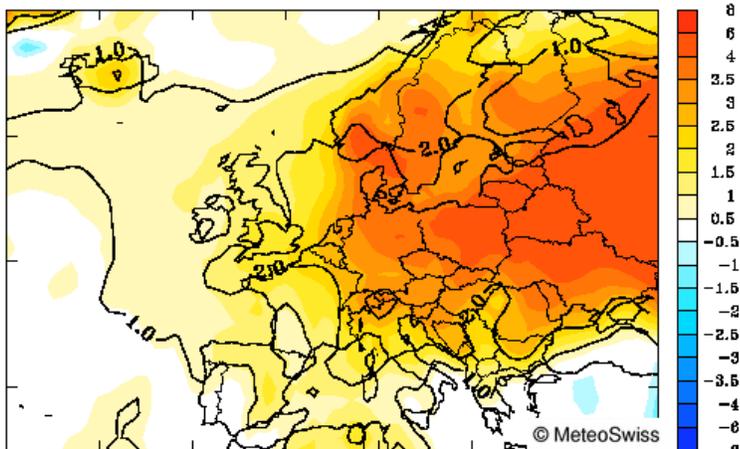
February snow

- 8 February
 - Maidenhead (30miles W of London) – deepest snowfall (9cm deep) for .18 years and the heaviest in a decade for parts of southern England.
- 21-26 February
 - Heavy snow in southern Norway, Denmark and southern Sweden.
 - At the boundary of a cold 'high' over NW Russia and warm, moist air over British Isles.
 - Blizzards, 5 foot drifts, power cuts, flights cancelled.



Winter warmth – mildest ever in much of Europe

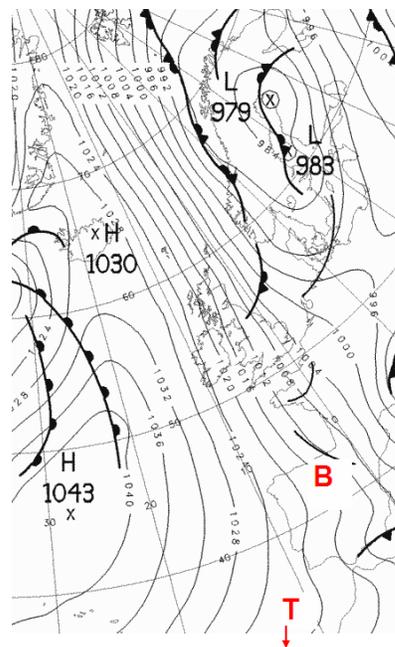
Since 1931, only 1989/90 has produced less winter snow in Switzerland.



1.0, etc anomaly wrt SD (1971-2000); 2.0 denotes 1 in 40 years.

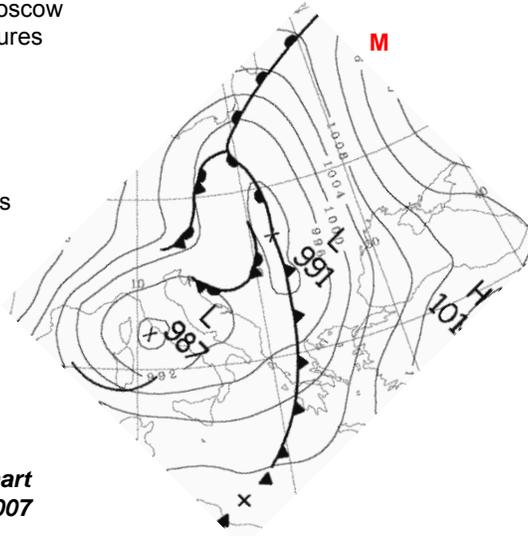
Spring starts cold...

- 19-21 March
 - Spain: Heavy snow leads to some significant travel disruption.
 - In **B**urgos, more than 1,000 lorries were trapped in the snow.
 - 20cm of snow fell in the Basque region.
 - On **T**enerife (30°N) 12 people were trapped in their cars in Las Canada del Teide after heavy snow fell.
- Switzerland
 - 37cm of snow fell in a few hours.
- Austria
 - Nearly 50cm of snow fell in some parts, cutting power to around 40,000 people as power lines came down.



Analysis chart 00Z 20 March 2007

- 21 March
 - Moscow: warmest ever on this day (13C) after 15C on the 20th. ... but also warm
 - Since the start of March, Moscow experienced daily temperatures about 6C above normal
- 30 March
 - 17.2C in Moscow
 - Many people sat outdoors at local bars and restaurants in shorts.



