

Climate Change in the Recent Past

Selected Climate Events from Historical Records

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Executive Summary

- Rapid climate change is not an unusual phenomenon in our planet's history. Warmer periods have generally been better for people than cooler ones.
- During the Medieval Warm Period (MWP), large groups of Norwegians settled in Iceland and Greenland.
- The MWP allowed European farmers to cultivate crops much further north and at higher elevations than today.
- Bountiful harvests freed up surplus manpower, which was subsequently tapped to build cathedrals and bridges.
- When the Earth cooled at the end of the MWP, Europe was hit with a deluge of extreme weather, floods and storms that remade the landscape and killed thousands of people.
- The Little Ice Age that ensued caused great havoc and, as with the MWP, played a key role in changing Europe's history.
- The histories of glacial activity and cloud formation provide further evidence of recent, rapid climate change.
- When the consequences of rapid global warming are compared with those for rapid global cooling, it's clear that mankind suffers more harm from the latter.

Introduction

Through their entire existence, humans have always been at the mercy of rapid climate changes. The planet endured 7 or 8 ice ages during the last million years. Our ancestors have adapted to irregular cycles of cooling and warming, floods and droughts since the last Ice Age 10,000 years ago. They developed strategies for surviving harsh droughts, decades of heavy rainfall or long cold periods with failing crops.

The arrival of the Medieval Warm Period (MWP)

During the 9th and 10th centuries, a warm period arrived in the north Atlantic that made it possible for the Norse population along the overpopulated Norwegian coast to sail and colonize Iceland. Records indicate that in 874 the Vikings took advantage of favourable ice conditions and permanently colonized the island. Earlier, Iceland had always been surrounded by ice, therefore its name.

For a few hundred years, Iceland hosted a thriving colony of Norsemen with a mild and stable climate. They survived because it was possible to grow crops and grass to feed sheep. The new settlers from mainland Norway were able to grow various cereals during this mild period, crops that cannot be grown today. That this is not possible today is one of the proofs that the MWP was warmer than now. In the early 13th century, the first signs of climate change arrived, with more ice in the waters surrounding Iceland, which made communication with Norway difficult and risky.

In 980, it was also feasible to sail to the southern parts of Greenland. Banned from Iceland, Erik the Red saved his life by escaping to Greenland. After five years he came back and pulled off perhaps the first real marketing stunt in history. He told his friends in overpopulated Iceland about the green lands to the west which he had named Greenland. In the year 985, Erik sailed off with 25 longboats to colonize Greenland. They were hit by a severe storm near the southern tip of Greenland, during which nine ships went down, men and all. The surviving crews established the Eastern and Western settlements. They also brought with them Christianity, as Erik the Red's wife Tjodhilde built a church at Herolfsnes (see photo below), under the protection of the Archbishop in Nidaros (Trondheim).



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A hundred years later it became almost impossible to keep in contact with the settlements on Greenland. When these sites were visited in the 17th century, the ruins were found, and graves, but not any dead people who would have starved to death and not been buried. It is very likely that the last remaining settlers packed their ships and sailed south to the New England area, where they became easy prey for Indian tribes along those coasts. The age of the Vikings was the warmest period in more than a 1,000 years, a fact which can be verified in the Greenland ice cores.



The MWP, a blessing for farmers

In northern Europe, the MWP was a blessing for poor rural farmers, who supplemented their harvest with fishing and hunting. There are many examples of medieval paintings showing rich harvests. At this time, it was possible to grow crops and cereals on the summits of south-eastern Scotland at Lammermuir Hills, 320 metres above sea level. The Kelso Abbey owned a farm in southern Scotland which had over 100 hectares under cultivation at 300 metres above sea level, well beyond today's limit. Today traces of these cultivations can still be found on hills around England and Scotland.