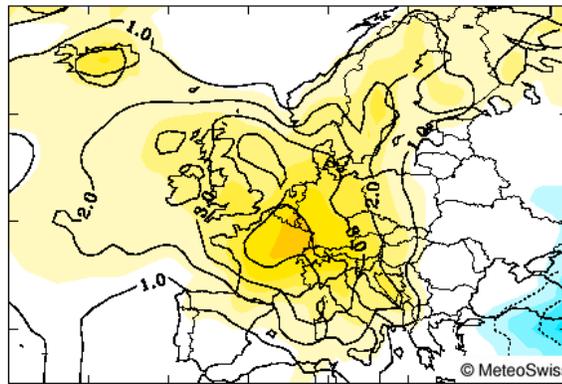
**Analysis chart
00Z 21 March 2007**

- Russia experienced one of its shortest and mildest winters and an early spring.
- 31 December 2006
 - After a mild start to winter bears at Moscow zoo finally went into hibernation.
 - They normally fall asleep with continuous snow cover in mid-November.
- 21 March
 - Bears at Moscow Zoo awoke early from their winter hibernation.
 - Russians were warned to be careful of grumpy, wild bears who would also wake up early.

A short sleep for Moscow's bears



April – very hot and dry in W Europe



1.0, etc anomaly wrt SD (1971-2000); 3.0 denotes 1 in approx. 250 years.

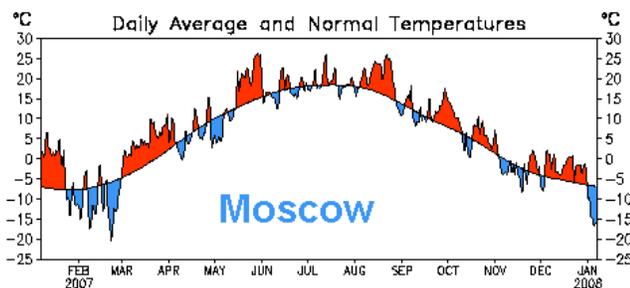
- 15 April
 - 28.7C at Uccle (Belgium) the highest April temperature since at least 1833.

- Overall
 - The warmest April in many parts of W Europe on record (e.g. since before 1659 in UK). Southern England - rainfall 5% of average in places.
 - Very sunny in W Europe.

Russian warmth

In Russia this warmth continued for much of the year (but February was cool).

- 23 May
 - 29.6C in Moscow - all-time date record.
- 28 May
 - Heatwave affected areas across western and central Russia in May
 - 32.9C in Moscow – the highest on record in the city in May.
- 31 May
 - At least 16 people in Moscow suffered from heatstroke this week
 - 30C exceeded for the past four days.



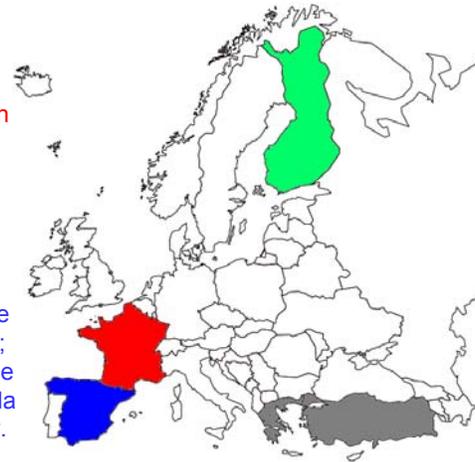
But

- 6 April
 - Extremely heavy snowfall and low temperatures
 - Heaviest Easter snowfall in Moscow for many years.

May – mixed weather

4th - Threat of a drought forces French authorities to impose water-rationing measures in places. In Brittany, the rivers have not been so low for 40 years.

23rd - Several train lines to Madrid were cut after heavy rain; 240mm of rain in the 24 hours at Alameda de Cervera, nearby.

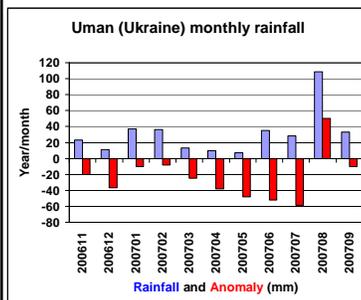


30th - Lightning strikes several buildings in Finland including homes and summer houses, setting some of them on fire.

26th-28th - Heavy storms, landslides, flash floods and lightning killed at least 23 people in Europe and Turkey. Six hikers died in Greece while trying to cross a river.

Ukraine/Moldova drought

- 29 May
 - Drought in the Ukraine hitting agricultural output.
- 19 June
 - Worst drought for a century in Ukraine.
- 26 September
 - 80% of Moldova in drought conditions; crop failures and livestock deaths.
 - Comparable to drought of 1946, when thousands starved to death.
 - Rain in August/September arrived too late to improve crop conditions.
 - European Commission to provide up to 40 million euros in aid.



Wheat prices, per bushel



June brought storms...

- 9-10 June
 - Several areas of Germany and Switzerland were swamped by flash floods after severe storms.
 - Three died in Switzerland with 50 homes destroyed.
 - In Germany, 27 people were injured after violent storms struck the south and south-west, also triggering flash floods.

...and fluctuating temperatures

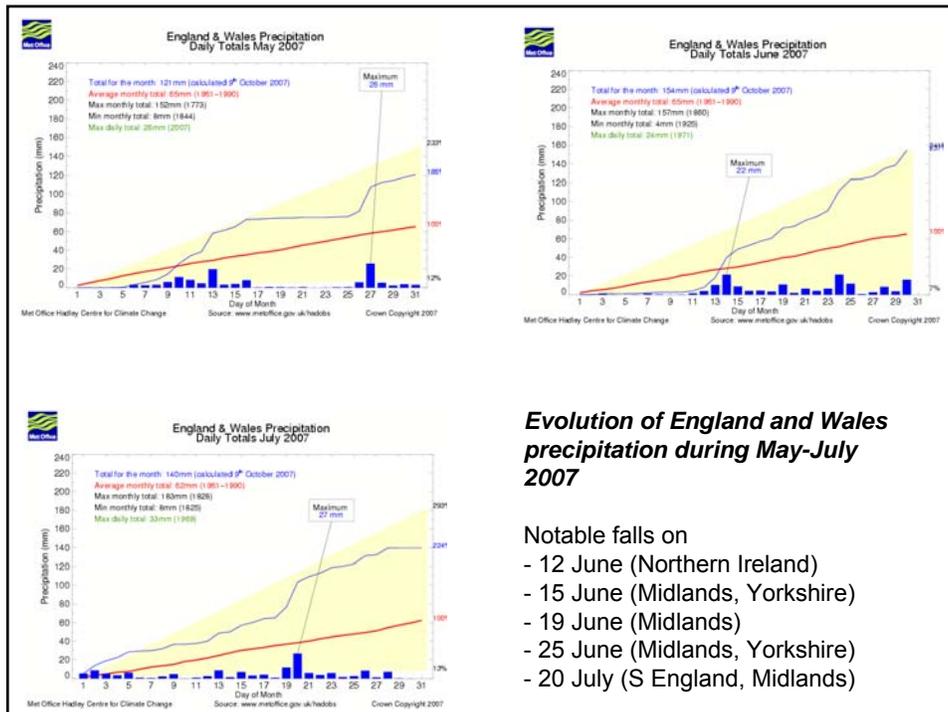
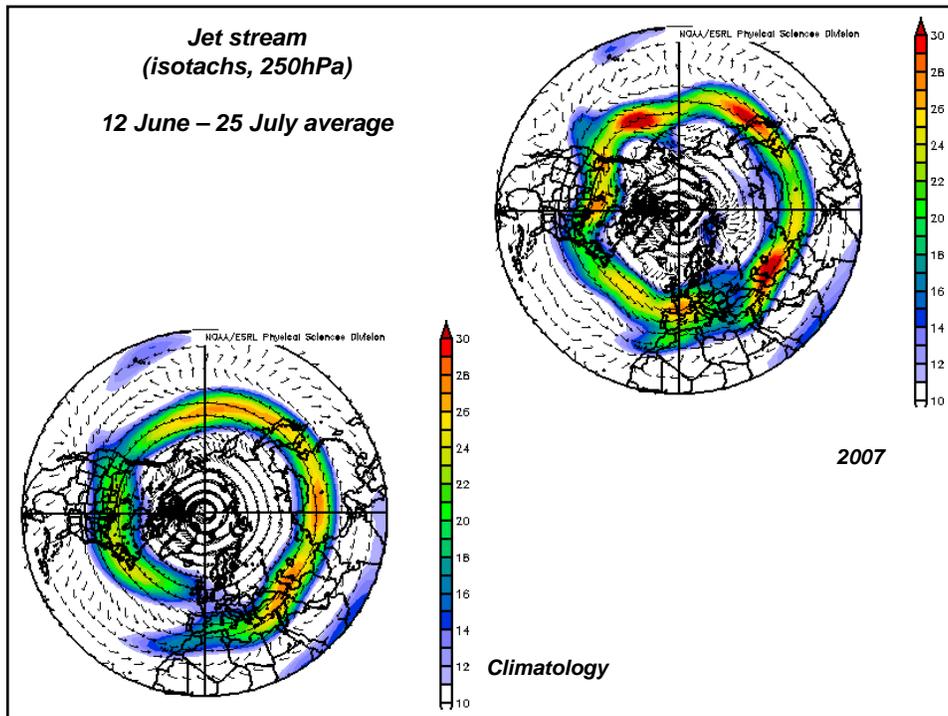
- 14 June
 - North-western Sweden experienced unpredicted snowfall following an intense heatwave.
 - Province of Harjedalen saw up to 10cm of snow falling.
 - 30C reported there a few days earlier (15C normal afternoon maximum).