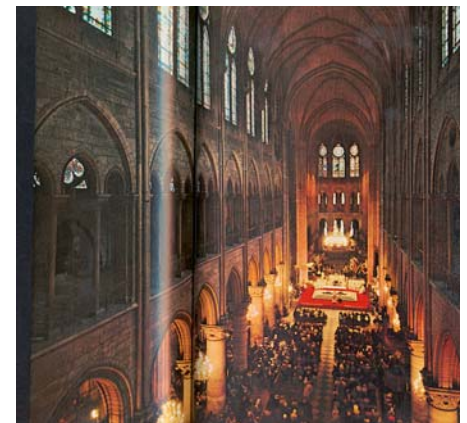
Even in a period of a warmer climate period, there were cold spells. Fluctuating grain prices at the time are a good barometer of changing temperatures.

Winemaking

Another important sign of a mild climate during the MWP is the fact that England was a major wine-producing country. Between 1100 and 1300, vineyards spread across southern and central England and as far north as Hereford. Commercial vineyards flourished 300 to 500 kilometres north of their 20th-century limits. During the height of the MWP, the French tried to negotiate trade agreements excluding British wines from the continent. How the climate changed year by year can be found in the vineyard archives indicating when the grapes were ready to be harvested. Between 1100 and 1300, night frosts were unknown in the month of May.

Cathedral-building

Because the warm climate during the 12th and 13th centuries ensured good harvests, not every living man had to work in the fields to secure enough food for the winter. The sudden appearance of a free workforce — or unemployment that perhaps caused social unrest — led to the start of cathedral-building and to golden days for architects. The Notre Dame cathedral in Paris (photo right) was commissioned by Bishop Maurice de Sully in 1159.



In England Canterbury cathedral was started in 1170 (photo below) and another in Lincoln in 1192, just to mention a few. The surge in Gothic cathedral-building, financed by a surplus of labour and wealth, was never repeated in later centuries.

Bridgebuilding

During the MWP, there was also a lot more rainfall in areas where there is a lot less today. Examples of this can be found in the city of Palermo on the island of Sicily. Here they built the Ponte dell’Ammivaglio bridge across the river Oreto in 1113. As seen in the picture (below), there is today a very small stream flowing under it. Another example is Pont d’Avignon in the lower Rhone area, built between 1177 and 1185.

The Norse discovery of America, settle-ments in Iceland and Greenland and Euro-pean conquests and the building of cathedrals all over the continent are a consequence of a global climatic phen-omenon. They are an enduring legacy of the Medieval Warm Period.



Copper mining in the Alps

During late prehistoric times, numerous copper mines had flourished in the Alps, until advancing ice sealed them off. Late Medieval miners were able to reopen some of them when the ice retreated.

A colder climate approaches

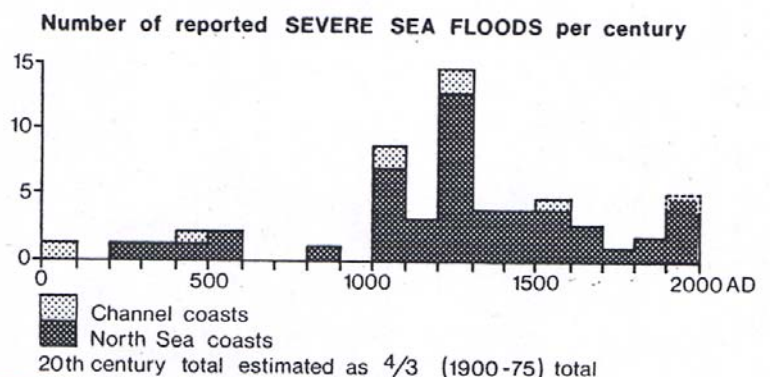
The first sign of a new cold period approaching was when the northern pack ice came all the way down to the Icelandic coast and polar bears went ashore. This happened the first time in 1203. During this first phase of an arriving colder climate, very strong gales, storms and floods hit the North Sea and Atlantic coasts of Europe. These storms were not only a big problem for fishermen and seafarers,

who lost their lives, but the storms also transported sand over land and created large sand-dunes. The flourishing port of Kenfig near Port Talbot in south Wales had to be abandoned after a severe storm deposited a high sand-dune over the harbour. Many villages at this time had major problems with wandering dunes burying both forests and villages. On the 19th of August, 1413, the small town of Forvie near Aberdeen was buried under a 30-metre-high sand dune.