Yes, this photo was taken a few days after the 30C was recorded in June!

Start of a wet summer in the UK

- 13 May and 27-28 May
 - Some heavy rain in southern parts of the UK
 - Over 70mm in 24h in places in the latter period.
 - The wettest May day since before 1766.
- The start of an unusually wet spell for parts of England
- June and July 2007
 - Atlantic jet-stream was displaced southwards of its normal position.
 - An upper-air trough close to the UK.
 - This large-scale environment led to weather systems tracking further south than normal towards the UK.
 - Drier than normal in Reykjavik (86mm) compared to average (144mm).



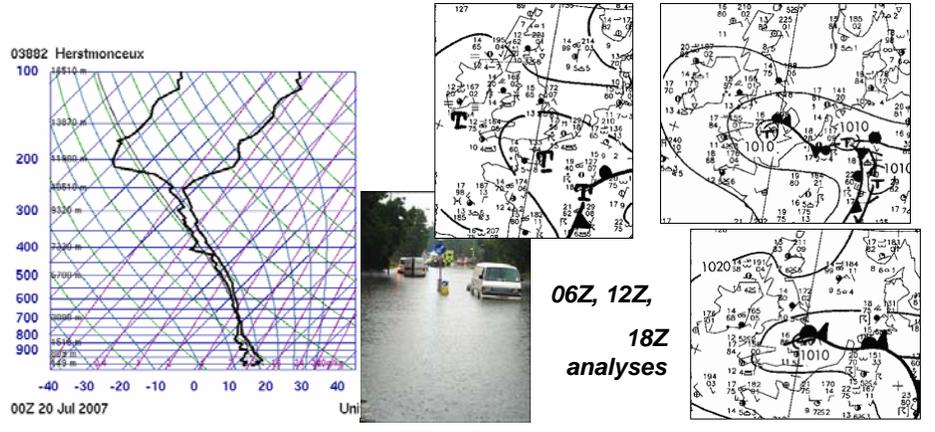
- 12 June
 - Lough Fea (Northern Ireland) recorded 53.4mm of rain, much of which fell in the space of a few hours.
- 15 June
 - Torrential thundery downpours led to flash flooding in the Midlands and Yorkshire.
 - Heavy rain and flooding forced some rail services in and out of Birmingham to be cancelled.
- 19-20 June
 - Over England thunderstorms led to heavy rain and flooding.
 - Almost 50mm of rain fell in just an hour at Manston (**the normal fall for a month**)



- 25 June
 - Frontal rain of 50mm in the Midlands; 100mm in Humberside, 111mm at Fylingdales **equivalent to over twice the normal monthly fall.**
 - Hundreds of people left their homes in three villages in South Yorkshire amid fears that a reservoir dam might burst...
 - ... and the M1 motorway was closed in case it did.
 - 900 people in emergency shelters in Sheffield after being left stranded
 - Five flood-related deaths.
 - 13,000 people left without power.
 - Widespread damage - with damage to more than 7,000 houses and 1,300 businesses in Hull (much of Hull is built on a flood plain)
 - River Don burst its banks, flooding Sheffield and Doncaster.
 - Widespread flooding in Derbyshire, Lincolnshire and Worcestershire.



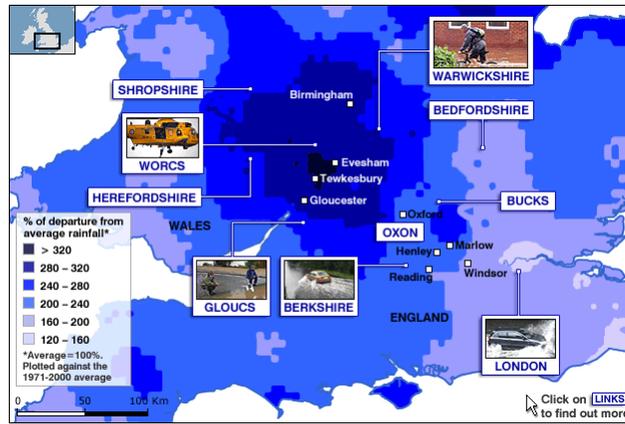
- 20 July
 - Pershore had 135.2mm of rain in 24h, with 157.4mm in 48 hours (50-70mm June normal). BUT THE EVENT HAD BEEN WELL-FORECAST.
 - Maidenhead: 51mm in 63 minutes – despite the low PWAT (30mm) and low T_{surface}.
 - Many schools closed – for many supposed to be the last school day before summer.
 - Widespread disruption to the motorway and rail networks (100,000 stranded on M5)
 - In the following days the River Severn and tributaries in Gloucestershire, Worcestershire, Herefordshire, Shropshire broke banks and flooded surrounding areas
 - River Thames and its tributaries in Wiltshire, Oxfordshire, Berkshire and Surrey also flooded as a result of the rains.