Storms and floods

During the 13th century, very heavy storms and floods took place. It is estimated that, during the storms that took place in 1200, 1212-1219, 1237 and 1362, at least 100,000 people were killed along the North Sea coasts of Germany and Holland. During this time, the Zuider Zee in the northern part of the Netherlands was carved out from prime farmland. The last storm was nicknamed “Grote Mandrake,” or the “great drowning of man.”

Floods often combined with storms at high tide, and in 1240 and 1362 sixty parishes along the Danish and German North Sea coasts were swallowed by the sea. (See graph, from Hubert Lamb’s *Climate History and the Modern World.*) Half of all the farmland in the Schleswig-Holstein area was destroyed by salt water. When the MWP arrived, the island of Helgoland off the North Sea coast of Germany had a diameter of 60 kilometres. Due to storms in 1300, half of the island, with many churches and villages, disappeared into the sea, leaving

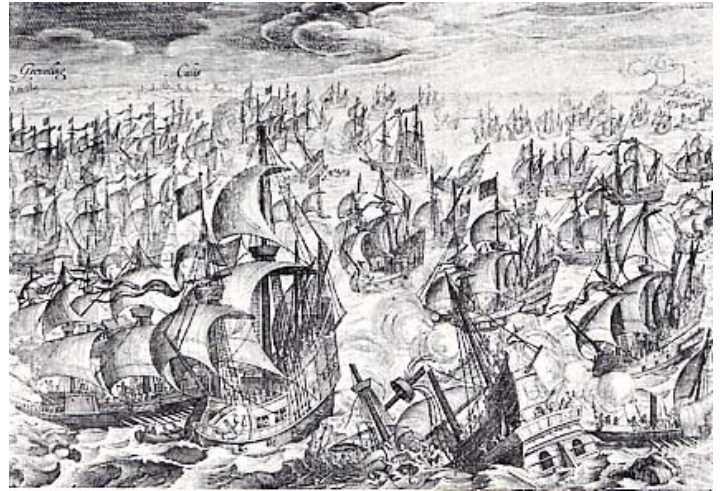


an island with a 25-km diameter. Today, the largest stretch of the island is only 1.5 km.

In 1315 Flanders stood more or less under water and prevented Louis X's military campaign from moving in. Horses sank to their saddle girths, wagons bogged down into the mud. The infantry stood knee-deep in the boggy fields. As food ran short, King Louis X quickly had to retreat. The thankful Flemings wondered if the floods were a divine miracle, already giving climate change a religious touch.

Overall, 1315 was a bad year with cold weather and torrential rains. Thousands of hectares of cereals did not ripen and hay could not be cured properly. The following year was also a terrible year, with rain and floods in central Europe. Intense gales battered the Channel and the North Sea. Storms reported in 1421, 1446 and 1570 caused more than 400,000 fatalities.

Areas along rivers were also heavily flooded at times. One year, Cologne was flooded and it was possible to row a boat over the city wall. The following year, it was so dry that one could walk across the Rhine. Europeans were getting used to severe storms, floods, droughts and cold winters.



In 1588 the British Navy was fighting the Spanish Armada off the western coast of Ireland. They were hit by a severe storm and the Spanish Armada lost more ships due to the storm than to the battle with the British Navy.

The Little Ice Age

The inhabitants in central Europe were invaded by ice and glaciers. During the 16th century, the "little ice age" was over Europe. Rivers, canals and parts of the seas froze in the winters. Farmlands endured floods and cold summers, with failing harvests and famine. Between 1315 and 1319, Europe experienced a serious food crisis that killed tens of thousands of people. (The same thing happened in 1714 and 1816, the year without a summer caused by the eruption of Mt. Tambora in present-day Indonesia. It is believed to be the most spectacular eruption during the last 15,000 years. Many of the extreme winters were most likely initiated by volcanic activity, when ashes spread in the upper atmosphere and shaded the sunlight.