Widespread flooding -> water and electricity supply failures.

May-July 2007:
It was the wettest such period since before 1766.

Rainfall, 1 May to 22 July 2007 (150mm is 'normal')





THE INDEPENDENT

• Flooding is now the worst to hit Britain in modern history, says Environment Agency
 • Thousands more people evacuated as Severn and Thames threaten to overflow
 • Scientists warn that disasters on this scale may become common in the next few years

A 21st century catastrophe

PHOTOGRAPH BY GUY LAWRENCE

FULL REPORT PAGE 24

Large-scale and widespread depression-related rains, not the more usual localised summer thunderstorms. Repeated falls over already-saturated areas.

Why did it happen?

Global warming?

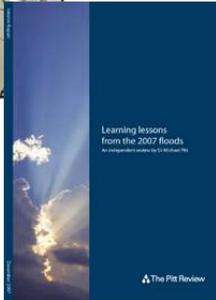
Building on the floodplains?

23 July: the government did not rule out more development on flood plains, as it unveiled plans for three million new homes by 2020....

The Association of British Insurers handled (mid-December) 165,000 claims; total damage over £5bn.

The Pitt Review

- More awareness of areas likely to flood
- Better preparedness



Learning lessons from the 2007 floods

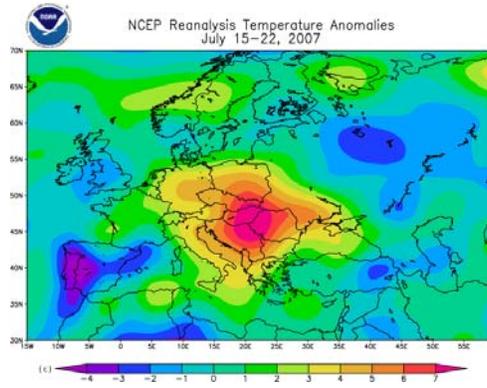
The Pitt Review

Summer heatwave in SE Europe

- The summer jet stream location across Europe enabled sub-tropical air from Africa to be drawn north into SE Europe at times.
- Romania, Hungary, SE Austria
 - Temperatures generally well-above average since start of 2007.
- 19 June
 - Rising temperatures caused water levels in Istanbul's reservoirs to drop to 39.7% of capacity. This time last year, water levels were at 86.5% of capacity.
- 20 June
 - Firefighters in Athens struggling to tackle a fire amid high temperatures.
 - Temperatures above 40C, thus feeding the fire.
 - The Public Power Corporation urged no cooking or air conditioning use.
- 27 June
 - 43C in Athens and 46.2C in Nea Philadelphia, the highest since 1955 (30C normal afternoon maximum).
 - At least 42 people dead in Italy and the Balkans.
 - In Romania 45C on the 26th with deaths from a violent storm
 - Temperatures in Israel of 42C led to a record demand for electricity.
- 3 July
 - 15 deaths now in Greece.
 - But, temperatures fell a little due to northerly winds.

Summer heatwave in SE Europe

- 18 July
 - A return to higher temperatures
 - Hungary: thousands of gallons of water distributed; 38C in Budapest.
 - Bulgaria: temperatures cause damage to some of the country's transport infrastructure, e.g. tram rails in Sofia buckling in temperatures of 40C.
- 23-24 July
 - Temperatures at 40C and above, with Greece expecting a high of 45C, hours after Rome recorded one of its warmest nights ever at 27.1C (normal 18C).
 - 46C at Petrich (Bulgaria) – a national record high.
 - More than 860 people fainted in the streets in Romania.
 - One person died and thousands were evacuated as a blaze affects 1,000 hectares of forest near Macedonia's second-largest city.



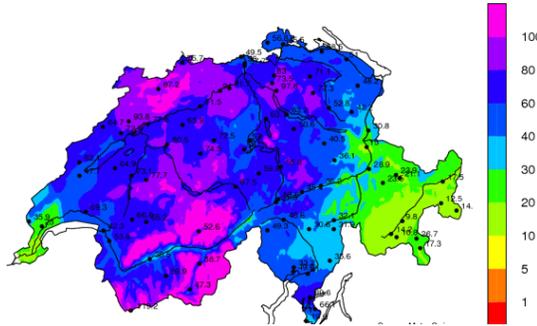
Summer heatwave in SE Europe

- 25 July
 - Over 500 deaths in Hungary attributed to the heatwave.
 - Belgrade construction sites silent at 1100h to help workers avoid exposure to heat.
- 3 August
 - A state of emergency declared in Bulgarian municipality Tsar Kaloyan.
 - Two-thirds of the wheat crops in the region have been destroyed, while damage to sunflower fields is expected to reach 100%.
- 14 August
 - 750 mosques in Ankara pray for rain amid a prolonged dry spell
 - The third major drought to hit Ankara in 50 years.
- Greek fires
 - Large areas ravaged by big wildfires, 23 August onwards, which continued into early September. Also some fires earlier in the summer.
 - 79 people died.
 - 670,000 acres destroyed (2,700 square km).
 - The worst fire season in 50 years.
 - The fires could be seen from space.



August rains

Precipitation (mm) 2007-08-08 (preliminary analysis)



- 7-9 August
 - In the Jura, 150mm fell in 72 hours (a normal monthly fall).
 - Many lakes and rivers passed warning levels.
 - Heavy rain also caused chaos in adjacent parts of Italy and France.
 - Zurich had 146mm in two days - unprecedented.
 - Only one fatality was reported.
- 22 August
 - Eight people died as a heavy storm swept across Poland.
 - 75mph gusts through the Mazury lake district.
 - Severe disruption at inland ports in the area, 50 yachts overturned.
 - More than 80 people had to be rescued from boats.

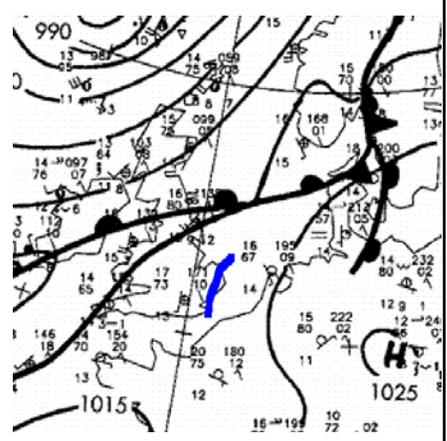
Bluetongue



- What is it?
 - A non-contagious virus.
 - Most commonly seen in the late summer and autumn.
 - All ruminants, such as cattle, goats, deer and sheep, are susceptible, although symptoms are generally most severe in sheep.
 - Flu-like symptoms.
 - Often leads to death in sheep.
- How is it spread?
 - Passed on by midges.
 - Bluetongue cannot be transmitted directly between animals.

Bluetongue

- July to September
 - Over 3000 cases seen in Netherlands, Belgium, France and Germany.
- 22 September
 - Disease confirmed in a cow in Suffolk, the **first time ever** in the UK.
 - 60 cases confirmed by 19 October
- Government report
 - Bluetongue probably introduced to Norfolk, Suffolk and Essex on the night of the 4/5 August by "windborne transmission of infected midges".
 - Moderate SE'ly breeze.
 - A cold winter could help eradicate the virus.



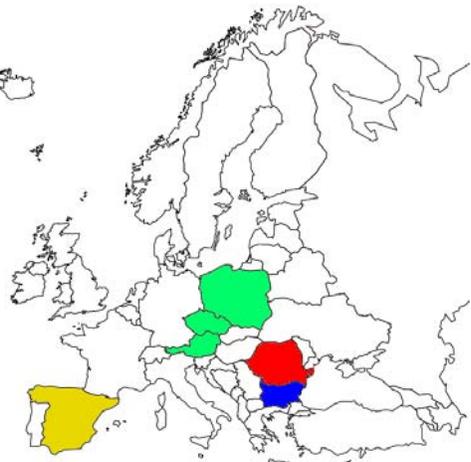
0000GMT analysis 5 August 2007

"One person in Felixstowe said they saw a swarm of midges or gnats coming in from the sea."

September storms end heatwave

13th-14th - Two die in S Spain due to floods/lightning.

21st – Andalucía: SE Spain): Heavy rain and large hailstones fell across the region prompting flash floods and injuring about 18 people.



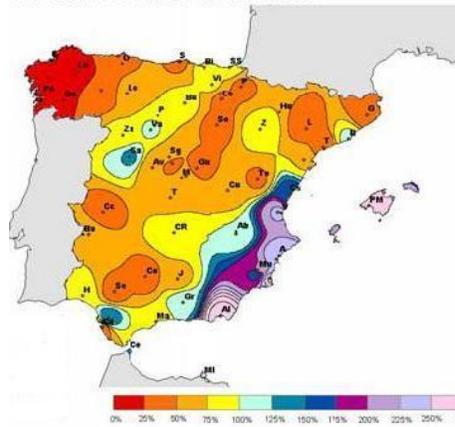
5th-6th - Two die after heavy rain in Poland. Heavy rain also led to floods in Austria and the Czech Republic.

1st - A girl died after being struck by lightning in Dospat.

6th - Seven people died as floods inundate parts of eastern Romania. More than 1000 homes flooded.