Peter Breughel the Elder's painting "Hunters in the Snow" (see below) shows a snowy landscape with the farmers skating on a frozen canal while some men are getting ready to go out hunting. The year was 1565, the first great winter of the Little Ice Age. Londoners have not forgotten when the Thames froze during those cold winters.



In 1658, King Carl X Gustav of Sweden took advantage of the fact that the southern Baltic Seas was ice-covered. He marched his troops march over the ice and attacked the Danes from the south. He won a quick victory and a peace treaty was signed in Roskilde which gave Sweden the districts of Halland, Blekinge and Scania, today the southern part of the country. The fact that the natural southern borders of Sweden are in the Baltic sea today are due to the Little Ice Age, which made it possible to move Swedish troops over the ice to the island of Fyn.

Glaciers in the Alps

With the Little Ice Age arrived, glaciers in the Alps started to grow and surge down valleys quite rapidly. The speed of the glacial attack on villages in Switzerland, which destroyed homes and fields,

occurred at 20 metres per year. At the time, this was perceived as a calamity but today, when the glaciers are withdrawing, that fact is regarded as a disaster.

In 1589, the Allalin glacier near Visp descended so low that it blocked the Saas Valley and formed a lake. In 1595, the Giétroz glacier in the Pennine Alps pressed into the bed of the Dranse River. Seventy people died when floods submerged the town of Martigny. In 1926, a beam in a house near Bagnes was found with the inscription, "Maurice Ollier had this house built in 1595 the year Bagnes was flooded by the Giétroz glacier." In 1599-1600, alpine glaciers pushed downwards and destroyed villages and farmland in the Chamonix area.

Clouds

Hans Neuberger, a famous meteorologist, studied the clouds shown in 6,500 paintings completed between 1400 and 1967 and displayed in 41 art museums in the United States and Europe. His statistical analysis revealed a slow increase in cloudiness between the beginning of the 15th century and mid-sixteenth century, followed by a sudden jump in cloud cover, with lows clouds increasing sharply after 1550. After 1850 the amount of cloud cover decreased. (The contrast is displayed below, in a 17th century Dutch painting and a 19th century Norwegian painting.)

Conclusion

I do not in this presentation discuss if the recent warming of the Earth's climate is natural or not. It is, however, strange that society in common is very alarmed about recent global warming. What is the alternative? Global cooling with failing harvests, or no change at all. When in history has the climate been unchanging? It never has and will never be. People's memory seems to be not more than a normal lifetime.

Cooling caused failing harvests resulting in migrations and wars for survival. To mention just a few more examples, the potato famine in Ireland in the 1840s killed one million people and the failing harvest in Finland in 1866-8 killed 100,000 people, 15% of the Finnish population at the time. It is also clear that none of these events had anything at all to do with human activity.

About the Author



A materials scientist and Doctor of Mechanical Engineering at the Royal Institute of Technology (KTH) in Stockholm, Sweden, **Dr. Fred Goldberg** served as Secretary for an international KTH seminar held in September, 2006, titled "Global Warming — Scientific Controversies in Climate Variability," where he first presented this paper. Considered an authority on polar history and exploration, he travels every year to Svalbard, an archipelago in the Arctic Ocean about midway between Norway and the North Pole. In 2002, to commemorate the centennial of the 1902 Swedish Nordenskjöld Antarctic expedition, he led a group that sailed aboard the Polar Star to re-enact the event and revisit the sites originally explored by Otto Nordenskjöld and his men. In January, 2007, he debated the topic "Climate Change: Human-Caused or Natural?" at the California Institute of Technology.

References

Zbigniew Jaworoski, "Solar cycles, not CO₂, determine the climate," *21st Century Science and Technology*, Winter 2003-2004

Brian Fagan, *How climate made history 1300-1850*, Basic Books, ISBN 0 465 02272 3

Hubert Lamb, *Climate history and the modern world*, Methuen, ISBN 0 416 33440 7