Rain in Spain in October

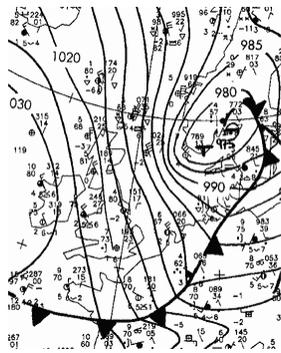
- 2 October
 - Heavy rain and hail struck Alcala de Guadaira near Seville.
 - Several people killed. Hail up to 50cm deep on the ground
- 4-5 October
 - A fierce storm affected Mallorca overnight, injuring people.
 - It destroyed homes and closed Palma Airport.
- 11-12 October
 - Thunderstorms triggered widespread floods in E Spain
 - Valencia: 100mm of rain fell in a one-hour period.
 - 200mm of rain fell in short periods of time in other places.
 - Two people killed.



October rain (% of normal)

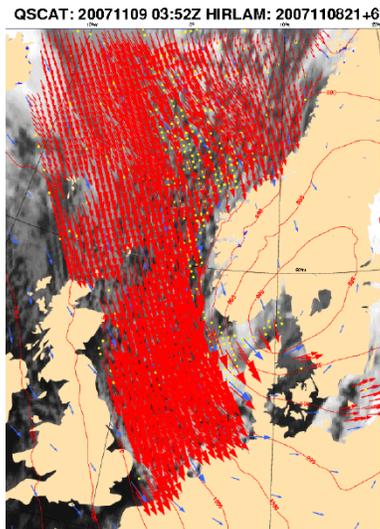
North Sea surge

- 8/9 November
 - A deep depression crossed from N of Scotland into S Scandinavia.
 - Strong N/NW'ly flow coincided with a high spring tide in southern North Sea.

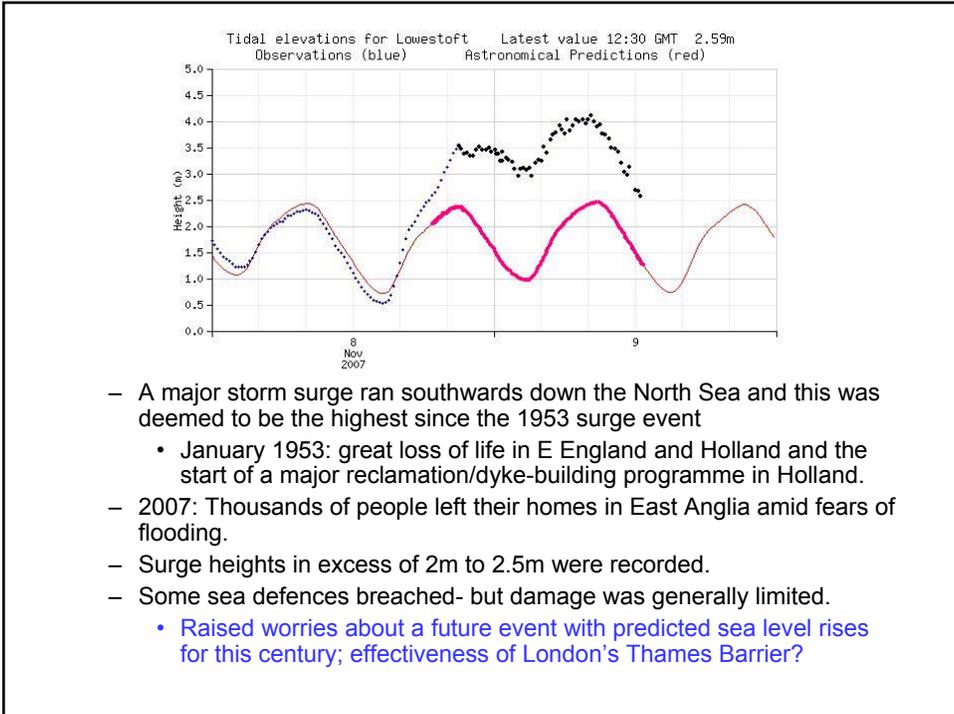


00Z analysis 9 November 2007

0352Z Quikscat winds and Hirlam 6h forecast valid 03Z on 9 November



Note: T='Low' on German charts.

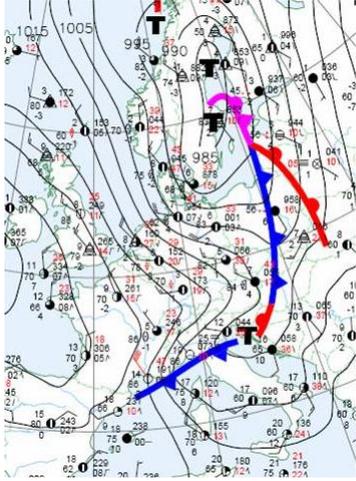


November storms

- 9-11 November
 - A snowstorm moved across Austria bringing heavy snow falls and strong winds.
 - Langem am Arlberg - 112cm of snow over 48h with gusts over 100mph.
 - Salzburg 70cm and 150cm reported in places.
 - Several roads closed, including the access road to the Lech resort – the first time this early since 1974.
 - Meteorologists: "the kind of conditions only experienced in the Alps every 30 to 50 years."

The same low system...

- 11 November
 - Broke a small Russian oil tanker in two off the Ukrainian port of Kerch, spilling up to 2,000 tonnes of fuel oil in what a Russian official said was an "environmental disaster."
 - Black Sea and Azov Sea: four freighters sunk and another damaged.

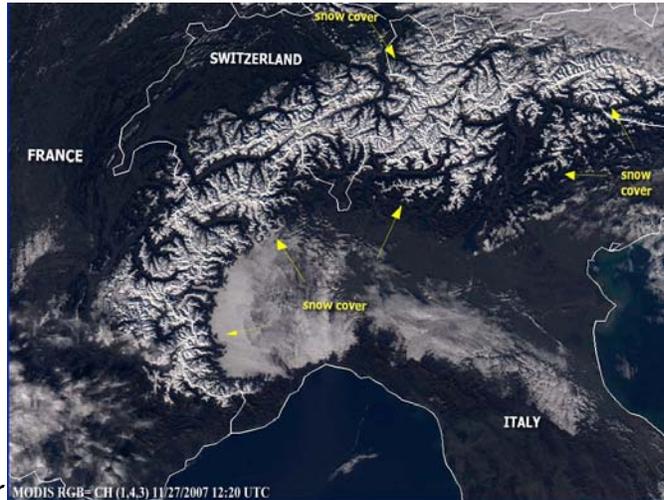


12Z 9 November 2007

Explosions and more snow

- 20 November
 - Hailstones the size of walnuts fell in southern Lebanon after a drought, and set off a series of explosions as they hit cluster bombs/landmines.

- 27 November
 - Zurich has the heaviest snowfall since 1955.
 - “Switzerland and Austria have had the best of the early snow.”



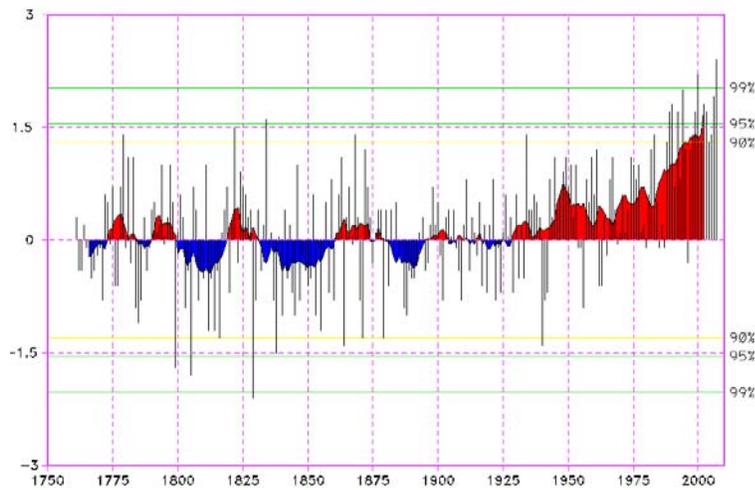
MODIS, 27 November

The year as a whole – another warm one in Europe

- **Continuing the warming trend:**
- De Bilt (Holland)
 - 2007 equalled 2006 as the warmest year on record.
 - Their annual temperature was about normal for the area between Lyon and Grenoble in southern France.
 - Eight of the ten warmest years in the past 300 years occurred after 1988.
- British Isles
 - Probably the second warmest year, after 2006.
- Russia
 - The warmest year in 150-year record.
- Central Europe
 - Generally the warmest on record, surpassing 2000.



Yearly Temperature Anomalies for Central Europe Years 1761–2007



Smoothed curve: 11-year running mean

**Temperature anomalies (C) based on temperatures at De Bilt (Holland),
Potsdam (Germany), Basle (Switzerland) and Vienna (Austria).**

Acknowledgements

- My grateful thanks to numerous individuals, institutions and news organisations, for providing the data, charts, reports and observations from which this presentation has been compiled. In particular, to
 - Mike Blackburn, Simone Kotthaus, Colin Youngs, BBC, Deutscher Wetterdienst, Environment Agency (UK), EUMETSAT, The Independent, INM (Spain), KNMI, Meteoswiss, Met Office (UK), NASA, National Climate Data Center, NCEP, NESDIS, NOAA/ESRL, NWS Climate Prediction Center, Universitat Koeln, World Meteorological Organization, Yahoo
 - and others
- See <http://www.met.rdg.ac.uk/~brugge/world.html>
- to see how 2008 evolves worldwide.